



African Development Perspectives



Yearbook 2022/23

BUSINESS OPPORTUNITIES, START-UPS, AND DIGITAL TRANSFORMATION IN AFRICA

EDITED BY

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Ulrike Schuerkens, Katinka de Wet,
Karl Wohlmuth (Eds.)

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and Digital Transformation in Africa**

African Development Perspectives Yearbook

Edited by the

Research Group on African Development Perspectives Bremen:
Herkulaas MvE Combrink, Tobias Knedlik,
Samia Satti Osman Mohamed Nour,
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The Research Group on African Development Perspectives Bremen

The uneven growth in Africa, the lack of inclusive development in most of Africa, and the aggravating social, political, and economic crisis in some countries of the African continent require new policy initiatives. These developments force institutions, organisations, researchers, development practitioners, ad hoc working groups, and networks being active on Africa, and all others involved in African development affairs to intensify the analytical and conceptual work on alternative development visions and designs for Africa. There exist so many development plans and restructuring programmes, strategy conceptions, research outlines on specific issues, and ideas for coherent policy action and innovative projects in Africa. Publications on Africa's development perspectives are focussing on the role of specific African crisis factors and structural impediments, but also on the new forces which are working towards inclusive growth and sustainable development. There is new emphasis on Africa's recent growth dynamics, and there is great interest to understand the opportunities and chances for structural adjustment and transformation. Now, the major theme for Africa is how to shoulder the digital transformation. Also, the issues of revitalizing development planning in Africa, of managing deep structural change beyond caring merely for macroeconomic policy adjustment, and of responding to the new globalisation trends are intensively discussed. The discussion which is referring to Africa's development problems and perspectives is indeed widening - as new digital media are becoming more important, as Africa heads towards the African Continental Free Trade Area (AfCFTA), and as African sources get a greater global influence. However, it is difficult to get an overall view of the different approaches, initiatives, and proposals and, subsequently, to make the discussion useful for the coordination of development policies and for moving towards new avenues in development cooperation. So, there is still a need for a comprehensive publication that compiles, evaluates, and analyses the scattered material and the often not easily available sources on Africa's development. Most important, it is necessary to present a balanced view of the medium to long-term developments facing Africa.

To fill this gap, the *Research Group on African Development Perspectives Bremen*, established at the University of Bremen, Faculty of Economics and Business Studies, is presenting the *African Development Perspectives Yearbook*, being published since Volume 1 on "Human Dimensions of Adjustment" in 1989. Research activities of the group members comprised over the years country case studies and comparative country analyses; studies on macroeconomic policies and strategies, on aspects of labour market policies and informal sector activities, on

human development policies and strategies, on agriculture and food security policies; studies on natural resources development and on environmental policies, but also researches on the promotion of small-scale industries, on private sector development policies, on entrepreneurship development, and assessments of sector and structural adjustment policies, of trade and regional integration policies, as well as reviews of economic diversification and alternative development options. The issues of science, technology, and innovation (STI) policies were also considered in various volumes, but the volumes 20 (2018) and 21 (2019) of the *African Development Perspectives Yearbook* gave a comprehensive analysis of the importance of these STI policies for Africa. The volume 22 (2020/2021) was on the policies to implement the Sustainable Development Goal Nine (SDG 9) in Africa. This volume 23 (2022-2023) is on Digital Transformation in Africa, on the rise of digital entrepreneurship, and on the forthcoming digital business opportunities. In 2019, the thirty years (1989-2019) anniversary of the *African Development Perspectives Yearbook* project was celebrated by the Research Group in Bremen; a Festschrift was published and was distributed to the many contributors and supporters of the project, to media and academia people, to experts of donor agencies and NGOs, and to key policymakers and international experts in Africa. The Festschrift is in its second edition available online. The *African Development Perspectives Yearbook* has become an Open Access Publication, and all the contributions are peer-reviewed. For volume 24 (2024) it was decided by the Editorial Committee to give the focus on the fiscal capacity in Africa, as resource mobilization is increasing in importance (for domestic resource mobilization and for the global components of the resource base). The global changes since the aggression war of Russia against Ukraine impact on energy and food prices, but also affect severely the inflation rates and the perspectives of inclusive growth.

The *African Development Perspectives Yearbook* is now the leading English-language periodical which is published in Germany, and which is relating to the key development problems, development successes, and development perspectives of Africa. African, European, Asian, and American experts from universities, research institutes, international and regional organisations, from the consulting business, from the media, and from non-governmental and donor organisations are reporting on problems and on possible solutions, on new political and economic approaches, on specific economic programmes, and on visions for alternative development paths for Africa. Country cases, sector cases, and project cases highlight the issues of implementing sustainable policies and innovative ventures in Africa. The growing interest of experts from Africa to contribute to the success of the *African Development Perspectives Yearbook* is highly appreciated.

Africa's future will depend on both, on its economic and political connections with the international community at the Pan-African, sub-regional, national, provincial, and sectoral levels, and on local projects and development efforts at the

micro and sector level. Most important are own African development visions, programmes, strategies, and policies. The *African Development Perspectives Yearbook* contains information and analyses regarding these various dimensions. Global analyses, regional and country studies, sectoral studies, and individual project evaluations are published in the *African Development Perspectives Yearbook*, as well as statements and declarations on Africa's development perspectives which are submitted as the result of international and regional African conferences. Important documents of African regional organisations, of regional economic communities, of individual African states, of important programmes, projects, and initiatives of African civil society organisations, of African cooperatives, businesses, and social enterprises, and of African self-help groups are also presented.

The *African Development Perspectives Yearbook* has an analytical, comparative and documentary character, but the editors successfully established over the more than three decades of work an extensive network for the exchange of news and information. Thereby the editors of the *African Development Perspectives Yearbook* develop relations with expert networks which are working on Africa, and are connecting with key development organisations, professional associations, and research institutions that are working in and for Africa. The members of the *Research Group on African Development Perspectives Bremen* are interested to deepen the contacts with partners in and outside of Africa who are sharing similar objectives. The *African Development Perspectives Yearbook* is targeted to political and executive decision-makers, to project and research personnel in development policy institutions, and to experts and staff members in project development offices, consultancies, media, research and development agencies, donor agencies and aid institutions, and to all others being interested in Africa's development perspectives.

The *African Development Perspectives Yearbook* offers comprehensive analyses and information about recent developments regarding the African continent, but the central focus is on Africa's development perspectives. Thus, the *African Development Perspectives Yearbook* is reporting on

- visions and conceptions regarding the long-term development strategies for Africa,
- strategies that emphasize a longer-run planning process that goes beyond conventional structural adjustment policies,
- successful projects and programmes concerning countries, regions, institutions, or specific sectors of African economies, by analysing the conditions of their success,
- resourceful and creative activities of socio-economic interest groups, of local development initiatives, and of NGOs, which could serve as models being of relevance for other regions,
- innovative strategies for structural change, digital transformation, and prospects of regional integration in Africa, and on

- economic, social, and political trends in Africa's sub-regions, nation-states, provinces, municipalities, and local communities.

The *African Development Perspectives Yearbook* uses sources and information from all relevant levels of action, policymaking, planning, academic discussion, and scientific research, i.e., from international, regional, and national organisations and institutions, committees, working groups, and NGOs, but of key relevance for the research work are those ideas and approaches which are originating from Africa.

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Issues of the African Development Perspectives Yearbook since 1989:

<http://www.iwim.uni-bremen.de/index.php?content=345&lng=de>

Selection of Projects of the Research Group on African Development Perspectives Bremen: http://www.iwim.uni-bremen.de/afrkanische_entwicklungsperspektiven_research_group/

Access for Download to the Festschrift “Thirty Years of the African Development Perspectives Yearbook (1989 – 2019):

To the Library System of the University of Bremen:

<https://media.suub.uni-bremen.de/handle/elib/4652?locale=de>

Direct Access to the PDF:

<https://media.suub.uni-bremen.de/bitstream/elib/4652/1/Wohlmuth-Festschrift.pdf>

Foreword and Acknowledgements

This Volume 23 of the *African Development Perspectives Yearbook* with the title “Business Opportunities, Start-ups, and Digital Transformation in Africa” has again benefitted from many contributions, from various inputs, and from important institutional support. The great number of contributions to this volume (essays, analytical surveys, country case studies, review articles, and book reviews) was made possible because of the continuing support from African and international organisations, from numerous research and development institutions, and from many individual development experts who are cooperating continuously with us on Africa. A great number of international and regional organisations, universities and research institutes have supported this project which led to this new publication of the *African Development Perspectives Yearbook*. While the volumes 20 (for 2018) and 21 (for 2019) had a focus on Science, Technology, and Innovation (STI) Policies, the volume 22 (for 2020/2021) was related to the Sustainable Development Goal (SDG) 9 and the achievements of Africa in this regard. This volume 23 is on digital transformation, digital entrepreneurship, digital start-ups, and digital business opportunities in Africa. It was of great importance to inform the global public about the anniversary ceremony of *Thirty Years (1989-2019) African Development Perspectives Yearbook*, an event which took place in 2019. The Festschrift was received with great interest as it contains so many suggestions for the future of the Yearbook project by former partners, supporters, contributors, and editors. A great number of former and still active contributors and editors have contributed to this Festschrift with essays on the history, the evolution, and the current situation of the Yearbook. The volumes 22 (for 2020/2021) and 23 (for 2022/2023) mark now the start of a further decade of this important publication on Africa’s development perspectives.

It is worth to mention the great number of supporters to the *African Development Perspectives Yearbook*, such as a number of international and regional organisations which have contributed over the years: The World Bank, the IMF (International Monetary Fund), UNESCO (United Nations Educational, Scientific and Cultural Organisation); ACBF (African Capacity Building Foundation); UNECA (United Nations Economic Commission for Africa); UNCTAD (United Nations Conference on Trade and Development), the African Development Bank (AfDB), the African Union (AU), the New Partnership for Africa’s Development (NEPAD). For the volumes 22 and 23, UNCTAD (United Nations Conference on Trade and Development) had a great role, as key experts have presented important contributions. For volume 23, a key expert from the African Development Bank (AfDB) has shared his knowledge and experience with our project. On the side of the universities, scientific academies, scientific governance institutions, and research institutes the following partners should be mentioned: the Department of Economics, Faculty of Economic and Social Studies University of Khartoum,

Khartoum, Sudan; the University of Bremen, Bremen, Germany, with its Chair in Small Business and Entrepreneurship at the Faculty of Business Studies and Economics, the University College London; the Alexander von Humboldt Institut für Internet und Gesellschaft (HIIG) in Berlin; the University of Oxford; the UNCTAD Division for Africa, Least Developed Countries, and Special Programmes; Université Rennes 2, France; Development Studies at the EHESS (École des Hautes Études en Sciences Sociales/School of Advanced Studies in the Social Sciences), Paris, France; Laboratory of Economic and Monetary Research (LAREM), Cheikh Anta Diop University of Dakar (UCAD), Dakar, Senegal; University of the Free State, Free State, Bloemfontein, South Africa; Free State Department of Health, Bloemfontein, South Africa; Odeion School of Music, University of the Free State, Free State, Bloemfontein, South Africa; Grid Related Research Group (GRRG) at the University of the Free State, Free State, Bloemfontein, South Africa; National Department of Health, Ministerial Committee for the Morbidity and Mortality of Children under 5 years, South Africa; National Coalition of the South African Civil Society for Women's, Adolescents' and Children's Health, South Africa; University of Ngaoundéré, Cameroon; ECM-Corporate & Investment Bank, Cameroon; Department of Political Science, University of Ghana; Global Development Institute, University of Manchester, Manchester, UK; United Nations University- MERIT, Maastricht, The Netherlands; The Open University, Milton Keynes, United Kingdom; World Bank Nigeria, Abuja, Federal Capital Territory, Nigeria; and various other institutions and agencies have contributed.

All these partners have directly supported this Yearbook project with contributions, expertise, and suggestions. Special thanks go to Professor Dr. Samia Satti Mohamed Nour, Department of Economics, University of Khartoum, Khartoum, Sudan, to Professor Dr. Ulrike Schuerkens, and to the research team of the University of the Free State, headed by Dr. Katinka de Wet and Dr. Herkulaas MvE Combrink. These experts have given advice from the first phase of planning this publication project, and they have accepted the task as unit and volume editors. Professor Samia Satti Osman Mohamed Nour accepted the position of the Book Reviews and Book Notes Editor for volume 22 (for 2020/2021), and this Unit 4 of the volume 23 (for 2022/2023) is again rich in entries of book reviews and book notes. Professor Dr. Samia Satti Mohamed Nour has already cooperated with her great expertise to the volumes 20 and 21 on STI policies in Africa as contributing to inclusive growth. Professor Ulrike Schuerkens has contributed as a guest editor with the Unit 2 on Digital Transformation and New Business Opportunities in West Africa. Interesting case studies report on digital entrepreneurship. We can be proud that she included contributions from the ManaGlobal programme, which has been supported by the European Union's Horizon 2020 Framework Programme through the Marie-Sklodowska Curie grant agreement 82374. Dr. Katinka de Wet and Dr. Herkulaas MvE Combrink from the University of the Free State (UFS) took over the function of unit and volume editors for Unit 3 on Digital

Transformation in South Africa to report in five essays on the opportunities of African universities to do development work around the university. They are co-directors of the Interdisciplinary Centre for Digital Futures (ICDF). This Centre of The University of the Free State's is defined as “a collaborative, co-creative, synergistic space – where social scientists, natural scientists, data scientists, engineers, health scientists, etc., collaborate, learn, and interact with industry, the private sector, government.” We can be happy about the opportunity to have the first report on the development role of this important institution. The volume editor of volume 23 (for 2022/2023), Professor Dr. Karl Wohlmuth, from IWIM/Institute for World Economics and International Management and from the Research Group on African Development Perspectives Bremen, is indebted to these experts for their encouragement, ideas, concepts, and the valuable contributions to this volume of the *African Development Perspectives Yearbook*. The cooperation with them was enjoyable and intellectually rewarding.

Institutional support is welcomed by the *Research Group on African Development Perspectives Bremen*. Many organisations in Africa, like the African Development Bank (AfDB) Group, the United Nations Economic Commission for Africa (UNECA), the African Union (AU), and the NEPAD (New Partnership for Africa's Development) Secretariat have contributed with information and encouragement. Also, the OECD (Organization for Economic Cooperation and Development) and its Development Centre, the IMF (International Monetary Fund) with offices in Africa, and the World Bank (with various offices at headquarters and in Africa) have given advice and information. We, as the Editors of the Yearbook, are always interested in their advice and guidance to structure the future work on the *African Development Perspectives Yearbook*.

For the volume 23 (2022/2023) of the *African Development Perspectives Yearbook* the Editors of the Yearbook took up the issues of Digital Transformation, Digital Entrepreneurship, and Digital Business Opportunities in Africa. These issues are so important for the structural change in Africa and for the much-needed redirection of economic and social policies in Africa, as all the social, economic, political, and ecological dimensions are affected by the digital transformation process. The volume 23 (2022/2023) considers the fact that structural reforms and structural transformation processes in Africa request policies to guide the digital transformation. Digital Transformation will also impact all the sustainable development goals (SDGs). All the analytical essays and case studies, but also the book reviews and the book notes, which are contained in the volume 23, take stock of the impacts and outcomes of digital transformation in Africa.

Unit 1 presents in six essays an analysis of digital transformation in Africa, by investigating the links between digitalization and development of productive capacities, the trends of digital infrastructure in Africa, and the role of African transnational entrepreneurs in the digital business. Also, two key sectors (finance and health) are related to the digital transformation process; this is done in the form of

case studies for Cameroon and Nigeria. This Unit 1 gives the theoretical base - by highlighting the general issues of digital transformation in Africa. Developing productive capacities, developing digital infrastructure, developing African transnational entrepreneurship, and developing the digital base of key sectors (such as finance and health) are the four imperatives for policy action and for business activity. The Unit 1 reveals how important digital drivers and digital assets are for the success of digital entrepreneurs.

Unit 2 presents five essays which are focussing on new business opportunities which are created by the digital transformation in West Africa. In case studies for Senegal, Ghana, and the Ivory Coast there are analyses of IT incubators, IT start-ups, and IT projects. A case of a business conglomerate in Ghana outlines successful combinations of analogue and digital expansion strategies. The Unit 2 is part of a global research programme on entrepreneurship development; in this context it is of interest to see how digital entrepreneurs in West Africa take over the new business opportunities, what the barriers are, what the government and private business associations can do, and how business successes emerge. A key aspect which was discussed already in Unit 1 refers to the local context; successes depend on deep relations with local people, local businesses, local ethnical and social groups, and on their attitudes. Local business successes in the analogue world (such as in handicrafts) can gain substantially through digital platforms and apps.

Unit 3 contains five contributions on the role of universities to support the digital transformation process in Africa, with a special focus on the University of the Free State in South Africa. The surrounding rural and urban areas can benefit from digital solutions which are developed by digital centres of the universities, and the university staff can benefit from the practical examples during the demonstration and application of digital solutions. The analyses in Unit 3 relate to basic digital education, to digital solutions for improved small-scale farming, to specific eHealth advances for precision medicine, and to the use of digital twins in agriculture development strategies. The theoretical base for such a collective work is already strong, due to the collaboration of the various faculties and due to the intellectual capacity of the partners who are working in such digital centres. However, challenging is the cooperation of such digital development centres with rural people living from small-scale agriculture, with schools and their pupils, parents, and teachers in neglected areas and townships, with health and care centres which are not well equipped and connected, and with planning departments of government agencies which still prefer to work along traditional bureaucratic lines.

Unit 4 presents book reviews and book notes for publications in the context of digital transformation, digital entrepreneurship, digital start-ups, digital business opportunities, and related to the adoption of digital technologies and 4IR (fourth industrial revolution) technologies in Africa. Many studies and documents were considered for book reviews and book notes and were classified around seven (7) categories. Reviewed are publications on digital entrepreneurship, on digital

business opportunities, and on specific digital transformation processes. Global Development Reports and African Development Reports include the theme in various formats. More specific publications on these digital transformation issues are in the form of monographs, specific reports, and discussion papers. There are also reviews of publications on wider issues of Africa's development perspectives, and of great relevance in this regard are reviews of major global economic development reports and of regional African development reports.

Many institutions have over the more than three decades contributed to the various volumes of the *African Development Perspectives Yearbook*, with news and information about African countries and regions, with information about new research projects in and on Africa, with publications about policies and strategies in Africa, with documents about declarations and agreements related to Africa, and with research papers focussing on current themes for Africa, also when drafted at their early stage. So, the editors of the *African Development Perspectives Yearbook* can grasp new events and new developments in Africa very early; this allows it to invite contributors with a great expertise for specific units (and chapters). Many regional and international organisations, like the African Development Bank (AfDB), the African Union (AU) and its affiliated institutions, the UNECA (United Nations Economic Commission for Africa), the World Bank, the UNCTAD (United Nations Conference on Trade and Development), the UNDP (United Nations Development Programme), the IMF (International Monetary Fund), the UNIDO (United Nations Industrial Development Organization), and the ILO (International Labour Organization), continue to support our scientific and editorial effort by sending us relevant materials. They make available - always timely - new strategy documents and drafts of their research papers; this is of use for the conceptualization of our Units, especially of the Book Reviews and Book Notes Unit of the *African Development Perspectives Yearbook*. For volume 23, the United Nations Conference on Trade and Development (UNCTAD) and the African Development Bank (AfDB) stepped in as key partners. But it is also true that individual experts in these important development organizations are of great help to sustain our project; they open the doors, they invite us to cooperate, and they share their knowledge with us.

Also, UNU-WIDER (United Nations University - World Institute for Development Economics Research), as an institution of global importance for development research, has continuously supported our work with most recent research papers, with access to their development research conferences and to the networks of researchers and affiliated institutes, and with publications and information about important scientific events in their domain of development studies. Furthermore, we would like to thank all those institutions which make us part of their global research networks; so, they are informing so many others in the development field about our work for Africa, namely the continual publication of the *African Development Perspectives Yearbook*. This is the case now since 1989 when

the first volume appeared under the theme of “Human Dimensions of Adjustment”. The Festschrift on the “Thirty Years of the African Development Perspectives Yearbook (1989 – 2019)” contains the views of so many editors and contributors; this is an impressive list of the personalities who have formed the Yearbook. They are also the base for peer-reviews of manuscripts and for reviews of books, journals, declarations, discussion papers, and strategy documents.

We express our gratitude to those persons who accept the position as members of the Editorial Committee for the volumes of the *African Development Perspectives Yearbook*, by acting as Editors/Co-Editors of a Unit and as a Volume Editor. These persons add to the stock of knowledge of the Research Group. For volume 23 we had three guest editors, with two of them from Africa (South Africa). Numerous colleagues have contributed as peer-reviewers of manuscripts, and many of them are from Africa (Kenya, Cameroon, Sudan, South Africa, and from other African countries). We are also indebted to the UNECA offices in Addis Ababa and Kigali, as they have pushed us to launch volumes of the *African Development Perspectives Yearbook* in their offices. In October 2016 this idea was realised. The Acting Director of the Kigali Office of UNECA, Andrew Mold, organized a launch event with a great programme for the volumes 18 (2015/2016) and 19 (2017) of the *African Development Perspectives Yearbook*. A major launch event with a high-level audience took place in Kigali, Rwanda. Our Managing Director, Professor Tobias Knedlik, Research Professor at IWH Halle and Professor for International Economics at the Fulda University of Applied Sciences, and our Project Adviser and Key Contributor for the further volumes 20 (2018) and 21 (2019) in the pipeline, Dr. Nazar Mohamed Hassan, Senior Regional Adviser, UNESCO Regional Office in Cairo, presented the two just published volumes 18 (2015/2016) and 19 (2017) of the *African Development Perspectives Yearbook* in Kigali, Rwanda. They informed the attending experts, policymakers, ambassadors, the UN staff, and representatives of donor organizations and the media about the *African Development Perspectives Yearbook* Project. It was a great event, and African TV and Radio Stations reported in 48 African countries about the launch event for the volumes 18 (2015/16) and 19 (2017) of the *African Development Perspectives Yearbook*. We are expecting such events to be held in the future more regularly. Issues of the Yearbook are presented at other occasions also. Dr. Nazar Mohamed Hassan has presented the two volumes 20 (2018) and 21 (2019) of the *African Development Perspectives Yearbook* at meetings in UNESCO offices (in Cairo and Paris) and for parliamentarians in Cairo, Egypt. This information had given additional weight to the theme of “STI Policies for Inclusive Growth in Africa”. Professor Samia Satti Osman Mohamed Nour gave such information to members of the Faculty of Economics at Khartoum University, Sudan; she did this also for volume 22 (2020/21) on “SDG 9 and Africa’s development”. In Bremen, Germany, launch meetings also take place; and the presentation of the Festschrift

was a great event. We hope that we can realise such launch and information meetings also for volume 23 (2022/23) of the *African Development Perspectives Yearbook*. It may be a good idea - regarding the theme of volume 23 - to do this in cooperation with the Interdisciplinary Centre for Digital Futures (ICDF) of the University of the Free State (UFS) in Bloemfontein, Free State, South Africa and African Chambers of Commerce and Industry, such as The Pan African Chamber of Commerce and Industry (PACCI) in Addis Ababa, Ethiopia. The proposal is now on the table and is addressed to the responsible directors.

Professor Dr. Tobias Knedlik, the Managing Editor of the *African Development Perspectives Yearbook*, and Professor Karl Wohlmuth, the Director of the *Research Group on African Development Perspectives Bremen*, and its Volume Editor, are also thankful to Professor Samia Satti Osman Mohamed Nour from the University of Khartoum in Khartoum, Sudan for her continuous work as the Book Reviews/Book Notes Editor of the *African Development Perspectives Yearbook*. She has done many deep reviews of major reports, has widened the field of reviewers, and has prepared a Guide for Readers to explain the classification system (in cooperation with Professor Karl Wohlmuth). She is associated with important global and regional research institutions and has numerous advisory functions. The Unit 4 on Book Reviews and Book Notes provides detailed assessments of a great number of books, journals, discussion paper series, research papers, and documents which are related to the specific theme of the volume. But also, the Unit reviews global reports on the state of the world economy, reports on African countries' economic situation, and specialised publications on Africa's development perspectives. The Unit on Book Reviews and Book notes is based on a detailed list of subjects/classifications which are filled with relevant reviews; the Unit is of value for all those readers who want to go deeper in their understanding of African development perspectives.

We are thankful to all the contributors and supporters of the *African Development Perspectives Yearbook* for their hard work, their steady encouragement and their continuous assistance. The valuable inputs from leading African research institutions and their experts have contributed over the years to the success of the *African Development Perspectives Yearbook* as an outstanding publication on and for Africa. In 2019 the *African Development Perspectives Yearbook* project has celebrated its 30th birthday, as the first volume has appeared in 1989. The Festschrift which appeared at this occasion (now in the second edition) has motivated a great number of former contributors, editors, and supporters to continue with their work for the Yearbook project. Many of them help in the peer-review process of incoming manuscripts. The readers of the various *African Development Perspectives Yearbook* volumes have a great role in the success of the Yearbook project; they continuously have contributed with critical comments and with supportive encouragement, so that over time a valuable partnership has emerged between

readers, contributors, and editors. As the Yearbook is now an Open Access publication, this process of collaboration with readers is intensified.

Various institutions have made over the years donations and have funded specific allocations to the *African Development Perspectives Yearbook* project, but the support of the University of Bremen, Bremen, Germany is of invaluable importance. The University of Bremen was awarded by the German scientific research community in June 2012 (and up to 2019) the title “Excellence University”, and the *Research Group on African Development Perspectives Bremen* is very proud about this distinction. The great honour for the University of Bremen was helpful in the further work of the *Research Group on African Development Perspectives Bremen*. These donations, direct supports, and research grants to the *African Development Perspectives Yearbook* project and to various related research projects have helped us to intensify the research activities on African development issues in Bremen and in Africa, to distribute the various volumes of the Yearbook to African partner universities and to major African research institutions, and to invite research scholars from leading African research institutions to work with us in Bremen. Institutions like the Volkswagen Foundation and the Alexander von Humboldt Foundation have generously financed the stay of senior researchers at IWIM (Institute for World Economics and International Management) in Bremen. Also, the African Economic Research Consortium (AERC), the World Bank, and the International Monetary Fund (IMF) have contributed with research grants, invitations, and access to their networks, thereby supporting the research of our staff/guest researchers. The Department of Agricultural Economics and Extension, Ambrose Alli University, Ekpoma, Edo State, Nigeria has cooperated with us for many years; the researchers who stayed with us in Bremen are now back to their home university. Professor Reuben A. Alabi from this university has supported the Yearbook project as editor/co-editor and as contributor for many years, and he was a research collaborator in various development projects. The Research Group on African Development Perspectives Bremen is happy about a significant number of long-term partnership agreements which are of great value for the Yearbook project, especially the partnerships with Sudan, South Africa, Nigeria, and Tunisia. We are thankful for all these contributions and donations to the research activities on African development perspectives which are taking place in Bremen and in Africa; these are important supports for the *African Development Perspective Yearbook* project.

African Development Research Workshops were regularly held in Bremen at the University to discuss the draft papers which were intended for publication in the *African Development Perspectives Yearbook*. These African Development Research Workshops served as forums for the intensive discussion of the draft papers and of related research topics. Still there is contact to many of these research visitors; they are part of our network. These workshops are now replaced by online discussion forums about Units and Drafts, what has also to do with the COVID-

19 crisis. The Editors also want to express the thanks to the many referees of the draft contributions for their committed work which they are doing for the Yearbook. By this input the *African Development Perspectives Yearbook* has become over the years a fully refereed publication. Also, the reviewers of the many books, journals, research papers, and documents for the Book Reviews/Book Notes Unit are doing an excellent job. This new outlook and the new focus, as well as the new communication strategy, pay off. Past volumes, like the volumes 18, 19, 20, 21, 22, and now the new volume 23 give evidence of this important part of the work of the *Research Group on African Development Perspectives Bremen*. But there is still considerable interest in the prior volumes which started in 1989 with volume 1.

Many persons have given support, advice, and encouragement; others have helped with frank and critical assessments. However, the responsibility for the final product remains with the editorial team of the *Research Group on African Development Perspectives Bremen*. While the *Research Group on African Development Perspectives Bremen* is presenting its volume 23 for the year 2022/2023 with the title “*Business Opportunities, Start-Ups, and Digital Transformation in Africa*”, an International Call for Papers for volume 24 (for 2024/2025) with the title was already released to invite contributors and guest editors to participate in the work on this new project and to collaborate with us over the next years. The theme of the new volume 24 prepared for 2024/2025 with the proposed title “*Fiscal Capacity and Resource Mobilization in Africa – New Strategies and New Instruments*” is related to important research and cooperation programmes of the *Research Group on African Development Perspectives Bremen* on fiscal capacity and resource mobilization in African countries in times of global health, energy, climate, and food crises.

In the name of the Editorial Team:

Professor Dr. Tobias Knedlik, Research Professor at IWH Halle an der Saale, Germany and Professor of International Economics at Fulda University of Applied Sciences, Fulda, Germany, Managing Editor of the African Development Perspectives Yearbook, and

Professor Dr. Samia Satti Osman Mohamed Nour, Full Professor of Economics, Department of Economics, Faculty of Economic and Social Studies, University of Khartoum, Khartoum, Sudan, Affiliate of various international research institutes, Book Reviews/Book Notes Editor of the African Development Perspectives Yearbook, and

Professor Emeritus Dr. Karl Wohlmuth, University of Bremen, Chair for Comparative Economic Systems, Faculty of Economics and Business Studies, Director of the Research Group on African Development Perspectives Bremen, Scientific Coordinator, and Volume Editor of the African Development Perspectives Yearbook.

List of Abbreviations and Acronyms

₦	Naira
2G	second generation
3D	Three Dimensions (printing)
3G	third generation
4G	Fourth Generation of Mobile Connectivity
4IR	Fourth Industrial Revolution
5G	Fifth Generation of mobile telephony and communication
A	Advisor
AAAA	Addis Ababa Action Agenda (to allow for global finance of sustainable development)
AACB	Association of African Central Banks
ACM	Association for Computing Machinery
ADA	African Digital Agenda
ADB	Asian Development Bank (ADB)
ADEPME/ADEP M	Agence de développement et d'encadrement des petites et moyennes entreprises
ADI	African Development Institute
ADIE	Agence de l'Informatique de l'Etat (Senegal)/State Informatics Agency
AERC	African Economic Research Consortium
AES	Agricultural Engineering Skills
AfCFTA	African Continental Free Trade Area
AFD	Agence Francaise de Développement/ French Development Agency
AfDB	African Development Bank
Africa CDC	Africa Centres for Disease Control and Prevention
Africa PGI	Africa Pathogen Genomics Initiative
AGI	Association of Ghana Industries
AI	Artificial Intelligence
AIB	Academy of International Business
ALDC	Africa and Least Developed Countries (Department in UNCTAD)
ALRP	Agriculture and Land Reform Policy (South Africa)

ALS	Automatic Loan Solution
ANADER	Agence Nationale d'Appui au Développement Rural (Ivory Coast)
ANAQ-Sup	Autorité Nationale d'Assurance Qualité de l'enseignement Supérieur (Sénégal)
ANPEJ	Agence nationale pour la promotion de l'emploi des jeunes
ANTIC	Agence Nationale des Technologies de l'Information et de la Communication/National Telecommunications Agency
API	Application Programming Interface
APIs	Active Pharmaceutical Ingredients
APRAO	Amélioration de la Productivité Rizicole en Afrique de l'Ouest/ Western Africa Rice Improvement Project
APRI	Africa Policy Research Institute
ARI	Africa Rice Initiative
ARSEL	Agence de Regulation du Secteur de l'Electricite/Electricity Sector Regulatory Agency
ARTP	Autorité de Régulation des Télécommunications et des Postes (Senegal)
ASMEs	African small and medium enterprises
ATM	Automatic Teller Machines
ATPC	African Trade Policy Centre (of UNECA)
AU	African Union
AUC	African Union Commission
AUDTS	African Union Digital Transformation Strategy
AWS	Amazon Web Services
B2B	business-to-business business model
B2C	business-to-consumer business model
BBB	Build Back Better (framework)
BC	Business in Cameroon (business magazine)
BCEAO	Banque Centrale des États de l'Afrique de l'Ouest
BCG	Boston Consulting Group
BD	business development
BFI	Banking and Financial Industry
BICEC	BANQUE INTERNATIONALE DU CAMEROUN POUR L'EPARGNE ET LE CREDIT
BPO	Business Processing Outsourcing

BRICS	Group of five countries (Brazil, Russia, India, China, and South Africa)
CA	California
CAA	Caisse Autonome d'Amortissement (du Cameroun)
CAGR	Compound Annual Growth Rate
CAMPOST	Cameroon Postal Services
CAMTEL	Cameroon Telecommunications
CAMU	Central African Monetary Union
CASP	Comprehensive Agricultural Support Programme (South Africa)
CBC	Commercial Bank of Cameroon
CBSS	Community Based Seed System
CDC	Cameroon Development Cooperation
CDSC	Cameroon Digital Skills Campaign
CE	Conformité Européenne
CEEAC	Communauté Économique des États de l'Afrique centrale
CENIT@EA	Centre of Excellence for Information and Communication Technologies in East Africa
CEO	Chief Executive Officer
CESA	Continental Education Strategy for Africa
CFA Francs	Franc de la Communauté Financière d'Afrique)
CFAO	Corporation For Africa & Overseas
CHU	Centre Hospitalier Universitaire
CIDV	Compagnie Ivoirienne pour le Développement du Vivrier (Ivory Coast)
CII	Competitive Industrial Index
CIMA	CONFÉRENCE INTERAFRICAINNE DES MARCHÉS D'ASSURANCES
CIP	Competitive Industrial Performance (Index)
CIPMEN	Centre Incubateur des PME au Niger
CIPRES	CONFERENCE INTERAFRICAINNE DE LA PREVOYANCE SOCIALE
CIRP	Collège International pour la Recherche en Productique/International Academy for Production Engineering
CMS	Content Management System

CMTI	Conférence Mondiale des Télécommunications Internationales
CNRA	Centre National de Recherche Agronomique
COBAC	Commission Bancaire de l'Afrique Central
COTVET	Council for Technical and Vocational Training of Ghana
COVAX	COVID-19 Vaccines Global Access
COVID	Coronavirus Disease
CRDI	Centre de recherches pour le développement international
CREATEAM	Centre Révélateur et Accélérateur de Talents d'Entreprises
CRM	Customer Relationship Management
CSOs	civil society organisations
CSR	Corporate Social Responsibility
CTE	Cameroon Tea Estates
CTIC	Accompagnateur de Croissance TIC Dakar
CUA	Commission de l'Union Africaine
D4ICT	Development for ICTs
DA	Data Analytics
DAC	Development Assistance Committee (of OECD)
DAI	Digital Acceleration Index (of BCG)
DC	Digital Citizen
DCP	Digital Credit Processing
DCVMN	Developing Country Vaccine Manufacturers Network
DDRI	Digital for Development Research Initiative
DDSS	Digital Decision Support System
DE4A	Digital Economy For Africa
DER	Délégation de l'Entrepreneuriat Rapide
DESA	Department of Economic and Social Affairs (of the UN)
DFID	Department For International Development (UK)
DFS	Digital Financial services
DI	Digital Insurance
DIE	Deutsches Institut für Entwicklungspolitik
DOI	Digital Opportunity Index
DS2025	The Digital Senegal 2016-2025 Strategy

DSL	Digital Subscriber Line
DSS	Decision Support Systems
DTCC	Digital Transformation Center Cameroon
DTSfA	Digital Transformation Strategy for Africa
E	Entrepreneur
EAC	East African Community
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECCAS	Economic Community of Central African States
ECG	Electrocardiograms
ECOWAS	Economic Community of West African States
ECR	European Research Council
EGF	Equity Group Foundation (Kenya)
EGH	Expert Group on ICT Household Indicators
EGTI	Expert Group on Telecommunication/ICT Indicators
eHealth	Electronic Health
EHFP	Enhanced Homestead Food Production (programme)
EIB	European Investment Bank
EISA	Enterprise Information Service Architecture
EN	Europäische Norm
ENEO	Eneo Cameroon S.A./The Energy of Cameroon
EPZ	export processing zone
ERA	Economic Report on Africa
ERP	Enterprise Resource Planning
ESC	Economic Sustainability Committee (of Nigeria)
ESCSA	United Nations Economic and Social Commission for Western Asia
EU	European Union
EUR	Euro/€
EVD	Ebola Virus Disease
FAAS	Farming-as-a-Service
FAFCI	Fonds D'Appui Au Femmes Du Cote D'Ivoire
FANG	Facebook, Apple, Netflix, and Google (old FANG model)

FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistics
FC	Forever Clair
FCFA	Franc Communauté Financière de l’Afrique
F-CFA	Franc de la Coopération Financière en Afrique
FCT	Federal Capital Territory (of Nigeria)
FDI	Foreign direct investment
FERDI	Fondation pour les études et recherches sur le développement international / Foundation for Studies and Research on International Development
FES	Friedrich Ebert Stiftung
FGDs	Focus Group Discussions
FGN	Federal Government of Nigeria
FIND	Foundation for Innovative New Diagnostics
FM	frequency modulation (for broadcasting)
FMS	Farm Management System
FMT	Finmark Trust
FS	Free State, South Africa
G20	Group of 20 largest economic powers
GAOFI	Grace Amey-Obeng Foundation International
GBC	Global Business Consulting
GBSN	Global Business School Network
GDP	Gross domestic product
GDPR	General Data Protection Regulation (South Africa)
GE	Great Enterprises
GFDA	Ghana Food and Drugs Authority
GFF	Global Financing Facility
GHABA	Ghana Hairdressers and Beauticians Association
GHC	Global Health Centre (Graduate Institute in Geneva, Switzerland)
GICAM	Groupement Inter-patronal du Cameroun (Cameroon Employers’ Association)
GII	Global Innovation Index
GIZ	Gesellschaft für Internationale Zusammenarbeit

GODAN	Global Open Data for Agriculture and Nutrition programme
GRRG	Grid Related Research Group (at UFS)
GRSI	Government Response Stringency Index
GSA	Ghana Standards Authority
GSM	Global System for Mobile Communication
GVC	Global Value Chain
GW	Gigawatt
HAS	Health and Safety Authority (Dublin, Ireland)
hbk	Hardcover Book
HDI	Human Development Index
HDP	humanitarian-development-peace (strategy)
HICs	High-income countries
HIIG	Humboldt Institut für Internet und Gesellschaft
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
HNSF	health normative standards framework
HRM	human resource management
IAM	Institut Africain du Management (Business School), Senegal
IBM	Integrated Business Model
IBRD	International Bank for Reconstruction and Development (of World Bank Group)
ICA	Infrastructure Consortium for Africa
ICDF	Interdisciplinary Centre for Digital Futures (of the UFS)
ICL	Imperial College London
ICSME	International Conference on Software Maintenance and Evolution (ICSME/IEEE)
ICT	Information and Communication Technology
ICT4D	Information and Communication Technology for Development
ICTD	Information and Communication Technologies and Development, Doha, Qatar
ICTs	Information and Communication Technologies
ID	identity

IDA	International Development Association (IDA belongs to the World Bank Group)
IDB	Inter-American Development Bank
IDI	ICT Development Index
IDRC	International Development Research Centre (Canada)
IDS	Institute of Development Studies
IEEE	Institute of Electrical and Electronics Engineers
IFABS	INTERNATIONAL FEDERATION OF AFRICAN BUSINESS STUDENTS
IFC	International Finance Corporation (of World Bank Group)
IFERA	International Family Enterprise Research Academy
IFPRI	International Food Policy Research Institute
IFRI	International Food Policy Research Institute
IHE	Integrating the Health Enterprise
IIARD	International Institute for Academic Research
ILO	International Labour Organization
ILOSTAT	ILO Statistics Database
IMD	International Institute for Management Development
IMF	International Monetary Fund
IMT	International Mobile Telecommunications
INET	Institute for New Economic Thinking
INRA	Institut National de Recherches Agronomiques (Ivory Coast)
INS	Institut National de la Statistique (du Cameroun)
INSEAD	Institut Européen d'Administration des Affaires (acronym/founded in 1957 under this name)
IOM	International Organization for Migration
IoT	Internet of Things
IPoA	Istanbul Programme of Action
IPOs	initial public offerings (at capital markets)
ISBN	International Standard Book Number
ISM _s	international support measures (for LDCs)
ISO	International Organization for Standardization
ISSN	International Standard Serial Number

IST-Africa	Programme for Innovation, Science and Technology adoption, policy, and research in 18 African countries
ISTE	International Society for Technology in Education
IT	Information Technology
ITC	International Trade Centre
ITEC	International Technical Educational Certificate
ITO	Information Technology Outsourcing
ITS	International Telecommunications Society
ITU	International Telecommunications Union
IV	instrumental variable
IWIM	Institute for World Economics and International Management (at the University of Bremen)
iWorkers	workers whose livelihood is secured through contracts via digital platforms
JEE	Joint External Evaluation (of WHO)
JICA	Japan International Cooperation Agency
J-PAL	The Abdul Latif Jameel Poverty Action Lab
KAM	Kenya Association of Manufacturers
KENRIK	Kenya Resource Centre for Indigenous Knowledge
kWh/m ² / day	Measure for solar irradiation measurement
LAREM	Laboratory of Economic and Monetary Research (at UCAD, Senegal)
LDCs	Least Developed Countries
LICs	low-income countries
LLAKES	Centre for Learning and Life Chances in Knowledge Economies and Societies, University College London (UCL)
LLC	Limited Liability Company
LLDCs	Landlocked Developing Countries
LMICs	lower-middle-income countries
LNOB	Leave No One Behind
LSE	London School of Economics
LTD	Low-Tech Data
MAXQDA	software for qualitative data analysis
Mbps	Megabits per second

MDGs	Millennium Development Goals
ME	Moyenne Entreprises
ME	Medium-sized Enterprises
MESs	Medical Embedded Systems
MFIs	Micro-Financial Institutions
MINAGRA	Ministry of Agriculture and Animals Resources/ Ministère de l'Agriculture et des Ressources Animales
MINPOSTEL	Ministry of Posts and Telecommunications
ML	Machine Learning
MNEs	multinational enterprises
MoMo	Mobile Money
MoTI	Ministry of Trade and Industry
MPT	Ministère des Postes et de Télécommunications
MR	Mechanisation Restrictions
MRO	maintenance repair operations
MSE	Middle Size Enterprises
MSEs	Micro and Small Enterprises
MSMEs	Micro, Small Scale and Medium Enterprises
MTN	Mobile Telephone Networks (Cameroon)
MVP	Minimum Viable Product
MW	Megawatt
N95	US-Standard for face masks (equivalent to FF2 masks)
NAF	Nigeria Airforce
NAFDAC	National Agency for Food and Drug Administration Control
NAN	News Agency of Nigeria
NCDC	Nigeria Centre for Disease Control
ND	no data (available)
NDoH	National Department of Health (in South Africa)
NDP	National Development Plan
NDS 30	National Development Strategy 30 (Cameroon)
NERC	National Emergency Response Committee (of Kenya)
NGO	Non-Governmental Organization
NIS	National Institute of Statistics (of Cameroon)

NP	not possible (correlation is not possible)
NPIs	Non-Pharmaceutical Interventions
NPRP	National Priorities Research Programme
NPS	National Payment Switch
NRI	Network Readiness Index
NSAGs	Non-State Armed Groups
NVQ	National Vocational Qualification
OD	Open Data
ODA	Official Development Assistance
ODAN	Open Data for Agriculture and Nutrition
ODCs	other developing countries
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
OFCHR	United Nations Human Rights Office of the High Commissioner
OII	Oxford Internet Institute
OM	Orange Money
OM	Observation Memo
ONDR	Office National du Développement de la Riziculture (Ivory Coast)
ORSTOM	Office de la recherche scientifique et Technique d’Outre-Mer
OSP	Office National des Semences et Plants (Ivory Coast)
P	Partner
PAMOL	Plantations Plc Company produces palm oil, palm kernel oil, oil palm seeds, washing soap, and rubber.
PAVIE	Projet d’Appui et de Valorisation des Initiatives Entrepreneuriales des femmes et des jeunes/Project for the Support and Valorisation of Entrepreneurial Initiatives of Women and Youth (Senegal)
pbk	Paperback Book
PC4IR	Presidential Commission on the 4th Industrial Revolution
PCI	Productive Capacities Index
PE	Petite Entreprises
PES	Plan for an Emerging Senegal

PFM	Public Financial Management
PIB	Produit Intérieur Brut
PIDA	Programme for Infrastructure Development in Africa
PM	performance management
PME	Petites et Moyennes Entreprises
POPIA	Protection of Personal Information Act (South Africa)
PPE	Personal Protective Equipment
PPP	Public Private Partnerships
PRIDA	Policy and Regulatory Initiative for Digital Africa
PSE	Plan Sénégal Émergent
PSE-J	Plan Sénégal Émergent/Senegalese Youth Employment Programme
PV	Photovoltaic
PVC	Polyvinyl chloride
PwC	PricewaterhouseCoopers (international advisory firm)
Q	quarter
Q2	Quarter 2
QLFS	Quarterly Labour Force Survey
QLM	Quantum Learning Machine
R	Rand (South African currency)
R&D	Research and Development
RECs	regional economic communities
RED	Rapid Entrepreneurship Delegation (in French DER)
REEEP	Renewable Energy and Energy Efficiency Partnership
RePEc	Research Papers in Economics (related to Munich Personal RePEc Archive)
retr.	retrieved
RfFTI	Readiness for Frontier Technologies Index
RFI	Radio France Internationale
RFS	Reverse Funnel System
RFTI	Readiness for Frontier Technologies Index
RGE	Recensement Général des Entreprises
RIM	Reference Information Model (to define standards and competencies in health systems)

RISE	Research and Innovation and Science Policy Experts (Group of EU's Horizon 2020 programme)
RoSA	Republic of South Africa
RP	research proposition(s)
RT-PCR	Reverse Transcription - Polymerase Chain Reaction
S&P	Standard & Poor's
SA	South Africa
SACCO	Savings and Credit Cooperative Organization
SADDSS	Socially Aligned Digital Decision Support System
SAIFSS	South Africa Integrated Food Security Strategy
SAJAE	South African Journal of Agricultural Extension
SAPs	structural adjustment policies/programmes
SARS-Cov-2	Severe Acute Respiratory Syndrome - Coronavirus type - 2
Schufa	Schutzgemeinschaft für allgemeine Kreditsicherung
SCOTA	Software Components Over The Air
SCP	Small Scale Producer
SDF	Skills Development Fund
SDG	Sustainable Development Goal
SDGC/A	Sustainable Development Goals Center For Africa
SDN 30	Stratégie Nationale de Développement 30
SDSN	Sustainable Development Solutions Network
SE	Small Enterprises
SE4ALL	Sustainable Energy for All
SEBS	Salon Equipment and Beauty Supplies
SECP	Sustainable Energy Consumption and Production
SGBC	Société Générale de Banques au Cameroun
SGC	SOCIÉTÉ GÉNÉRALE CAMEROUN
SHS Web of Sciences	Conference proceedings in social sciences and humanities
SIS	seed information system
SMBs	Small and medium-sized businesses
SMCs	submarine telecommunications cables
SME	Small and Medium Enterprise
SMS	Short Message Service

SO	specific objectives
SODERIZ	Société de développement de la Riziculture (Ivory Coast)
SONARA	Société Nationale de raffinage (National Refining Company LTD)
SOT	second-order theme(s)
SSA	Sub-Saharan Africa
SSFP	Small-Scale Female Producers
SSRN	Social Science Research Network
STATS SA	Statistics South Africa
STEM	Science, Technology, Engineering and Mathematics
STI	science, technology, and innovation
SWOT	strengths, weaknesses, opportunities, and threats (analysis)
TB	Tuberculosis
TE	Transnational Entrepreneur (ship)
TIC	Technologies de l'Information et de la Communication
TKN	Transformative Knowledge Network
TPE	Très Petite Entreprises
TPRA	The Telecommunications and Post Regulatory Agency (in French ARTP)
TRB	Telecommunications Regulatory Board
TV	Television
TVET	technical and vocational education and training
UA	Unit of Account
UAE	United Arab Emirates
UBA	United Bank of Africa
UCAD	Université de Cheikh Anta Diop, Sénégal
UCL	University College London
UFS	University of the Free State (South Africa)
UHC	Universal Health Coverage
UIBM	unique integrated business model
UIS	UNESCO Institute for Statistics
UK	United Kingdom
UK-DfID	UK Government's Department for International Development

UKI	United Kingdom and Ireland
UMAC	Union Monétaire de l'Afrique Central
UMICs	upper-middle-income countries
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNCDF	United Nations Capital Development Fund
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Education, Scientific and Cultural Organization
UNFSS	United Nations Forum on Sustainability Standards
UN-HABITAT	United Nations Human Settlements Programme
UNICEF	United Nations Children's Emergency Fund
UNIDO	United Nations Industrial Development Organization
UNU-EHS	United Nations University, Institute for Environment and Human Security
UNU-WIDER	United Nations University - World Institute for Development Economics Research
US	United States
US DOS	United States Department of State
USAID	United States Agency for International Development
USD	United States Dollar
USSD	Unstructured Supplementary Service Data (digital codes)
VC	Venture Capital
VSE	Very Small Enterprises
VSS	voluntary sustainability standards
WADEP	West Africa Digital Entrepreneurship Programme
WBESs	World Bank Enterprise Surveys
WBG	World Bank Group
WDI	World Development Indicators (of the World Bank)
WEF	World Economic Forum
WELLBYs	Well-Being-Adjusted Life-Years
WFP	World Food Programme

WHO	World Health Organization
WHO-GMP	WHO- Good Manufacturing Practices
WHORO Africa	WHO Regional Office (Africa)
WHR	World Happiness Report
WIPO	World Intellectual Property Organization
WSIS	World Summit on the Information Society
WSS	Within cluster Sum of Square
WTO	World Trade Organization
XAF	Code for the Central African Franc BEAC (BANQUE DES ÉTATS DE L'AFRIQUE CENTRALE)
XOF	Code for the West African Franc/ CFA Franc (BCEAO Banque Centrale des États de l'Afrique de l'Ouest)

**Unit 1: Digital Transformation, Digital Entrepreneurship,
and Digital Business Opportunities in Africa
– General Issues**

Digital Transformation, Digital Entrepreneurship, Digital Start-Ups, and Digital Business Opportunities in Africa – An Introduction

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1 The Issues

The Digital Transformation Strategy of the African Union

The Digital Transformation Strategy for Africa (2020 – 2030) of the African Union (AU 2020)² is an important document which highlights under ten headlines (in ten sections) major themes, proposals, analyses, and recommendations and actions. In the Introduction (*section 1*) it is emphasized that with the Digital Transformation Strategy for Africa (DTSfA) the “sea of economic opportunities in virtually every sector” (p. 1) can be activated and exploited, as digital transformation is (see p. 1) “a driving force for innovation, inclusive and sustainable growth.” The Digital Transformation Strategy for Africa was developed in cooperation with various African agencies being interested in ICT, development, and digital transformation; the strategy was built on existing initiatives and frameworks, such as the Policy and Regulatory Initiative for Digital Africa (PRIDA), the Programme for Infrastructure Development in Africa (PIDA), and various other programmes. A great role was played by Smart Africa³ which is aiming at a Digital Single Market in Africa, looking at it as a strategic vision. In *section 2* on Vision and Objectives we find a clear Vision which is based on an integrated and inclusive digital society and economy in Africa, a Vision which improves the quality of life of Africa’s people, strengthens the economic sector, enables diversification and development, and ensures continental ownership with Africa as a producer and not only as a consumer in the global

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² See: African Union (AU), 2020, The Digital Transformation Strategy For Africa (2020 – 2030), May 18, 2020, 53 pages, African Union: Addis Ababa, Ethiopia; for the download of the document: <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>, and: <https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf>

³ See on Smart Africa, from vision to action programmes: <https://smartafrica.org/>

digital economy (pages 2 - 3). The Overall Objective relates to promoting Africa's integration, generating inclusive economic growth, stimulating job creation, breaking the digital divide, eradicating poverty, and ensuring Africa's ownership of modern tools of digital management (see page 2). The Specific Objectives (see pages 2 - 3) relate to the key transformations which are ongoing in Africa, such as accelerating industrialization, contributing to the digital economy, and supporting the African Continental Free Trade Area (AfCFTA). Very ambitious expectations for the year 2030 are formulated in these specific objectives which are intended with the DTSfA. In *section 3* there is a preliminary SWOT analysis (pages 3 - 4). Presented are the internal strengths and weaknesses, and the external opportunities and threats of a digital transformation strategy. While various promising strengths and opportunities are obviously there (because of the young people and the increasing qualification), some crucial weaknesses and threats are also observed (mainly related to the coordination failures of African institutions). Obviously, it is not possible yet to give any quantified form to evaluate the real bottlenecks for a Digital Transformation Strategy, what is a problem because of the short period left to the end-year of 2030.

After these three introductory sections we find in *section 4* a note on how to develop the strengths and the weaknesses for a Digital Transformation Strategy for Africa (see the pages 4-5). *Section 5* is a short reminder of how to respond to the opportunities and how to manage the threats (p. 5). In these two short sections the African Union (AU) and the African Union Commission (AUC) assume responsibility for the Continental Digital Transformation Strategy for Africa and offer its coordination and policy guidance services to do this work in the coming years. *Section 6* gives the Conceptual Framework (pages 5 - 6). The approach for the DTSfA is based on using the previous initiatives and documents and on guiding the task through collaborative and multi-stakeholder actions. The schedule is to move from the conceptual framework to the practical implementation of the DTSfA through a sequence from Foundational Pillars to Analysis, to Pathways to Transformation, to Strategies to Unlock the Pathways, and then to Tools for Success. Key elements are the Foundation Pillars (enabling environment, policy and regulation; digital infrastructure; digital skills and human capacity; and digital innovation and entrepreneurship), the Critical Sectors (digital industry; digital trade and financial services; digital government; digital education; digital health; and digital agriculture), and the Cross-cutting Themes (digital content & applications; digital ID; Emerging Technologies; cybersecurity; privacy and data protection, and research and development). These three key elements will constitute the digital ecosystem which is then based in the implementation process on focussed policy recommendations and actions. The section also presents Principles for the digital ecosystem (to make it comprehensive, transformative, inclusive, homegrown, safe, and changing the attitudes of the actors to a new mindset). *Section 7* (pages 6 - 22) gives details on the various Foundation Pillars

which must be considered and implemented so that digital transformation can be stable and self-sustaining; this will help to create critical digital dividends across and between the many sectors of the economy and society. For the four (4) key Foundation Pillars (enabling environment; digital infrastructure; digital skills & human capacity; and digital innovation & entrepreneurship) we find in the DTSfA a clear description and structure with a general overview of the issues, with a definition of the problems, and with valuable policy recommendations and related proposed actions. The emphasis on policy recommendations and actions is quite strong, and these blocks reveal a lot of measures to be followed in these four (4) core fields.

Section 8 is on “Critical Sectors to drive Digital Transformation”. Some sectors are critical to generate the benefits of digital transformation for the general population. The successful digitalization of the critical sectors depends on the implementation of the foundation pillars in these sectors. Starting with the “Digital Industry” (critical sector 1), the AU Strategy focusses on the development of “a competitive advantage in the area of digital exploitation and production through the development of a competitive ICT industry and service sector.” (p. 23). This was already an important sector for responding to the Covid-19 crisis in Africa. The next key sector is “Digital Trade and Financial Services” (critical sector 2), being necessary to create a “digital market” which is supported by increasing the quality of financial services, by addressing conditions for a fair competition, and by providing for advanced consumer protection. The outstanding focus is to create real conditions for digital trade and financial services (p. 24). While “digital industry” relates to the production of ICT products, “digital trade and financial services” relates to conditions for national, regional, and global e-commerce. The next sector of interest is “Digital Governance” (critical sector 3), and the idea with it is to provide the same service standards in the governance sector as in the private sector (by assuming that the private sector in Africa is still better organized). A good system of digital governance can overcome the “silo approach” by a “whole of government approach”, so that all government functions are considered in reforms instead of starting with one function (like a silo) only. Obviously, Africa can learn from four countries in this regard (Seychelles, Tunisia, South Africa, and Mauritius), as the UN e-government development index reveals indicators of superiority there (p. 29). To support enterprises through government services, the Enterprise Information Service Architecture (EISA) needs to be strengthened through openness, transparency, and use of best practices (p. 29). “Digital Education” (critical sector 4) refers to the AU Continental Education Strategy for Africa (CESA 2016 - 2025), being a complement to the ambitions of the AfCFTA to make countries benefit from skills expansion in Africa. The optimization of the supply chains and the implementation of the fourth industrial revolution (4IR) will depend on a continued progress of CESA. Emphasized is the need to include “digital skills training into the core curriculum of formal education courses for all

learners...” (p. 31). Also, informal education needs to be included, but may be already part of CESA. The next critical sector is “Digital Health” (critical sector 5). The Africa Health Strategy (2016-2030) relates as well to the objectives of the AfCFTA, as productivity increases depend on using fully digital health instruments all over Africa, and aiming to reach rural and remote areas, but also informal workplaces. Universal Health Coverage (UHC) can be reached by digital health instruments and data sources. Key is interoperability between health system institutions and agencies to use fully the digital health solutions and the data sources. “Digital Agriculture” (critical sector 6) is a key sector as farm productivity in Africa needs to increase faster than the global average to overcome the hunger crisis situations in Africa. The potential of digital technologies is praised as a chance for this sector to apply cheap and reliable ICT devices, and because of the possibility to include all the stakeholders (farmers, investors, and entrepreneurs) in a digital development strategy for Africa’s agriculture and agribusiness. Inefficiencies along the agribusiness value chains can be overcome by digital solutions and by digital data sourcing if the institutional set-up of the sector is reformed. The high losses of agricultural produce along the value chain can be reduced rather quickly in a digitally enabled economy.

In *section 9* some Cross-cutting Themes are discussed. “Digital Content and Applications” (cross-cutting theme 1) refers to critical internet sources so that via dotAfrica⁴ domain names the benefits for internet users can be fully realised and local content can be made available more easily by local hosting. For most of the 216 million active Social Media Users in Africa it is the case that most of the content which is accessed is hosted overseas. Increasing the production of local content and of hosting the content locally are the two important objectives for solving the dilemmas related to cross-cutting theme 1. There are still serious policy gaps to support such a localization strategy. The awareness of the necessity for local content production and for local hosting to reap the related benefits is now widespread, but still there are barriers which may become removed with the AfCFTA. “Digital ID” (cross-cutting theme 2) means that a legal identity can be created for All in Africa. It is argued that the digitalization of identity “is the unique identification of individuals through a digital channel.” (p. 40). Many economic, social, and legal benefits are associated with such an ID. Digital ID, when based on biometrics, can help to identify positively and uniquely individuals in Africa (for national ID, for refugee ID, and for non-resident ID). Digital ID is a precondition for participation in Africa’s digital economy and with it in the labour market and the wider society. The Digital ID is also a precondition for the Digital Single Market and for the full exploitation of the benefits of the AfCFTA.

⁴ See about the African Union position (Launch of dotAfrica, March 10, 2017): <https://au.int/en/newsevents/20170310/launch-dotafrika>

“Emerging Digital Technologies” (cross-cutting theme 3) are also gaining interest in Africa, mainly to leapfrog technologies for industrialization. Such digital emerging technologies (such as blockchain, artificial intelligence, Internet of Things, Internet of Nano Things, and 3D Printing) can provide tasks which are normally based on human intelligence. They allow it to shift from physical to digital business models and from firm-based to network-based business models. Already, such technologies are used in some of the mentioned critical sectors in Africa. Because of the rapid growth of the number of young people in Africa, and because of related qualification increases, there are enormous opportunities to benefit from the application of such emerging digital technologies. A regulation of such technologies is however needed to conform the derived business models with the objectives of a fair competition and of higher levels of transparency. Protecting the rights of the citizens and establishing fair and competitive markets should be the objectives of an adapted and effective regulation. Cybersecurity, Privacy and Personal Data Protection (cross-cutting theme 4) is a relevant issue as the increasing access to broadband connectivity may lead to more cyberattacks in Africa. This problem may grow and can become a problem especially for African enterprises and some government actors. As trust is an important requirement for the functioning digital economy, educating businesses and government officials on the risks of cybersecurity is key. Digitally connected and facilitated Research & Development (cross-cutting theme 5) is becoming more relevant as the African R&D systems and its institutions are more and more integrated into the global science, technology, and innovation (STI) systems, for which the broadband connectivity and the facilitation of Internet access are important. A cooperation between all the R&D stakeholders is needed, and as well all the global and national R&D promotion agencies need to be involved. A strategy to improve the resource development capacity of R&D needs to be developed, based on digital architecture, digital infrastructure, and digital governance.

Section 10 is on strategic enablers. This requires “political commitment at the highest level, aligning of policies and sector regulation and a massive scaling-up of investment and dedication of resources towards the foundation pillars and critical sectors for digital transformation.” (p. 50). The three key enablers are a strong political commitment for digital transformation, a strengthened implementation of digital transformation frameworks, and adequate means of financing and investment for digital transformation. Focus is much on financing through donors and external investors, but local private sectors and public sectors have an increasing role to play in this context. Other enablers are mentioned, like private sector & civil society engagement, regional and international cooperation, capacity development, advocacy and awareness, and a monitoring and evaluation framework.

The Digital Transformation Strategy for Africa is a valuable guide to assess how digital transformation is advancing in practice and to identify which steps got

neglected in the ongoing process. Obviously, there is some focus on the foundation pillars, and an increasing awareness about the role of some few critical sectors, but most of the cross-cutting themes are not yet addressed strongly in the debate. There are some support initiatives for the African Union's "Digital Transformation Strategy for Africa" from international finance organizations, regional organizations, and bilateral donors, such as "The Digital Economy For Africa (DE4A) Initiative" from the World Bank, but it is not clear from the text of the DE4A Initiative how the very ambitious objectives – "to ensure that every individual, business, and government in Africa will be digitally enabled by 2030" - are implemented.⁵ Also the European Investment Bank (EIB) has a programme to support the strategy of the African Union (AU), especially through a portfolio of complementary initiatives on universal access to affordable connectivity, digital services, financial inclusion, entrepreneurship, cybersecurity, and green power alternatives (see EIB 2021). It is not clear if there is enough coordination between donors; if not, there may be some highly expensive duplication efforts. Also, companies like Google and Alphabet claim to have an important role in Africa since many years to prepare the continent for digital transformation (see Pichai 2022).

Although the Digital Transformation Strategy of the African Union is rich and deep in content, it is a framework study, by highlighting foundations, drivers, sectors, and actions. It is not an analysis of digital transformation policies or an analysis of the maturity of African countries and companies on digitalization. We see in various analyses of ICT policies that Africa has good and bad policies on digital transformation, and in some African countries we find corrections from bad to good policies and vice versa (see Stuart 2022; ITU/International Telecommunication Union 2021). When countries tax Internet use through the transactions of individual persons and businesses or keep intact monopolistic market conditions of the telecommunication industry so that the prices of services remain high, then the digital divide will be prolonged or even become wider. Harmful are also the Internet shutdowns in some African countries as a form of censorship. When countries grant tax or other incentives to promote the competitiveness of digital services and when they reduce - in a negotiated and rational way - the service prices of the two or three telecom giants in a country, this will promote digital transformation. Countries with steady electricity supplies will also benefit in terms of digital transformation. Various indexes measure the progress of digitalization of Africa's companies; one index looks at the various digital transformation dimensions in companies, like strategy, marketing, operations, support functions, working modalities, technology, sources of new digital growth, or the ecosystem. Evidence on "digital maturation" shows that

⁵ See on "The Digital Economy For Africa (DE4A) Initiative" from the World Bank: <https://www.worldbank.org/en/programs/all-africa-digital-transformation>

African companies have certain advantages and various disadvantages (measured by the Digital Acceleration Index/DAI). The DAI is based in eight criteria (BCG 2020), and it shows that Africa is quite good in digital strategy building and in regard of the digital ecosystem, but less so in operations and technology or in the execution of other digital tasks.⁶ But Africa has world class companies with a high DAI score which is comparable to other world regions, despite of the low average score for Africa of 29 (out of a possible score of 100). Most important, data gaps are a severe problem which is not adequately addressed in the Digital Transformation Strategy of the African Union. This refers to the rural-urban and to the gender-related digital divide data and to the data on availability of basic, standard, and advanced ICT skills. Many African countries do not collect data on ICT skills (see ITU, 2021). Closing these gaps is important for employment policies, especially for the youth, as we must know more about the availability of ICT skills and the relevance of the various types of ICT skills for digital jobs (IDS/Institute of Development Studies 2016). It is obvious that analyses for countries, sectors and companies matter for a full evaluation of the state of digital transformation, and that data gaps need to become closed as quickly as possible (on the many ICT data gaps in Africa see ITU, 2021). Analyses and policy designs are hindered tremendously by these ICT data gaps.

The Unit 1 of the yearbook volume focusses on issues like trends of digital transformation, of digital entrepreneurship, of digital start-ups, and of digital business opportunities. But some specific issues related to critical sectors and cross-cutting themes are as well considered in this Unit 1.

Digital Transformation in Africa - New Explorations, Pathways, and Developments

The ongoing discussion on digital transformation in Africa is deepening and widening. Various lines of the discussion among academicians, development experts, and donors can be observed. Eight issues are mentioned in this overview.

The *first* issue (Africa's young labour force and the readiness for digital work) focusses on Africa's young population and the strong increase of Africa's labour force in the coming decades. This is the starting point to discuss the regional and the global potential for Africa's digitalization and entrepreneurship development. Many perspectives of digital transformation for global integration and employment creation are considered - the potential for outsourcing of work towards Africa and of using Africa's talent, the increasing use of global and regional digital platforms where Africans can apply for jobs and contracts, the

⁶ See on the Digital Acceleration Index (DAI) the report "The Race for Digital Advantage in Africa" by Boston Consulting Group (BCG), 09 March 2020: <https://www.bcg.com/de/publications/2020/race-digital-advantage-in-africa>

implications for competing globally in manufacturing, and the attraction of Africa for foreign direct investment in manufacturing and high technology sectors. Many arguments relate to the chances for manufacturing and services subsectors in Africa when applying digital technologies and 4IR technologies. The young entrepreneurs and the digitally skilled labour force of Africa can help to regain competitive positions for some products and services, as these sectors may benefit from the lower wage costs of the engineers, agriculturalists, managers, and marketing experts. It is also argued that young African entrepreneurs will support – after digital training and qualification programmes – a new wave of industrialization, of reindustrialization after decades of deindustrialization, and a new wave of domestic and direct investment towards activities beyond the resources sectors (see on the discussion: AU 2020; AUC/OECD 2021; AfDB et al. 2018; Cariolle/Carroll II, 2020; Dobson et al. 2021; Melia 2020; Melia 2019).

The *second* issue (return migration of the skilled to Africa and increasing role of transnational entrepreneurship) refers to the potential for Africa of capitalizing on the great number of skilled Africans who work overseas and who have already gained experience on digital workplaces and in high-tech sectors. Return migration also implies that African entrepreneurs use their knowledge in their home countries, and this can be side by side with their ventures in the host countries and in third countries. The role of African transnational entrepreneurs - who started originally with a business in their home country and who have then founded ventures in one or more host and third countries - for Africa's renewal is emphasized as more and more examples of returnees emerge. These transnational entrepreneurs may then later reinvest again in Africa, based on new experiences. The research on transnational entrepreneurs is now increasing in depth and quality. Such entrepreneurs have not only gained experiences in their home country but also in host countries where they have studied and/or worked. As they have founded businesses under quite varied conditions in home and host countries, they have gained resilience and strength in their daily operations. The diaspora is of great potential importance for digital transformation in Africa; these networks bring knowledge to various countries and help in establishing start-ups and digital entrepreneurship ecosystems (see on the discussion: AU 2020; Taura et al. 2019; Dobson et al. 2021; Friederici et al. 2020; Kuo 2015; UNCTAD 2018; WBG/World Bank Group 2017; Disse/Sommer 2020).

The *third* issue (exploiting the fourth industrial revolution (4IR) technologies in Africa) raises the question how the digital transformation can be speeded up by the adoption of fourth industrial revolution (4IR) technologies. The Covid-19 crisis has also in Africa led to the application and spread of such technologies (artificial intelligence for health and finance sectors; 3D printing through small and medium firms in formal and informal sectors; establishing health, retail, services, logistics, education, and finance platforms; using robots for care and repair technologies, using drones for transport and defence technologies, etc.). The

Covid-19-crisis has also led to the repurposing of traditional industries towards the production of Personal Protective Equipment (PPE) for infection control, like masks, hygiene products, and handling operations under safe conditions; this repurposing had already impact on the flexibility of industrial production in Africa. But also, various manufacturing and services sectors have benefitted from these 4IR technologies; the health, equipment, and care sectors and the bank, insurance, and finance sectors have benefitted most in terms of speed and scope of adoption. Innovations have proliferated from the utilization of 4IR technologies, although with highly uneven impact on sectors. Mining industry has also adopted 4IR technologies with impact on exploration, excavation, risk evaluation and management, and adding value through beneficiation of the raw materials. In the context of the fast increase of the African labour force it is observed that the agricultural sector and the agribusiness value chains may adopt 4IR technologies for many key activities (for transport logistics and supply chain management, for weather forecasting, for storage and quality of product control, for insurance and banking activities, etc.); the agriculture sector can absorb a great number of managers, scientists, engineers, and agronomists, but will also generate a pool of young entrepreneurs (see on the discussion: AU 2020; Accenture 2022; Andrews et al. 2018; ANTIC 2019; Banga/te Velde 2018; Bayuo et al. 2022; Bolat/Taura 2019; Cariolle 2020; Cariolle/Carroll II 2020; Dahir/Kazeem 2017; Phamodi/Power/Singh 2021; Singh/Said 2020; WEF 2022; Wohlmuth 2019; OECD 2019).

The *fourth* issue (digitalization of the education and training systems for All in Africa) relates to the great potential for digital transformation when reforming the education and training systems in Africa. Digital transformation centres are attached to African universities and colleges to adopt digital technologies for tertiary education. But there is need for adopting such technologies at all levels of the education and training system. Also, vocational training can benefit - at formal and informal sector workplaces – from adopting such technologies. It is argued that the digitalization should not start at the level of the tertiary sector, but that the primary school system, the secondary school system, and the vocational training schools and programmes should be part of the digital revolution of education and training systems in Africa just from the beginning. Educating teachers for the digital tasks at the level of primary and secondary schools will give the basis for the digital education revolution. It is obvious that this will further the reduction of the digital divide and will help to reduce inequality gaps between women and men. A Digital Strategy for All means that all barriers should be removed which divide those people who are benefitting from digital technologies from those people who are left out of such programmes. It is possible to identify such barriers and to work out support programmes for overcoming the digital divide (see the discussion: AU 2020; AUC/OECD 2021; EC/Africa Europe Alliance 2019; FES 2020; Möbius/Wünsch 2020; Roberts 2018).

The *fifth* issue (raising governance, accountability, trust, and transparency standards with digital tools) refers to a quite important sector where digitalization can lead to great improvements, namely in governance, accountability, trust, and transparency standards. Various global indexes show that digitalization can facilitate monitoring and evaluation, can help to ensure accountability, and can support the fight against all forms of corruption. New 4IR technologies, like blockchain and artificial intelligence, matter in this context. Their application is already part of governance, accountability, and taxation reform programmes, such as in the case of locating the source of mining products and the value of the product; other applications refer to cross-border trade transactions, to the identification of the health and quality standards, and to the optimization of the agricultural value chains. For key public functions (taxation, recording of the values to gain non-tax revenues, identification of beneficiaries for cash payments and other payments along the social safety nets, etc.), digital instruments are already helpful. Digital transformation in Africa is seen as a chance to restructure and to reform the public administration systems and to make the public-private partnerships more viable. It is observed that the application of digital tools is not enough, as the political will is deciding about far-reaching impacts on governance (see the discussion: AU 2020; Nanfuka 2022; SDSN et al. 2021; WBG 2022; AUC/OECD 2021).

The *sixth* issue (improving the trade and regional integration frameworks of Africa through digitalization strategies) relates to a future trade and regional integration strategy that uses fully the available digital tools and strategies to improve the operational frameworks. It is observed that overseas trade of Africa, intra-African trade, and regional and global integration of Africa will benefit from the digital transformation in Africa. There is evidence that the transport logistics sector depends on the full use of digital technologies at all levels and modes of transport, but that also the continuity of key supplies in agricultural, industrial, mining and services value chains can be secured through digital devices and instruments (for weather forecasts, climate change adaptation, extreme weather risk insurance, financing of value chain stakeholders, identification of new market niches, and for increasing the cross-country mobility of skilled people through the upskilling of workers, entrepreneurs, academicians, officials, students, etc.). The discussion about the African Continental Free Trade Area (AfCFTA) tells us that higher digitalization standards will allow it to reach a quicker trade and regional integration level by promoting a Single Digital Market (as proposed in full by the African Union Digital Strategy for Africa). The creation of a “Digital Identity” for persons and firms, for traders and investors, for skilled workers, migrants and refugees, academic staff, for students and teachers, and for consultants and experts is a major step in such an ambitious project (see the discussion: AU 2020; AUC/OECD 2021; Leke/Signe 2019; Umeh 2021; UNECA et al. 2019).

The *seventh* issue (using digital tools for social protection, inequality reduction, poverty alleviation, and implementation of the sustainable development goals) refers to problems how digital transformation can advance social development as a base for sustainable socio-economic development. The following policies, measures, and actions allow the use of digital instruments: bridging the digital divide, including women into the labour market, protecting the vulnerable groups, promoting financial inclusion, overcoming the social barriers of access to schools (because of transport costs and high school fees), reducing inequalities of incomes and assets, facilitating the access to the health system for all, advancing environmental protection, and optimizing the agricultural value chains. Evidence shows that digital transformation gives new impetus to these social actions, as beneficiaries can be better reached; and selected target groups can be better identified. The Covid-19 crisis has shown that targeted support can only be disbursed if there is a verified digital information (and digital identity); otherwise targeting is not feasible (see the discussion: AU 2020; AUC/OECD 2021; J-PAL 2020a; J-PAL 2020b; Unwin/Holloway 2019; Tricks 2017).

The *eighth* issue (support of leapfrogging in Africa through digital tools for accessing global knowledge and through the establishment of excellent and digitally connected R&D institutes). By such institutions the access of new technologies can be spearheaded through all sectors and areas so that local (homegrown) solutions can be found for developmental problems. These solutions can be of the “frugal innovation type”, meaning that digitalization allows for the localization of key functions which are embedded in complex technological products. Key functions of mobile phones for local use in rural and remote areas are easily identified and can be adapted towards new local demands. The optimization of value chains, the access to education and health, the access to information about weather conditions, to security support, and to the use of digital instruments for money transfers and the execution of regular payment commitments are some examples of what can be of immediate help. Leapfrogging is not only a task for some few excellent research institutions and universities but depends also on the information provided by huge numbers of stakeholders, firms, individuals, and actors in the field. Case studies show that the speed of releasing frugal innovations in Africa since the Covid-19 crisis is exemplary. Informal manufacturing and services sectors have added to the knowledge in the health and care sector, and have created valuable new products and services, but have also created safer workplaces in these informal workshops (see the discussion: AU 2020; AUC/OECD 2021; Wohlmuth 2019).

Digital Entrepreneurship in Africa - New Approaches

Africa is increasing rapidly its base for digital entrepreneurship. Software developers work on apps, on websites, and on online platforms; they started with businesses for the use of e-drones and e-robots; they work on EdTech, FinTech,

e-Health, and e-Government solutions. The share of Internet on GDP is increasing fast in Africa, especially so in Kenya, Morocco, Senegal, South Africa, and in Ghana. By 2025 the Internet economy of Africa could have a volume of \$180 billion, projected to rise to \$712 billion by 2050 (see the blog by Accenture, 2022). The number of African software developers is increasing quickly. With 720,000 software developers there are now more software developers in Africa than in California with 630,000.⁷ Small and medium-sized businesses (SMBs) with a focus on digital solutions and the junior software developer talent pool of Africa can create websites, payment apps, and other software solutions without acquiring or hiring advanced technical expertise (Accenture 2022). This mass of developers, of young talents, also pays in international competition, as 38% of the African software developers work for at least one company which is headquartered outside of the African continent (Accenture 2022). Digital entrepreneurship is also supported by special national government initiatives, such as the Tunisian Start-up Act, by establishing Centres for AI/Artificial Intelligence and Robotics, and by setting up AI (Artificial Intelligence) portals to attract foreign investors and to open windows for public and private sector action in regional economic communities (RECs) and for the AfCFTA project. Venture Capital (VC) investment is advancing quickly in Africa, reaching over \$4.3 billion in 2021; this means that between 2015 and 2021 VC investment has increased more than 10 times (Accenture 2022). Nigeria is especially strong in FinTech start-ups, and the country gets a 37% share in VC investment of all the VC funding undertaken in Africa (as it was recorded for the first eight months of 2021).

Most of the many software developers in Africa work for start-ups, so that the IT work is the base for the development of new enterprises. The IT sector is a unique pool for digital entrepreneurship development in Africa. It is reported that digital entrepreneurship often starts from some family businesses, such as the start-up “Made in Rwanda”, an e-commerce platform that is connecting women artisans to online markets. When visiting her family, the Rwandan computer engineer saw the high quality of the local handicraft, products which were sold only when foreign visitors sporadically came to the village. The income base increased sharply by the online platform sales. She also trains for computer literacy in remote rural villages and advises on modalities for establishing start-ups.⁸ International organisations, like the International Trade Centre (ITC), give support to important digital entrepreneurship programmes for Africa. The programme “Fast Tracking

⁷ See on “Tuning into Africa’s digital transformation”, February 26, 2022, blog by Accenture (2022); access for download <https://www.accenture.com/us-en/insights/software-platforms/africa-digital-transformation>

⁸ See: “Young digital entrepreneurs leading Africa into a new era”, 28 November 2019, UNCTAD/Prosperity for all; access for download: <https://unctad.org/news/young-digital-entrepreneurs-leading-africa-new-era>

Digital Entrepreneurship in Africa” benefits digital entrepreneurship development and IT start-ups in seven African countries (with 7 leading tech hubs, 200 tech start-ups, and 2000 digital entrepreneurs).⁹ Because of the interest of local governments and businesses in Africa, it can be expected that these programmes will be followed-up after the end of such projects. Corporations like Microsoft are using their cloud as the basis for accelerating digital entrepreneurship development, digital start-ups, and local software developers. Cloud-based initiatives from Microsoft are supporting the growth of digital start-ups.¹⁰ Developing digital entrepreneurship ecosystems and digital start-ups depends on a great number of stakeholders who need to collaborate in a systematic way. This is clearly demonstrated by a report of the World Bank Group on the “West Africa Digital Entrepreneurship Programme”/WADEP (WBG/World Bank Group 2017).¹¹ Africa can use the outcome of such national, regional, and international interventions for leapfrogging digital tools and technologies; leapfrogging is practised in various sectors. The great number of software developers and the many stakeholders of digital entrepreneurship ecosystems increase the potential for the transfer of knowledge.

Of great relevance is the local context for successful digital entrepreneurs, and this is the case in digital start-ups and digital enterprises. Case studies for Cameroon support the view that adaptability to various key context factors is decisive (see Ngoasong 2015). Context factors refer to availabilities at local spaces. Findings reveal that first, entrepreneurs who either have a formal ICT training or a strong interest for ICT have a higher probability of successfully creating digital enterprises; second, digital entrepreneurs with some, although limited, start-up capital are more likely to succeed by creating digital enterprises that rely on ICT infrastructure which is helpful to manage interactions among key stakeholders within their value chain; third, digital entrepreneurs with a good market orientation and with the ability to deploy innovative digital solutions to solve the problems affecting their (local) society are more likely to succeed in creating enterprises; fourth, knowledge (to get information about market and

⁹ See on the ITC programme for promoting digital entrepreneurship:

<https://etradeforall.org/dev-solution/itc-fast-tracking-digital-entrepreneurship-in-africa/>

¹⁰ See the blog “Digital transformation is key to enabling entrepreneurial growth in Africa” on the Microsoft strategy to scale-up Africa’s community of software start-ups: <https://www.microsoft.com/africa/4afrika/digital-transformation.aspx>

¹¹ The World Bank programme “West Africa Digital Entrepreneurship Programme” (WADEP) is related to the WBG/World Bank Group’s Digital Economy for Africa (DE4A) Initiative, by referring to the digital entrepreneurship pillar and to three other DE4A pillars (digital skills, digital financial services, and digital platforms); see for download: <https://documents1.worldbank.org/curated/pt/963641556793151009/pdf/West-Africa-Digital-Entrepreneurship-Program-An-Initiative-of-the-Digital-Economy-for-Africa-DE4A.pdf>

logistics conditions via connectivity) and capabilities (to solve such problems via organization and techniques) to respond to the geographic challenges, which are associated with digital entrepreneurship, increase the likelihood of successfully launching and operating a digital enterprise; and fifth, those entrepreneurs who are able to deal successfully and transparently with the liability of smallness and newness by outsourcing component parts of their digital enterprises, that require physical interactions with key stakeholders, are more likely to reduce their operational costs (see the research propositions in the section “Findings” of the study by Ngoasong 2015). Other factors may play a role for successful digital enterprises to grow in specific locations (climate, security, cultural factors, social factors, etc.).

The academic literature about digital entrepreneurship in Africa (Friederici, N., Wahome, M., Graham, M., 2020; Taura, N. D., Bolat, E., and Madichie, N. O., 2019) presents various case studies how such enterprises are adapting to local country and sector conditions. The study by Friederici et al. (2020) does not yet offer a single theory, because digital entrepreneurship is an interdisciplinary construct, and most empirical studies relate to few developed countries. It is too early to expect a full and unified theory on digital entrepreneurship, but Africa is more and more included in the relevant literature. It is according to the study by Friederici et al. (2020) necessary to use for a better understanding of the perspectives of Africa’s digital entrepreneurship both, popular discourses (in the media) and academic discourses (in scientific journals). Africa is “discovered” more and more in the theory of digital entrepreneurship and in management studies related to digitalization, and the publications are filled with new information coming from Africa’s places where such enterprises develop in hubs and clusters. The main message is that digital entrepreneurship in Africa is an option for development with some potential for the growth of digital enterprises, but only if illusions about a Silicon Valley type progress are avoided. African digital enterprises will learn from local customers, and these enterprises will grow if the customer and partner base is strong, if local information platforms are successful, if local assets are invested which are of use for customers in high-income countries (for outsourcing, trade, and recruitment of talents), and if digital platforms match rather perfectly well analogue outreach structures. A case in Unit 2 fits exactly this last condition for business growth. A warning is found in Friederici et al. (2020) that losing the local customer base may quickly produce losses of market shares. Key is the development of “ecosystems” for digital enterprises; three levels of development are distinguished (“learning”, “incipient”, and “maturing” ecosystems). Such ecosystems comprise a set of supporting institutions and actors (hubs, incubators, accelerators, financing institutions for start-ups, government promotion agencies, universities, research centres, computer centres, management training institutions, etc.); not in all cases digital start-ups and digital enterprises are gaining in sustainability through these ecosystems. It is observed that such

“ecosystems” can even be counterproductive if the social complexity of hubs, incubators, and accelerators and their ability to communicate is not adequately considered and if the ecosystem is not improved by government regulation and by transparent private sector action (see Bolat/Taura 2019). Some of the hubs in Africa are not considered as helpful to support digital start-ups and to ensure their survival.¹²

It is also made clear that digital transformation is much broader than establishing digital enterprises, as middle and large-sized enterprises need to transform their production, marketing, logistics, research & development, and their central administration & strategy departments by digital tools and by digital competence building. Some case studies in Taura et al. (2019)¹³ show that digital technologies can lead to new business ventures and business models, but also to a renewal of existing, but matured corporate business models. This is the case with agriculture-technology (agritech) firms, but this trend also refers to movie and music industry. When traditional engineering firms in Africa use digital technologies to support farmers with innovative technical solutions, such as for rice processing, they can substantially renew their business models, and the agriculture sector will be widely impacted. The case studies in Taura et al. (2019) give critical insights on fin-tech, ed-tech, animation games and agri-tech for Nigeria, Ghana, Rwanda, Senegal, Kenya, and Tanzania. A broader view of entrepreneurship development is considered in the study by Dobson/Jones/Agyapong/Maas (2021)¹⁴; the focus is on inclusive growth through entrepreneurship development, on sustainable entrepreneurship by looking at environmental, financial, and cultural contexts, and on entrepreneurial ecosystems by focussing on education and policy. The focus on entrepreneurial ecosystems highlights issues of improving higher education, of using more fully incubation centres for learning, and of institutionalizing entrepreneurship education. A specific and deep analysis of the digital entrepreneurship ecosystem in higher education in the East African Community (EAC) gives insights into the structures of digital entrepreneurship in higher education institutions in East Africa (see

¹² See Bolat/Taura, September 10, 2019; access for download:

<https://theconversation.com/digital-technologies-are-transforming-african-businesses-but-obstacles-remain-120005>

¹³ See for Taura/Bolat/Madichie 2019: <https://link.springer.com/book/10.1007/978-3-030-04924-9>

¹⁴ See for Dobson/Jones/Agyapong/Maas (2021):

<https://www.routledge.com/Enterprising-Africa-Transformation-through-Entrepreneurship/Dobson-Jones-Agyapong-Maas/p/book/9781138371231>

Möbius/Wünsch 2020).¹⁵ A key message is that a much closer link of the universities to the private sector is needed to educate and to support digital entrepreneurship, and to create a thriving entrepreneurship ecosystem. The policy recommendations (in Möbius/Wünsch 2020) relate to education & content, to networks & awards, and to awareness. An overall strategy of transformational entrepreneurship development to support structural change is presented by UNCTAD (2018).¹⁶ It is argued that more than establishing a digital ecosystem is needed; a contribution to structural change is needed. It is necessary to work for a coherent entrepreneurship policy, to include all the important entrepreneurship dimensions of general economic policy, and to organize for an entrepreneurial state.

Digital Start-Ups - New Dynamics

Venture Capital financing for start-ups in Africa is growing although the recorded volumes of annual finance differ because of methodological differences in data sourcing and evaluation between Partech Partners,¹⁷ Disrupt Africa,¹⁸ and TechCrunch¹⁹. These agencies are seen as the main collectors and providers of data sources on start-ups and venture capital. Important is the fact that 43% of the VC funds which are invested in Africa are headquartered in Africa and are managed locally (Tee 2022). Nigeria is leading as an African source country because of its huge fintech industry. The largest financing rounds for Africa went to the finance sector²⁰, and the two countries South Africa (Jumo²¹) and Kenya (Cellulant²²) benefitted with their start-ups in terms of volume. While Jumo has a “smart financing platform”, Cellulant has a “one-stop-shop payments platform”. Both start-ups managed to receive in 2018 around \$50 million. This is not a surprise, as “mobile money” made it possible for Africa to raise financial inclusion

¹⁵ See on Möbius/Wünsch 2020: <https://www.giz.de/en/downloads/giz2021-en-entrepreneurship-higher-education.pdf>. Various organizations have supported this study, also GIZ and CENIT@EA (<https://cenit-ea.org/>). The Centre of Excellence for Information and Communication Technologies in East Africa (CENIT@EA) is a hub of female empowerment in the ICT sector.

¹⁶ See about “The Least Developed Countries Report 2018” (UNCTAD 2018): https://unctad.org/system/files/official-document/lcdr2018_en.pdf

¹⁷ See about Partech Partners: <https://partechpartners.com/>

¹⁸ See about Disrupt Africa: <https://disrupt-africa.com/>

¹⁹ See about TechCrunch: <https://techcrunch.com/>

²⁰ See on “The State of Tech Start-ups in Africa”, by Naeem Tee, January 24, 2022: <https://contentfly.com/blog/the-state-of-tech-startups-in-africa-2>

²¹ See more details on Jumo, South Africa, referring on the website to “Intelligent Banking Technology”: <https://jumo.world/>

²² See the website on Cellulant, Kenya, described on the website as “one-stop-shop payments platform for businesses across Africa”: <https://www.cellulant.io/>

quickly. As in many African countries not much more than 20% of the adults use a mobile money account, there is a huge potential for expansion, especially when looking for the agricultural sector. But many other economic sectors are also coming up quickly with tech start-ups (off-grid energy tech; electronic and mobile commerce; education; personal services; health care; transportation and logistics; water, sanitation, and hygiene; leisure and travel; and creative, media, and entertainment businesses (Tee 2022). From the African Tech Start-ups Funding Report 2020 of Disrupt Africa we learn that African start-up funding is heading to more destinations, but that now the “big four” (South Africa, Kenya, Nigeria, and Egypt) collect the lion’s share on funding.²³ It is interesting to be informed via Disrupt Africa that the African start-up scene has shown strength in the Corona year 2020, with 12 African start-ups recommended to be watched in the year 2021²⁴. A deeper analysis is presented for the top 10 African start-ups to be watched in 2021, showing that some companies not only have survived the Corona event but have thrived.²⁵ Prior to the Corona pandemics, The Africa Report has informed that nearly 100 African start-ups have raised capital in 2019, a great share of them on fintech and located in English-speaking Africa. But, in terms of trends, Chinese investors are on the rise, and there is a growing interest in agricultural start-ups.²⁶ The Fast Company has released a list of the 10 most innovative companies in Africa for 2020. All these companies are finding (digital) solutions to local problems. The solutions are related to finance, supply chain optimization, food and agriculture, medicine, trade and transport, and labour markets.²⁷

Out of the top ten countries which are receiving start-up funds, three countries have a leading position - South Africa (with 30% of the total funds for Africa), Kenya (with 26%), and Nigeria (with 20%); these countries are the dominant destination places for the financing of tech start-ups. The other seven countries are

²³ See on the African Tech Start-ups Funding Report 2020 by Disrupt Africa: <https://disrupt-africa.com/2021/01/26/african-startup-funding-is-heading-to-more-destinations-but-big-four-still-collects-lions-share/>

²⁴ See from Disrupt Africa on the news report “12 African start-ups to watch in 2021”: <https://disrupt-africa.com/2021/01/05/12-african-startups-to-watch-in-2021/>

²⁵ See on the “Top 10 African Start-ups to Watch in 2021”, in: *The Modern Product Manager*, by Alex Mitchell, and released in November 14, 2020.: <https://themodernproductmanager.com/top-10-african-startups-to-watch-in-2021/>

²⁶ See on the trend analysis of The Africa Report, 31 December 2019, about the “Start-ups: which 7 African tech companies raised the most capital in 2019?”: <https://www.theafricareport.com/21702/start-ups-which-7-african-tech-companies-raised-the-most-capital-in-2019/>

²⁷ See on “The 10 most innovative companies in Africa for 2020”, released by Fast Company, 3/10/2020: <https://www.fastcompany.com/90457936/africa-most-innovative-companies-2020>

Egypt, Rwanda, Ghana, Uganda, Senegal, Morocco, and Cameroon. South Africa has a huge infrastructure base, an excellent connectivity, and a huge pool of talent, but it has also huge investors in tech start-ups, like Naspers²⁸, a media, internet, and investment company of origin in South Africa. Kenya is strong on mobile phone connectivity for use of payment services and for service delivery; the diversified economy and the openness of the trade and investment regimes of Kenya are additional advantages. Nigeria is strong on tech start-ups because of the huge economy and because of the combination of talent, infrastructure, improvisation ability, and the entrepreneurial spirit. Farmcrowdy is a good example for a Nigerian start-up which serves the agricultural sector with digital technologies.²⁹ South Africa has important start-ups in the health sector, the finance sector, and in the retail and trade finance business. Kenya has start-ups on mobile food supply platforms to link farmers and vendors in urban markets, on payment platforms, on door-to-door delivery platforms, on internet networks providing access for rural areas, on start-ups related to on-demand inventory services for small businesses, and on start-ups for online logistics coordination platforms. Nigeria has start-ups with platforms for mobile payments, platforms to hire service professionals and start-ups with news and entertainment apps to collect free airtime. The country has also platforms for print expertise, platforms for legal services, and platforms for independent digital content providers (Tee 2022). Looking at the other countries on the list, Egypt has a start-up on electronics recycling, Tanzania has a start-up for bus reservation and ticketing systems, Ghana has a start-up with a platform for online real estate transactions, Rwanda has a platform Uber for motorcycle taxis, and Morocco has a healthcare technology platform connecting patients with doctors.

One can see that the start-up scene of Africa is moving in a dynamic way far beyond the fintech sector towards many other sectors with commercial innovations; the reason for the exploding fintech sector is that Africa has now around half of the world's mobile money users; Africa also has a huge pool of entrepreneurial talent, and in the continent more than 20% of the working-age population are setting up their own businesses. Because of all these trends Africa can be considered as a superpower for start-ups (see Bayuo, B. et al., 2022).³⁰ A look at the growth of the VC finance volume from the year 2017 to the year 2021 shows a high multiplication factor from \$560 million in 2017 to \$4.9 billion in

²⁸ See the website on Naspers, South Africa as a global internet and investment group for supporting start-ups in Africa: <https://www.naspers.com/>

²⁹ See the website on Farmcrowdy as a start-up aiming at "sustainable food solutions": <https://www.farmcrowdy.com/#/>

³⁰ See on "Supercharging Africa's Start-ups: The Continent's Path to Tech Excellence" by Bayuo B. et al. 2022: <https://institute.global/sites/default/files/articles/Supercharging-Africa-s-Startups-The-Continent-s-Path-to-Tech-Excellence.pdf>

2021. To keep these positive trends at high levels, ten recommendations are proposed to promote the growth of start-ups in Africa (see Bayuo, B. et al., 2022): three recommendations refer to the closing of the funding gap to secure investment of \$90 billion for tech start-ups by 2030; five recommendations relate to the building of a flourishing business environment for tech start-ups, and two recommendations are for the nurturing of connections through tech networks. It is observed by reviewers of the situation of the African start-ups scene that such perspectives are not unrealistic, as most of the preconditions for a flourishing start-ups scene can be created and most of the barriers could be removed by policy action, in digitally progressive African countries and later in the whole AfCFTA. Many of the promising economic and social sectors are not yet covered by a vital start-ups scene, beside of fintech start-ups dominating over many more years the scene and beside of health tech start-ups which have emerged over the last two Corona years. Agricultural Tech, Logistics and Transport technologies, and EdTech are now also coming up more rapidly. From a more theoretical view, digital start-ups will bridge public and private sectors by new types of partnership, as it became visible in the health systems during Corona; they will bridge formal and informal business sectors, as e-logistics and e-commerce start-ups serve both sectors; they will bridge rural and urban areas, as cities attract a large number of software developers and their start-ups will reach out to rural areas; and they will bridge between socially protected and socially unprotected groups, by reaching out to vulnerable groups in remote areas, possibly by organizing new social protection modes and tools through digital devices (World Bank 2020).³¹ Digital start-ups therefore have a large bridging function; heterogenous sectors and fragmented sectors are linked, so that virtuous circles can be created. Informal sector producers benefit from supply, trade, and logistics platforms and can support semi-finished or finished products and services to firms in the formal sector.³² This “bridging function” between sectors may be the greatest achievement of the digital transformation in Africa; therefore, it needs more

³¹ See on the World Bank (2020) publication “E-Conomy Africa 2020”, a study of Google and IFC/International Finance Corporation:

<https://www.ifc.org/wps/wcm/connect/e358c23f-afe3-49c5-a509-034257688580/e-Conomy-Africa-2020.pdf?MOD=AJPERES&CVID=nmuGYF2>

³² TradeDepot in Nigeria is linking informal traders with manufacturers, and because of the great number of informal and formal actors such digital platforms have great impact on trade volumes and efficiency of trading (see World Bank 2020, p. 27). See the website of TradeDepot for the agenda: <https://www.tradedepot.co/>. They write about their profile: “When you register as a supplier, TradeDepot becomes a full-time distributor of your products. We buy and store the inventory and take care of everything from shipping and pricing to customer service and returns.” This is attractive for informal sector firms and for remote producers in rural areas of Africa.

analyses what is done in Units 2 and 3 of this volume of the African Development Perspectives Yearbook.

While there is a lot of information on trends, sectors, volumes of financing for start-ups, the policies of African governments towards the start-ups are not yet revealed in a sufficient way. This is reviewed in specialised reports (such as WEF 2022). It is argued that governments can fuel tech start-ups and other small businesses through tax incentives and through investment in workforce skills. But most of the incentives from African governments are not really facilitating investment for the adoption of 4IR (Fourth Industrial Revolution) technologies. Tech start-ups in Africa suffer from the low R&D investments of only 0.42% of the GDP in 2019 (what is less than a quarter of the global average of 1.7%), and from low upskilling investments into the workforce, but also from the bureaucratic burden of registration, from incoherent and ineffective incentives contained within the approved legislation, and from the lack of binding laws on start-ups' establishment, financing, and current operations. Three strategies are important (WEF 2002): First, Start-up Acts have an important role to play to facilitate the establishment, the financing, and the operations of the start-ups. Second, Laws for Start-ups should include concretely the relevant incentives in the legislation (start-up grants, rebates on efficiency gains through technology implementation, co-investment of critical infrastructure, tax-free operations for the early business years, and incentives for R&D).³³ Third, Investments into the Workforce on education, skills, and competencies are requested and need prioritisation. The share of STEM (science, technology, engineering, and mathematics)-related university students is with only 2% far too small. For the second point on the use of the government-sponsored incentives it is observed that less than 10% of these incentives facilitate the establishment of start-ups and the adoption of 4IR technologies. And for most of these more relevant incentive schemes there is a lack of monitoring & evaluation systems to assess their effectiveness. But Africa can learn from its own successful cases. It is reported from Cote d'Ivoire, South Africa, and Tunisia that these countries have some positive examples of public incentives for start-ups in their legislations (WEF 2022). Recent global politics changes the investment picture for Africa. The digital transformation model of FANG (Facebook, Apple, Netflix, and Google) is still of relevance, especially among the members of the AfCFTA (Dailey 2022). But now the role of the old FANG model (of the ICT giants) is debated, as the war of Russia against the Ukraine replaces the old FANG model by the new FANG model (Fuel,

³³ There is a summary of the report (WEF 2022) for the press with the title "Tech Start-ups Key to Africa's Digital Transformation but Urgently Need Investment", released on 20 January 2022, Geneva, Switzerland; see: <https://www.weforum.org/press/2022/01/tech-start-ups-key-to-africa-s-digital-transformation-but-urgently-need-investment/>

Agriculture, Natural resources, and Gold) with consequences on volumes of investment for digital transformation and interest of investment companies in digital start-ups.³⁴

There is a dramatic change of the value of start-up ecosystems in Africa and globally, as we can see by looking at Yabacon Valley in Lagos, considered also as the next Silicon Valley; it was highly rated at \$2 billion in 2018.³⁵ The value of start-up ecosystems may however change quickly because of local developments and because of global changes which affect valuation. New methods to measure the value of start-up ecosystems at a global scale are of interest to compare the attractiveness of these start-up hubs and clusters.³⁶ Concerning measuring the dynamics of digital African hubs, we see that the cities of Accra, Nairobi, Lagos, Cotonou, and Casablanca have a lead according to experts; there are specific assets which determine their position, such as the artificial intelligence (AI) research centre of Google as in Accra, Ghana, or a start-up ecosystem – Benin Smart City – at the landing point of the new undersea cable for the global Internet at Cotonou, Benin.³⁷ We can see different assessments of value for start-up ecosystems, but we also see that there is a global competition between the fully developed start-up ecosystems. Also, the other three urban hubs have distinct specialisations.³⁸ Beside of the urban hubs with specific assets, these countries have also other hubs with

³⁴ See the information on the “new FANG” and the repercussions on the “old FANG” in the blog of the “Business Insider Africa” with the title “The ‘new FANG’ trade will be in commodities amid market turmoil sparked by Russia’s war in Ukraine, says wealth manager”, by Natasha Dailey, released on March 23, 2022 4:10 PM; access for download: <https://africa.businessinsider.com/markets/the-new-fang-trade-will-be-in-commodities-amid-market-turmoil-sparked-by-russias-war/bw5n7b0>

³⁵ See the story on Yabacon Valley: “Welcome to Yabacon Valley: What Nigeria’s tech town is learning from Israel”, In recent years, Nigeria has grown a formidable tech ecosystem in Africa focused on innovation to help solve its local challenges, by James Spiro, released on 30.11.2021; access for download: <https://www.calcalistech.com/ctech/articles/0,7340,L-3923720,00.html>; see also “Lagos: the Next Silicon Valley”, *The Business Year*, May 3, 2018; access for download: <https://www.thebusinessyear.com/article/lagos-the-next-silicon-valley#gsc.tab=0>

³⁶ See on the methodologies to measure the value of start-up ecosystems in the global reports “The Global Start-up Ecosystem Report” by Start-up Genome: <https://startupgenome.com/reports>

³⁷ See the blog by The Agility Effect on “Five Urban Hubs At The Heart Of Africa’s Digital Transformation”, released on 20/02/2020; access for download: <https://www.theagilityeffect.com/en/case/five-urban-hubs-at-the-heart-of-africas-digital-transformation/>

³⁸ See the blog by The Agility Effect on “Five Urban Hubs At The Heart Of Africa’s Digital Transformation”, released on 20/02/2020; access for download: <https://www.theagilityeffect.com/en/case/five-urban-hubs-at-the-heart-of-africas-digital-transformation/>

more general start-up systems in new cities and in intermediary-sized cities, like Kenya and Nigeria. A link to universities, research institutes, and technology cities is often part of the ecosystem.

Kenya is strong on developing grassroots innovation ecosystems through careful assessments of traditional knowledge, and many experiences can be transferred from Kenya to other African countries (see the valuable study by A. Gupta et al. 2019). The Kenya Resource Centre for Indigenous Knowledge (KENRIK) is in this context of great importance. It may be useful to bridge the Grassroots Innovation Ecosystems with the Start-up Ecosystems. Traditional agricultural and medical knowledge could become the base for start-ups in rural and urban areas; such start-ups could work on presenting local solutions via digital tools. At the other end of innovations, Kenya is developing the Konza Technopolis, a smart city project with superior infrastructure and governance systems, which is developed in the context of Kenya's Vision 2030³⁹. Now four start-ups were proposed to bring various smart solutions to the "world-class smart city" with 30,000 inhabitants. The Konza Innovation Challenge 2021 had four winners (three of them are Kenyan); these start-ups will present "smart city innovations" on intelligent asset management, smart parking management, access management, and traffic management.⁴⁰ The case of Kenya - as an African leader on developing start-ups - shows that there is a convergence of plans, projects, regulations, and visions.

Digital Business Opportunities - Key Sectors are Moving

In the earlier subsections of this Introduction there were already references about digital business opportunities in various economic sectors of Africa, and there are many new reports on profitable digital business opportunities and on digital enterprises and start-ups in Africa which are exploiting these opportunities. These enterprises and start-ups are using for their business models specific digital tools to speed up digital transformation (via apps and platforms), and selected 4IR technologies are used to support the economic transformation process in Africa (via Artificial Intelligence, Machine Learning, Internet of Things, Big Data, Blockchain, 3D printing, etc.). These reports show an increasing interest of investors in financing modernization of enterprises and start-ups for certain fields of economic activity. We can see that many economic sectors are involved, and that the bridging functions of digital tools for intermediating between sectors and social groups (public and private sectors, formal and informal sectors, employers and employees, people in rural and urban areas, etc.) explain the increasing

³⁹ See on the perspectives of Konza Technopolis: <https://konza.go.ke/>

⁴⁰ See on the four winners of the Konza Innovation Challenge 2021: <https://konza.go.ke/2021/05/11/four-start-ups-to-pilot-smart-solutions-at-konza-technopolis/>

relevance of digital business opportunities. Apps and online platforms, but also the 4IR technologies are the instruments used by the firms and start-ups to do the bridging between sectors.

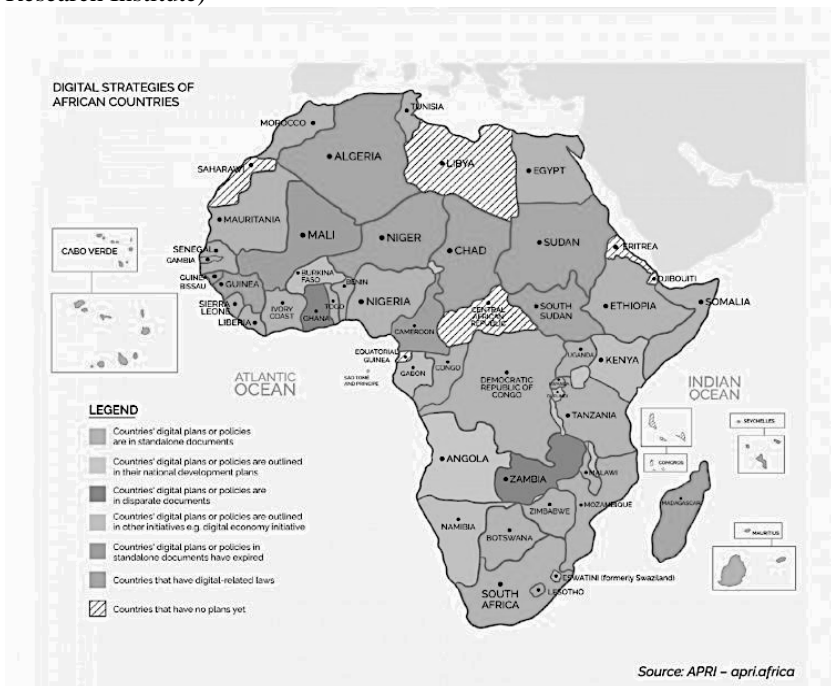
We identify four approaches to assess the digital business opportunities in Africa: *First*, the Digital Transformation Strategy for Africa of the African Union has defined various Critical Sectors to drive the digital transformation, such as digital industry, digital trade and financial services, digital governance, digital education, digital health, and digital agriculture. These sectors are introduced in the Digital Strategy of the African Union by a general overview, by defining the problem, and by presenting a long list of policy recommendations and proposed actions. Together with the links to the Foundation Pillars and the Cross-cutting Themes this survey of Critical Sectors leads to a balanced overview. These six critical sectors are considered by the African Union as sectors with huge digital business opportunities for African firms and start-ups. This is a conventional way of recording the business opportunities in Africa.

Second, there is an attempt to look at all the digital plans and plan components which relate to the ongoing digital transformation in African countries (see the map below on the status of digital plans). The presentation of the Digital Agenda of Africa shows that most African countries have some form of a digital policy document.⁴¹ The digital agenda documents are found as legal texts, as stand-alone digital strategies, as sections of national development plans, or as texts on digital policies within other policy documents. Most of these documents refer to the use of digital technologies for economic development through further education initiatives, such as for the upskilling of the people and of the workforce. These documents also include suggestions for harnessing more efficient public and commercial service delivery through digital tools, and for seizing opportunities for e-government by using digital technologies. Several countries also have in their documents a reference to cybersecurity strategies. Considered collectively, all these documents indicate that there is an emerging African Digital Agenda (ADA). Internal and external actors and stakeholders play their roles. External actors are impacting strongly on the African Digital Agenda (ADA). While China is supporting Africa's digital infrastructure, the EU is establishing and reforming the regulatory frameworks of Africa for the benefit of sustainable digitalization. It is however necessary to promote an Africa-led process of digital transformation despite of so many external inputs to the emerging African Digital Agenda (ADA)

⁴¹ See on the Annual Report 2021 of APRI (Africa Policy Research Institute) the discussion about the theme "What is Africa's Digital Agenda", with the report (APRI 2021) to be accessed for download: <https://afripoli.org/what-is-africas-digital-agenda>

process. The digital business opportunities are dependent on and are defined by the policy and regulatory frameworks which are revealed through the digital plans and documents. These digital documents are assumed to reflect an Africa-led digital transformation process, and so firms and start-ups may decide on this basis about the choice of their business model. One can see (from the map below and from APRI 2021) that the presentation of the documentation is quite different among countries (there are standalone documents; texts with strategy and policy content as part of national development plans; there are implicit policies as part of digital economy initiatives; for some countries there are found already expired documents; there are African countries with digital transformation-related laws and regulations; and there are African countries with no digital plans at all). Mauritius, Egypt, Kenya, and Senegal are presented as cases (APRI 2021). These documents show the interest of governments for digital transformation; they have the function to signal their readiness to attract domestic and foreign firms and start-ups to exploit the digital business opportunities.

Map: Digital Planning Documents for Africa classified by APRI (Africa Policy Research Institute)



Source: APRI (Africa Policy Research Institute), 2021 - What is Africa's Digital Agenda? For Download: <https://afripoli.org/what-is-africas-digital-agenda>

Third, there are numerous consultancy recommendations on the use of digital business opportunities in Africa; these are from various private and public sources (mainly recorded in African Business News magazines). They refer to untapped business opportunities, to profitable businesses to start, to untapped profitable business ideas, to business opportunities that will make more millionaires in Africa, to the top 25 investment and business opportunities, or to the top 10 business opportunities in Africa. The blog on “Africa: 14 business ideas with strong profit potential” is of exemplary interest as niches for profitable businesses are identified which also use digital tools and 4IR technologies.⁴² Some of these ideas are of convincing practical relevance, such as: selling electric motorbikes for Africa’s urban centres; tapping into affordable housing markets; managing garbage disposal; developing value discount retailers; organizing battery recycling; building the value chain of an efficient, effective, and highly profitable maintenance repair operations (MRO) industry; investing into tourism-related businesses; adding value to local commodities; selling consumer goods to the rural middle class; trading in education services; converting street hawkers into powerful marketing activators; and other suggestions could be added to this list. This is a list based on commercial niches and on low-cost solutions for business opportunities. Another list comes up from crises and challenges (food crises, climate crises, transport crises, security crises, challenger banks, alternative energy supplies, virtual education for remote areas; etc.) in Africa; business opportunities emerge out from crises and out from challenges.⁴³ The list has the following entries: branded food products; cybersecurity & data storage; urban logistics; challenger banks; telemedicine; mini-grid solar installations; virtual education; and others are mentioned. The third list of opportunities which are presented here is based on the most profitable businesses to start with in Africa.⁴⁴ Indeed, on the list are basics (automobile business, agribusiness, affordable housing, solar power, and waste recycling), and these products and services are indeed mass markets for new and established enterprises. Digital transformation is of relevance to all entries on these three lists; the digital content of all these businesses is on the increase. Some of the ideas on these lists were already translated into Africa’s business reality (as we can see from the case studies in Unit 2 of this volume of the African Development Perspectives Yearbook). It is

⁴² See on “Africa: 14 business ideas with strong profit potential”, in: How we made it in Africa, by Staff Writer, released on 26 November 2019; access for download: <https://www.howwemadeitinafrica.com/africa-14-business-ideas-with-strong-profit-potential/63924/>

⁴³ See “11 Big Business Opportunities to Watch in 2021 (and beyond)”, in Smallstarter, February 5th, 2021, released by John-Paul Iwuoha: <https://www.smallstarter.com/browse-ideas/roadmap-11-big-business-opportunities-in-africa-2021-and-beyond/>

⁴⁴ See “5 Most Profitable Businesses to Start in Africa”, in: Africa Com, August 24, 2020: <https://www.africa.com/5-most-profitable-businesses-to-start-in-africa/>

obvious that such business opportunities have an increasing digital content and need digital tools and 4IR technologies. To exploit these business opportunities fully there is need for more financial inclusion, what is important for the involvement of women to these markets (see Sustainable Development Solutions Network/SDSN et al., 2021). There is a common ground for all these business opportunities; homegrown digital solutions are relevant (Umeh 2021).⁴⁵

Many of these business ideas require the careful selection of digital business models which are based on online platforms and apps, and/or are using inputs from 4IR technologies. The discussion about Africa's "untapped business potential" is related to the digital business opportunities, and five opportunities are mentioned: Africa is a continent with a fast growing and urbanizing population; Africa is an industrializing continent; Africa is a continent which is closing its infrastructure gap; Africa is a continent that needs to unleash agricultural and resource wealth through innovations; and Africa is a continent with increasing digital and mobile access (see Leke/Signe 2019).⁴⁶ Looking at the African countries, these five opportunities can be assessed, and the mapping of the opportunities by countries and cities shows that African firms do business in countries which are grouped as "stable growers", as "vulnerable growers", or as "slow growers". Firms and start-ups can gain in all the three groups of African countries if they use fully their chances for innovation and digitalization. The mapping of countries is done via GDP growth rates and vulnerability indices (see Leke/Signe 2019).

Fourth, most important is the impact of the 4IR technologies on the business opportunities in Africa, as the contribution of such technologies to economic transformation in various investment fields may be huge (see African Development Bank/AfDB et al, 2018). The 4IR technologies will play an increasingly important role for Africa's economic transformation process. Although there are limits to exploit all these business opportunities in a short timeframe, there are already some advances observed in Africa. It may also be that the growth rate and the employment elasticity⁴⁷ can be increased over time by such technologies when they are used intensively by start-ups and by young

⁴⁵ See about the financial inclusion of women the Accountability Report 2021, G7 Partnership for Women's Digital Financial Inclusion in Africa, September 2021: <https://static1.squarespace.com/static/5b4f63e14eddec374f416232/t/614b908a22248f652b66cc1b/1632342167775/Accountability+Report+2021-4.pdf>, and about homegrown solutions to digital transformation: <https://hbr.org/2021/12/digital-transformation-in-africa-requires-homegrown-solutions>

⁴⁶ See on the business opportunities by countries, sectors and strategies in Africa the study from Brookings: <https://www.brookings.edu/research/spotlighting-opportunities-for-business-in-africa-and-strategies-to-succeed-in-the-worlds-next-big-growth-market/>

⁴⁷ This is the increase in percent of employment which is generated by 1% of economic growth. As it is on average in Africa near to 0.4%, any long-term increase will be favourable.

entrepreneurs in investment fields such as agriculture, modernization of services, local content for extractive industries, export-led manufacturing, and infrastructure (these are the sectors which are confronted with five types of 4IR technologies according to the study by AfDB et al., 2018). For agricultural transformation we see that all the 5 groups of 4IR technologies matter in Africa (AfDB et al., 2018, pages 37-41). Artificial Intelligence/Machine Learning can contribute to agricultural transformation through applications of plant breeding to speed varietal selection, while intelligent robots can reduce the use of inputs by over 90 percent; the Internet of Things (IoT) can contribute via the use of drones to the monitoring of crops and via internet-enabled irrigation systems to the saving of scarce water; Big Data/Data Science can contribute through telephone farming, practising e-extension services, providing agricultural inputs as a service transaction, not as a sale transaction, and using big data for a credit scoring of farmers; concerning 3D printing, local fabrication of agricultural machines and parts is an option to supply equipment; and the Blockchain Technologies can be used for food traceability systems in international trade. The impact of these five 4IR technologies on competitiveness of agriculture can be very high, so that these business opportunities and the related employment effects will be important. For modernized services the impact on competitiveness will also be very positive. Other sectors will not benefit to the same extent (AfDB, 2018, pages 37-41). The two high employment-creation sectors agriculture and services will see a significant job expansion based on such 4IR technologies; start-ups will have good business opportunities if the national policies in these sectors are appropriate. Advances in e-governance may be helpful to exploit these business opportunities.

2 The Contributions

In the *first essay* with title **“Building Productive Capacities and Digitalization in Sub-Saharan Africa”** the authors **Paul Akiwumi and Lisa Borgatti**, both from UNCTAD headquarters in Geneva, give a balanced view of the relation between and the interaction of the Digital Economy and the Productive Capacities. The authors and UNCTAD define the main components of the “digital economy” first, as a core process, which comprises the foundational components of the digital economy, including innovation, technologies, and enabling infrastructures; second, by digital and information technology sectors, which produce key products or services that rely on core digital technologies, including digital platforms, mobile applications and payment services; and third, via the process of digitization of other sectors where digital products and services are increasingly used. These three components of the digital economy are assumed to contribute to the creation of spill-over effects and of other intangible outcomes that benefit all the spheres of the economy. “Productive capacities” are defined by the authors and

by UNCTAD (United Nations 2006) as “the productive resources, entrepreneurial capabilities and production linkages which together determine the capacity of a country to produce goods and services and enable it to grow and develop”.⁴⁸ The productive capacities are built through three interrelated processes, namely capital accumulation, technological progress, and structural change.

UNCTAD’s Productive Capacities Index (PCI) is used to measure the relation with the Digital Economy (United Nations 2021).⁴⁹ The PCI is presented as a multi-dimensional, composite index, which summarizes the state of productive capacities by computing scores that range between 0 and 100. The overall PCI index is broken down into eight categories: information and communication technologies (ICTs), structural change, natural capital, human capital, energy, transport, the private sector, and institutions. Digitalization is proxied by mobile phone usage and the share of internet users. The analysis contained shows that an improvement in digitalization is positively and significantly linked to enhancements in productive capacities, and that the processes are interacting in a virtuous circle. The authors argue that this relationship has not before been theoretically defined or empirically tested. More than establishing this relationship, industrial policy can use the analysis for concrete policy interventions (at micro, meso, and macro policy levels).

The concept of “productive capacities” is related to the concept of a “digital economy” to show how a virtuous circle can be enhanced, with developments of the digital economy that are gaining from advances of the productive capacities (through structural changes demanding more and more digital applications and uses in many sectors), and with gains for productive capacities through new digital instruments and solutions (which are affecting the speed and the usability of information technologies for the 4IR). These concepts and measurements are brought by the authors into a new relation and are applied to Sub-Saharan Africa. An empirical analysis brings out the main factors being responsible for the virtuous circle. In the Annex the methodology for the empirical analysis is described, clarifying details of the cluster analysis and of the sensitivity analysis. All this information can help in a further step to work on new industrial policies for the times of digitization in Africa.

The literature on digitization has emphasized so far more the issue of digital diffusion in relation to productivity changes at the firm level and at the country

⁴⁸ The discussion about “productive capacities” goes back to “The Least Developed Countries Report 2006” on “Developing Productive Capacities”, United Nations: New York and Geneva 2006, with the link: https://unctad.org/system/files/official-document/ldc2006_en.pdf.

⁴⁹ See on the UNCTAD Productive Capacities Index: United Nations, Geneva, 2021, and the link for download: https://unctad.org/system/files/official-document/aldc2020d3_en.pdf.

level, by investigating how firms of different size, sector, ownership, technological complexity, age, phase of development, etc. are benefitting from digitization through adoption of digital technologies, and what all this means for the productivity development in a country or in a sector. The focus was not on the broader concept of productive capacities as related to digital transformation. We can see that digitization is affecting productivity quite differently and that not all firms are equally impacted (Andrews et al. 2018).⁵⁰ This has implications for industrial policy interventions, and it shows that it is worthwhile to look at the benefits of more holistic strategies which lead to virtuous circles of development in Africa. A larger diffusion of digital technologies can speed up productive capacities; mobilizing the productive capacities will then require a different approach to digital diffusion compared to the past. For a virtuous circle to come forth, digital diffusion matters and will require more investment into managerial quality and into ICT skills, and much deeper policy action to remove barriers for digital advancements in the labour markets. Beside of capabilities, incentives matter for the virtuous circle to come forth, like incentives being relevant for market access, market competition, and for the efficient reallocation of labour and capital. There are obviously strong complementarities between capabilities and incentives towards the adoption of digital technologies (see Andrews/Nicoletti/Timiliotis 2018). Industrial policy approaches towards the productive capacities are an important component to gain from the virtuous circle of development.

The authors argue that in Sub-Saharan African countries overcoming development constraints and achieving structural transformation in the long run depends on the creation of new and the utilization of existing productive capacities. The study also provides a novel theoretical framework to analyse the mutually reinforcing contributions that productive capacity development and the digital transformation process will have. The empirical analysis supports the findings that an increase in productive capacities would support the improvement of digitalization levels in the Sub-Saharan countries, and that an improvement in digitalization will be positively and significantly linked to enhancements in productive capacities. Africa can use advances in both sectors to develop into the direction of a virtuous circle. Obviously UNECA looks at the potential and is

⁵⁰ See on the digital diffusion issues and the complementarities between capabilities and incentives towards getting to an efficient and inclusive digital transformation process: OECD, Digitalisation and productivity: a story of complementarities, with the link: <https://www.oecd.org/economy/growth/digitalisation-productivity-and-inclusiveness/>, and: Andrews/Nicoletti/Timiliotis, 8 November 2018, Digital technology diffusion: A matter of capabilities, incentives or both?; with the link: <https://www.oecd-ilibrary.org/docserver/7c542c16-en.pdf?expires=1651876154&id=id&accname=guest&checksum=1723B4DA07D5DDC37F92AA6FE7E4755D>

moving in this direction, as recent comments by the Executive Secretary are signalling.⁵¹ The Digital Transformation Strategy of the African Union (AU) is another signal in this direction.

In the *second essay* with the title “**How African Digital Entrepreneurship Ecosystems are Escaping Silicon Valley’s Long Shadow?**” the three authors **Michel Wahome, Nicolas Friederici, and Mark Graham** give an overview of types and characteristics of digital entrepreneurship ecosystems in Africa. Their intention is to classify the digital entrepreneurship ecosystems to allow for a better understanding of the origins, the evolutionary paths, and the policy environments of digital enterprises. In 2019, the authors published a book “*Digital Entrepreneurship in Africa – How a Continent is Escaping Silicon Valley’s Long Shadow*”⁵² which has received much attention by the scientific community. In this essay the authors summarise some of the key questions and findings, and then they are proceeding to some generalizations and policy conclusions. The book represented an interdisciplinary study of the sources, the growth patterns, and the structures of digital entrepreneurship in Africa. The authors did examine the rhetoric around digital entrepreneurship and the implicit arenas of expectation; they did this because of some concerns about the “fetishization of entrepreneurship” by assuming that the African entrepreneur will overcome all basic and structural problems in Africa⁵³. The goal of the book was to examine the emergence of digital entrepreneurship in African contexts and to “produce a clear-eyed analysis given popular warring narratives of success and failure of digital entrepreneurship in Africa”. One major obstacle had to be solved to proceed with the analysis. So much depends on finding appropriate cases of digital start-ups and digital enterprises to assess the criteria for success or failure of ventures.

The authors compared cities that were building a reputation as digital economy hubs and cities that are peripheral in that domain but are key/capital cities in their nations and regions. In their methodology they selected eleven cities as the sites for the research: Abidjan, Ivory Coast; Accra, Ghana; Addis Ababa, Ethiopia; Dakar, Senegal; Johannesburg, South Africa; Kampala, Uganda; Kigali, Rwanda;

⁵¹ See Dr. Vera Songwe, The Role of Digitalization in the Decade of Action for Africa, 07 September 2020, with the link: <https://unctad.org/news/role-digitalization-decade-action-africa>

⁵² See: Friederici, N., Wahome, M., Graham, M., 2020. Digital Entrepreneurship in Africa: How a Continent Is Escaping Silicon Valley’s Long Shadow. Access: <https://doi.org/10.7551/mitpress/12453.001.0001>

⁵³ See on this expression about the African entrepreneur: Kuo, Lily. 2015. “Video: Ory Okolloh Explains Why Africa Can’t Entrepreneur Itself out of Its Basic Problems.” In: Quartz Africa, September 15, 2015. Access: <https://qz.com/africa/502149/video-ory-okolloh-explains-why-africa-cant-entrepreneur-itself-outof-its-basic-problems/>

Lagos, Nigeria; Maputo, Mozambique; Nairobi, Kenya; and Yaoundé, Cameroon. The analysis emphasizes generalizable patterns and offers insights how contexts shape different outcomes in cities and countries. It was of interest to understand how specific determinants led cities to become digital entrepreneurship hubs, and how bottlenecks have prevented others to develop towards such a hub. Selecting Johannesburg, the industrial hub of South Africa, rather than Cape Town as the digital economy hub, allowed the team of authors to explicitly discuss variations in dimensions of digital entrepreneurship that vary starkly across the continent, such as the size of domestic and urban digital markets and the strength of the localised digital entrepreneurship ecosystem. Developing a generalisable analysis that was based on the analysis and the comparison of situated contexts was seen as a way of creating blueprints for policymakers. Also, others interested in encouraging digital entrepreneurship in their localities could rely on the results of comparative analysis rather than relying on single-hub case studies only. But “intermediary cities” in Africa (between large and small cities) may also have a growing digital economy, and so it may be useful to extend in the future the research to such African cities. The increasing role of intermediary cities justifies such an extension of the research on digital hubs; these cities are nearer to rural people, to remote areas, and to agricultural activities.

After the Introduction in section 1 the authors look in section 2 on African Digital Enterprise Ecosystems, in section 3 on the Tier 1 Ecosystems, in section 4 on the Tier 2 Ecosystems, in section 5 on the Tier 3 Ecosystems (for describing by the tiers the level of development of the ecosystems), in section 6 on the issue of How Firms Can Learn to be Successful, in section 7 on the Suggestions for Policymakers, and in the final section 8 with Conclusions and a Summary. The Introduction in section 1 also includes a discussion on the methodology, while the next section 2 discusses the central attributes of digital entrepreneurship ecosystems in Africa. The digital ecosystems are composed of three elements (start-ups, angel investors, and hubs) and of a certain number of established digital enterprises. Most important is the ability of digital ecosystems to manage ecosystem bottlenecks (markets and infrastructures, entrepreneurial knowledge and mentorship, labour and talent, hubs and support organizations, and access to funding). Of great relevance are the detailed analyses of the Tier ecosystems, for describing the level of development of ecosystems: Tier 1 (“maturing” ecosystems), Tier 2 (“incipient” ecosystems), and Tier 3 (“learning” ecosystems), what is done in section 2 and more deeply in sections 3 to 5. The final sections give advice to entrepreneurs to become successful in a specific tier (section 6) and to governments for their policy actions and strategies (section 7). In section 8 the key messages are summarised. This is a very systematic approach which can be used for further work on African digital ecosystems.

The analysis by the authors found out that influencing factors and bottlenecks are not only linked to individual management and entrepreneurial competencies

but are also related to geographical and sociological variables. Although the expectations in regard of African digital ecosystems are influenced by impressions about the Silicon Valley ecosystem, it is very true that local contexts rather than supposedly universal logics of digital economies play a large role. But Silicon Valley remains a reference model with its huge stock of software engineering talent, specialized technological knowledge, risk investment, organizational and personal networks, flexible and risk-friendly worker and entrepreneurial attitudes, and many other factors and characteristics. The evolution of African digital ecosystems shows that the Silicon Valley attributes are not easily replicable in other local environments, as the local context and bottleneck factors determine the paths of development. The essay highlights how entrepreneurs in Africa can learn to be successful within the constrained opportunities that are available to them in their specific tier ecosystem. Also, in each digital ecosystem factors like class, status, race, ethnic identity, and regional variables interact and operate. But also, these factors and variables reflect on and interact with the global arena of digital transformation.

An important conclusion which was derived is that African entrepreneurs who are successful are “hyperlocal” in their orientation, meaning that they had the ambition to succeed locally before moving to regional and global markets. The term “hyperlocal” refers to local creativity factors, to specific local knowledge and access to it, and to supportive means that decide about success in the local environment. Localisation is obviously the key to success, while internet connectivity and the ability to benefit from globalised information and markets are used for successful localisation strategies. The authors consider the evolution of ecosystems that focus on the development of local and contextually relevant technologies, not because they represent potential technological breakthroughs, but because they facilitate localisation through cost-effective adaptations to existing technologies. The production of locally relevant use-cases for digital technologies is offering - according to the authors of the essay - the greatest promise for African entrepreneurs to start a business and to move later towards regional and global growth of the firm.

The *third essay* has the title “**On the Cultural Sphere of Transnational Entrepreneurship: Evidence from Digital Business Development of African Entrepreneurs**” and was written by the author **Jörg Freiling**. This essay with the focus on Transnational Entrepreneurship is based on deep analyses of transnational entrepreneurship research, and this now booming field of business research introduces the transcultural dimension. Business research moves towards new tools and instruments to understand and to measure the impact of transcultural factors for digital business development. The author argues that the role of high cultural distance was largely ignored in entrepreneurship studies. In times of digital transformation, regionalisation, and globalisation this disregard of cultural distance is not plausible. The author in his research project – which has given the

idea and the motivation for this essay - addresses this cultural distance and raises important research questions like the following: How do the (cross-)cultural peculiarities of transnational entrepreneurship – in the light of cultural distance – influence the business development of transnational entrepreneurs? By conducting qualitative empirical research that is based on a single case study, the findings contribute to the literature through analyses on the role of personal discrimination of entrepreneurs, on a specific network category for entrepreneurs called “transnational networks”, and on stabilizing factors for the transnational entrepreneurs like “resilience” and “hope”. A set of research propositions structures the findings. These research propositions can lead to further research on transnational/transcultural entrepreneurship, but they can also guide policy interventions for start-ups and digital enterprises.

While there is consent in the scientific literature about the positive impact of transnational entrepreneurs on host country entrepreneurship development, cases of high cultural distance between home and host countries of transnational entrepreneurs are largely unknown, as reported by the author. This essay addresses this gap by raising the question how the (cross-)cultural peculiarities of transnational entrepreneurship in case of high cultural distance are influencing the business development of transnational entrepreneurs. A single case study of a Ghanaian entrepreneur with businesses in Ghana and Germany and with many business links to various other countries in the world is a first output of the research project. The author responds via innovative explorative empirical fieldwork. The findings - based on the single case study - reveal considerable obstacles for the African transnational/transcultural entrepreneur to business development but also unique assets primarily of the cultural kind as well as fundamental strengths to advance business development. As the Ghanaian entrepreneur with businesses in Ghana and Germany is involved in supplying digital products and services (E-Drones and E-Robots) to various markets, the case is of interest to understand better the quality of the business links, the various factors of success, and the global impacts of transnational and transcultural entrepreneurship. The essay brings out some opportunities and some challenges which are associated with cultural distance. As the digital business is of growing local to regional and to global importance, the management of the “cultural distance factor” is an important element for a sustainable business success. As digital tools and technologies are bridging sectors and countries, they can also bridge cultures; a special role for bridging cultures has the transnational entrepreneur.

After the Introduction in section 1 which has the purpose to highlight the importance of the research on African transnational entrepreneurs, the author provides in section 2 the conceptual foundations for the essay, clarifies the terminology, and gives an overview on the state of research about transnational entrepreneurship, transculturality in transnational entrepreneurship research, cultural distance in transnational entrepreneurship, and the context of digital

transformation by transnational entrepreneurs. Section 3 portrays the method employed and specifies the research design for the single case study about the Ghanaian entrepreneur. While section 4 presents the results, section 5 discusses them in the light of prior research. Section 6 concludes and provides policy implications. A great role is concentrated on the various networks in which the transcultural entrepreneur is embedded – the home country networks, the host country networks, the ethnic group networks, and the transcultural networks. With this approach the author reaches a new level of sophistication, as business activities in the digital era can benefit from transcultural networks of entrepreneurs. In the single case study about the Ghanaian entrepreneur, it is well argued that an entrepreneur who is part of transcultural networks can serve customers, suppliers, authorities, and finance institutions much better than those who are limited to home and host country networks and to ethnic group networks. The single case study shows how this works – how various technological levels can be combined within transcultural networks, how costs can be reduced by transcultural networks, how new partners can be found in such networks, how the value of the other networks can be upgraded through transcultural networks, and how digital business opportunities can be combined in such networks (as it is done in the fields of E-Drones and E-Robots).

All the subsections of the essay add up to get the “Findings” on transcultural entrepreneurship and their developmental role. These issues are part of the introductory section 1 which gives the background for the essay. In section 2 it is becoming clear that “transcultural competencies” are a valuable stock for business successes. The transfer of such competencies (in combination with competencies acquired in the home country, in the host country, and via the ethnic group in the host country) takes place between different locations and works especially well in the case of digital businesses as such competencies allow it to get access also to high-growth markets. In section 3, the author presents the case of a Ghanaian entrepreneur who has developed digital solutions, namely a drone project for rural regions in Africa and a robotic solution for wind turbines in Germany. The design of the methodology is of interest as specific interview sessions played a role to get more information about the substance of transcultural business activities. The section is rich on data sourcing, data analysis, and quality assurance in regard of the research findings. Section 4 gives more details on the case, on the entrepreneur, and on the digital businesses involved. The author has used an interactive procedure between raw data and prior research to develop a structure of first-order concepts, second-order themes, and aggregate dimensions (which is presented fully in his figure 1). The results from the interview sessions are used to analyse the eight (8) second-order themes which basically concern cultural challenges of transnational business development, and drivers of and assets for transnational entrepreneurship. The table 1 provides an overview of the entire causality systems based on the twenty-six (26) research propositions (RPs) which were developed

by the author. The causality system suggests “that African entrepreneurs can build on a distinct profile that may provide advantages in competition, even though high cultural distance causes problems that do not seem to arise if this distance ranges on lower levels”. Section 5 is on a Discussion of the research results, and section 6 is on Conclusions and Policy Recommendations; both sections give a view on future research needs in regard of transnational entrepreneurship. The academic side and the policy side can benefit from further research. It may be advisable for development to promote ventures of transcultural entrepreneurs in digital businesses.

In the *fourth essay* with the title “**Digital Transformation in Cameroon and the Growth of New Enterprises**”, which was written by **Ngo Tong Chantal Marie and Boubakari Hamadou**, there is a country case of digital transformation for Cameroon and an analysis on the growth of new, already established, and digital enterprises in the country, with a strong focus on the role of financial enterprises. Cameroon is discussing intensively about a concept of digitalization which fits the aspirations, expectations, and ambitions of the country to reach the status of an emerging economy through structural change and transformation. As the firms in Cameroon are addressed as the key actors, the concept of digitalization is related to their business models. Digitalization, which can be defined as the use of digital technologies and of digitized data to update continually the business models, provides the opportunities and tools to move into a “digital economy”. Digitalization is considered as an important step towards digital transformation as there is a general agreement in the country that digitalization causes large-scale and sweeping transformations across multiple areas of industry and society. Digital transformation refers to the integration of digital technology and the systematic use of ICTs for the implementation of activities in all areas of business and administration. It is also referring to the process of using ICTs to create new activities or to substantially modify existing activities in all sectors of the economy. In Africa, and as well in Cameroon, digitalization is expected to create new opportunities for reducing unemployment and for supporting entrepreneurship. However, despite the opportunities which are seen and anticipated with hope, unemployment and precarious informal employment remain predominant as negative social phenomena also in Cameroon, because the potential of digital entrepreneurship is still largely untapped. This essay analyses strategies, opportunities, and constraints of the Cameroonian government and of the many economic actors in Cameroon on their paths to promote and to achieve a digital transformation to lay the foundations for a “digital economy”. Key focus is on new digital enterprises and on improving the digitalization of functions in existing enterprises, with a focus on finance institutions’ functions. Start-ups play a significant role for the generation of new enterprises, and digital entrepreneurship is seen as an important element for employment creation.

In this essay the following issues are discussed in six (6) sections. In section 1 the Introduction is presented, by giving an overview of the essay. The promotion agency ANTIC (Agence Nationale des Technologies de l'Information et de la Communication) for Cameroon argues (see ANTIC 2019) that “*digital transformation is a novelty which Cameroon considers as an essential catalyst to its development agenda*”⁵⁴. This view of the ICT promotion agency about the role of digital transformation for Cameroon’s development process is more deeply analysed in the section 2 of this essay. Presented are also the research methodology, including the definitions, the literature review on digital transformation, the analysis of some statements regarding the subject of digitalization, the theories constructed relative to digital transformation, and then the method used to collect data and to conduct the study. In section 3 the process of digital transformation in the country and its impact on traditional (already established) businesses are analysed, referring mainly to the digitalisation of the financial sector. In the sections 4 and 5 there are analyses of the dynamics of the creation and the growth of new digital enterprises (start-ups), reviews of the difficulties that entrepreneurship is facing in the context of insufficient or irrelevant regulations, and case studies on selected start-ups, which successfully moved from the start-up phase to the scale-up phase. Then finally, in section 6 there are conclusions and policy recommendations about key issues of digital transformation which are still open in Cameroon.

All the subsections contribute to the major findings of the study. In the Introduction, in section 1, the authors relate the state of the digital transformation to the socio-political crisis in the Anglophone area of the country and to the Corona crisis, although other crises, like the climate crisis, also matter. The Internet market was transformed in Cameroon because of early investments for the ICT infrastructure, but also because of the impacts of the crises mentioned above. The discussion in section 2 on the research methodology gives an overview of domestic discussions in Cameroon, related to the state of digital transformation. It is argued that a comprehensive roadmap on digital transformation needs to be developed, followed, and implemented to speed up digital transformation. Obviously, a turning point was reached in the country in the year 2016 when the discussion about the digital transformation led to concrete actions, such as the Strategic Plan

⁵⁴ See ANTIC, 2019, Cameroon’s digital transformation, ANTIC sets stage for evaluation; for download: <https://www.antic.cm/index.php/en/component/k2/item/379-cameroon-s-digital-transformation-antic-sets-stage-for-evaluation.html>

for a Digital Cameroon in 2020. Since 2016, Cameroon has seen more than drafted papers, especially decisions about new actions, new fields of policies, and new investments towards digital transformation. Also, data collection and data research on ICT and Internet penetration were improved; surveys on the digitalization of enterprises of different sizes and sectors were undertaken; and a Digital Transformation Centre for Cameroon was established to serve also the rural and the remote areas. As the financial sector of Cameroon reveals a greater speed of digital transformation than other sectors, this sector is emphasized in the essay. But also, even before the Corona crisis, the health sector got involved in new digitalization efforts, especially through the creation and promotion of start-ups. A survey of digitalization progress in traditional (established) businesses is presented in section 3. The evidence for traditional (established) businesses shows that there is in Cameroon a rather unbalanced progress on digital transformation among companies of different size, sector, and region. Apps “Made in Cameroon” were developed successfully in the finance/banking sector, to guide users and partner towards financial transactions like money transfer, mobile money solutions, microfinance applications, and all types of “bank to bank”, “bank to customer”, and “bank to business” transactions. All major banks of Cameroon were part of these changes, and so they were part of the competitive race. The financial industry is composed also in Cameroon of credit/bank institutions, microfinance institutions, insurance institutions, and social security institutions. In the banking system the digitalisation was advancing more rapidly than in other finance industry subsectors, and there was considerable progress in the field of supplying digital financial services and in raising the financial inclusion rate. Digitalization has helped to raise the financial inclusion rate for social groups, economic sectors, and regions. The digitalization of the finance industry has however also shown impacts on other sectors, such as agriculture and energy. Agriculture-related digital financial services are forthcoming and impact on productivity, but also the energy sector is positively impacted what is important because electricity is a constraint for Internet uses.

Section 4 moves beyond traditional (established) enterprises and gives an account of the digital start-ups in Cameroon. FinTech, HealthTech, EducationTech, E-CommerceTech, B2B EnterpriseTech, and AgriTech are the most important sectors for digital start-ups in Cameroon. The case studies on FinTechs show that there is a real contribution in terms of value generation via the digital financial services that are supplied. All types of digital financial services are served via apps and platforms. But also, other sectors like E-health and E-commerce play a great role in the digital advances. Even failures of start-ups have an impact, like the one by the online trader Jumia in Cameroon, a firm which left the market, but the existing commercial market niches were observed by new start-ups who then acted as followers. There is however a great heterogeneity in terms of scaling-up the start-ups; some start-ups manage to grow while others fail in this

respect. Policies on taxation, on registration, and on regulation play a role in this success rate, and trust is a key factor. Section 5 presents a case of successfully scaling-up a start-up business; the case is referring to the health sector. It is HIMORE MEDICAL, and this is the first Medical Embedded Systems (MESs) manufacturer in the Central Africa region. The start-up is of relevance for presenting tools for reaching remote areas through the health system; medical examination results recorded by CardioPads can be transmitted to cardiologists and to other specialists, to data analysts, and to service providers. This case shows that via this innovation complex analyses and technical solutions can be managed despite of the rather weak health systems which are prevalent in countries like Cameroon. This is the result of a successful scaling-up process, as the company grows to serve more patients, as it establishes a dense network, as it performs sophisticated functions at speed, and as it finds practical and cost-effective solutions by reducing complexity in the medical value chain. Entrepreneurial successes allow for and guarantee scaling-up effects of start-ups, by linking remote health stations, by integrating local health workers, and by accessing hospitals, care stations, cardiologists, and specialised services. Also, links to high quality R&D institutions become possible, what improves the overall health system and allows it to access skills and medical resources.

Section 6 is on policy recommendations towards digital transformation and digital businesses in Cameroon. So far, on the African continent only few countries have adopted Start-up Promotion and Development Acts, and the actual and potential digital entrepreneurs in Cameroon are also waiting for such an initiative. In this section various important policy recommendations are presented, referring to key constraints which need to be overcome, like regulatory constraints, technology constraints, and social and structural constraints. All areas of policy being of relevance for digital enterprises are affected by regulatory constraints, as incoherent acts and regulations do harm to start-ups in their development. Technology constraints impact via gaps in the digital infrastructure and because of the lack of low-cost access to Internet. Lack of electricity affects digital transformation quite massively, and especially low income, rural and remote areas are impacted by social and structural constraints. The electricity gap excludes many producers from Internet access, and especially sectors of importance like agriculture, education, and health suffer. Progress in creating digital jobs is slow because of these constraints and gaps, so that the overall employment effect of digitalisation remains small in Cameroon.

The country case of Cameroon's digital transformation shows that much more economic impact is possible. It is therefore urgent to work on a new Digital Transformation Strategy for Cameroon and to improve the Promotion and Support Systems for ICT start-ups. A law to promote digital start-ups is still necessary, as the support for start-ups and the promotion of start-ups depends on clear definitions and on a coherent framework for the creation and the growth of digital

start-ups. And a change in the education system is needed as digitalization should be an issue also at the primary school level, not starting first (and too often exclusively) at the tertiary education level. While Cameroon is an interesting case of digital transformation with some advances, a case with many inspiring developments which become visible in recent times, a more systematic and a more holistic approach towards planning and implementing digitalization is needed.

The fifth essay with the title **“Africa’s Industrial and Technological Supply Response to the COVID-19 Pandemic: A Preliminary Analysis of 4IR Readiness”** was written by the two authors **Oyebanke Abejirin and Oyebanji Oyelaran-Oyeyinka**. The COVID-19 pandemic has impacted lives, livelihoods, businesses, and economies globally and in Africa in unprecedented ways. The African Development Bank (AfDB) estimated that Real GDP in Africa contracted by 2.1 percent in 2020, but it projected that the continent may grow by 3.4 percent in 2021 (AfDB, 2021). Although these are huge negative changes, the continent has also experienced fundamental structural changes since. Most important however is the fact that COVID-19 has tested the readiness of countries to leverage technological response to the pandemic. “Readiness” means flexibility, adaptability, using competencies to change production, exploiting new channels for key supplies, and the willingness to implement new science, technology, and innovation (STI) policies. African countries responded in different ways, depending on their structure and their political system, with some sectors of their economies which were hit harder than others did. While the pandemic had affected all economic sectors, some key industrial and services sectors - pharmaceuticals, medical equipment and supplies, health and care, social protection, Information & Communication Technologies (ICTs) - were the leading sectors in responding to the demand for medicines, medical equipment, personal protective equipment (PPE), health and care services, and to the disrupted global and regional supply chains. Supply chain disruption was a major issue to address as shortages in medical equipment and medicine exposed the fragility and weakness of Africa’s health and pharmaceutical sectors; and fundamentally, the region’s lack of industrial capabilities became more obvious. Countries, industries, and firms with relatively deep technological and innovative capacities were better able to respond faster, to mitigate, and to adapt to the negative impacts of the pandemic. Also, the level of digitalization determined to some extent the ability to respond to the pandemics - at the level of consumers and producers, and at the level of government officials and entrepreneurs.

This essay examines how firms, industries and governments in Africa have responded to COVID-19 within the framework of digital transformation and the emerging fourth industrial revolution (4IR). It analyses both the supply response as well as the supply constraints to the disease outbreak. The essay adopts a cross-country approach to provide observable patterns of industrial and technological readiness and of supply chain response and constraints. The Global Innovation Index (GII), the Network Readiness Index (NRI), and the Competitive Industrial Index (CII) are used to analyse country's industrial and technological capabilities and to give a preliminary indication of the 4IR readiness at a regional and global level. Using these three indexes, which in combination give a good picture of technological capabilities and of industrial readiness, the authors select three relatively advanced African countries – Mauritius, South Africa, and Kenya - and three relatively less advanced African countries – Ethiopia, Mozambique, and Niger – to carry out a multi-case study analysis of their supply chain responses and the constraints to react to the pandemic. Finally, the authors use the case study of Nigeria to present country-specific information on supply response and recommendations on the way forward. Most important is the final evaluation what the African countries can do to improve their technological capabilities and their industrial readiness. There are many strategies and policies which can be successfully used, and the health sector and the pharmaceutical industries are a good starting point for action. As these sectors need digital tools and 4IR technologies, advancement of industries and of related services sectors can be promoted rather quickly. Also, some of the informal sectors can benefit from this action.

The essay starts with an Introduction in section 1, followed by a literature review in section 2. The section 2 presents issues like the context of the Covid-19 Pandemic challenge, the Pandemic and impacts on supply chain Disruptions, the imperative of digital technology capability for the Health Sector in the Pandemic Era, Africa's Industrial and Technological Capacity in Pharmaceuticals, and the Hypotheses derived for the proposed methodology of the essay which is explained in section 3. Section 3 on Methodology informs about the sources of the data, the three indexes used, the cross-country analyses based on the indexes, the multi-case studies for more and less advanced African countries in terms of industrial and technological capabilities, and the full case study for Nigeria as an economic power of Africa with a huge potential for industrial development and a great digitalization base. Section 4 presents the results of the analysis and the discussion of the findings for the impact of the industrial technological readiness on the Covid-19 response. The country-by-country comparison of results of the three indexes, the country case studies, and the case of Nigeria give a picture of the capabilities and the supply responses. Section 5 is on Conclusions and Policy Recommendations with the ambition to bring together the main conclusions and recommendations for reaching more resilience in Africa's industries.

All the subsections are relevant for the Findings of the Essay. In the Introduction (of section 1) the authors ask about the impacts of Covid-19 for industrial restructuring and for reforming the health and care systems in Africa. Restructuring the basic pharmaceutical and medical equipment industries and reforming the weak health systems are now seen as global tasks, but also in Africa such changes are ongoing, and in some country, sector, and firm cases we see a spectacular dynamic. It is argued by the authors that the pandemic has already led to higher investments in the healthcare sector and that the related industrial capacity was increased and allows it to produce more critical drugs. This trend does more than provide employment; the living standards are raised, and the health security is improved. Inequality and poverty trends are mitigated if such policies are consolidated. The Literature Review in section 2 highlights the fact that Africa was very much hit by the severe disruption to the global supply chains for medical supplies during the COVID-19 pandemic, so that there was no choice but to start with measures to substitute for the consequences of supply shortages. Although the responses differed, Africa started to strengthen its resilience, also the countries with very weak health systems and with low industrial and technological capabilities. Countries who had suffered from the Ebola Virus Disease (EVD) had some experience in responding early and decisively to the pandemic. Digitalization was seen as an instrument to make supply chains more agile and flexible, and the use of 4IR technologies helped to rearrange production systems. Virtual care was seen as a possibility to reach patients in remote (mostly rural) areas of African countries; it includes telemedicine and telehealth and connects health professionals, clinicians, patients, and family members. This digital mode helped to coordinate care, to provide health services, to support self-management in the health system, and to promote professional collaboration. The authors look at the ways to balance the performance of industrial and healthcare systems. The intersection of industrial capacities (for pharmaceutical and health equipment) and of healthcare systems (by structures, characteristics, and performance levels) matters for the authors. In case of a certain balance of the two systems, countries can respond better to Covid-19 than countries with a great imbalance. The authors mention nine (9) indicators to measure such a balance/such an imbalance. They derive hypotheses for the further investigation from this argument. The section 3 on the Methodology looks at the link between industrial capacities as recorded via three indexes (networking readiness, global innovation capacity, and industrial competitive performance) and the access to health products and vaccines (substances and end-products) via local development, production, and distribution. The authors use three levels of analysis (a cross-section analysis for a sample of African countries, analyses of selected African country cases, and a deep investigation of the Nigerian country case). The measured balance/imbalance between industrial systems and health systems is central to the investigation.

Section 4 presents the Results of the analyses and gives a Discussion about the findings. Cross-country analyses based on index scores for the countries and correlations with the status of vaccine development, production, and distribution show that vaccine developers have a strong base for industrial and technological capabilities (they are in OECD countries, but are not present in Africa), while countries which do not develop, but manufacture and distribute vaccines show a lower correlation with the base of industrial and technological capabilities (as measured by the Network Readiness Index and the Global Innovation Index). While Egypt is the only (confirmed) country in the manufacturer/distributor category for Covid-19 vaccines, some few African countries are now on the way to manufacture/to distribute and are hoping for later times even to develop such vaccines. According to the Global Innovation Index (GII) scores Kenya, Tanzania, Botswana, Rwanda, Egypt, Cabo Verde, Senegal, Namibia, Ghana, and Malawi are the countries best placed in the group of lagging countries (relative to the developed countries). Some countries in this group (Kenya, Rwanda, Egypt, Senegal, and Ghana) may be the potential manufacturers/distributors and may even become later developers of vaccines, although not too many African countries will be able to move beyond the “fill and finish” category because of the persisting dependence on the supplies of key substances from outside (from the OECD world). For six African countries - three at the top (in terms of the indexes for measuring the capabilities, namely Mauritius, South Africa, and Kenya) and three at the bottom (Mozambique, Niger, and Ethiopia) - the analyses confirm the link between industrial and technological capabilities and the readiness to respond with supplies of vaccines and health equipment to the pandemic by own facilities. There is some optimistic point to note as some countries like Ethiopia can successfully leapfrog and catch up if they can continue their development path with stable and peaceful policy conditions (although currently such conditions are not prevalent because of the war between regions and ethnic groups of the country). The case study on Nigeria confirms that despite of rather limited industrial and technological capabilities as well as weak health and care systems there is potential, because of the size of the economy, the R&D base, the stock of skilled people, the flexibility of some firms and entrepreneurs to use 4IR technologies, and because of the networks and partnerships of the pharmaceutical industry. It is shown that an all-sector perspective is needed to raise the industrial and technological capabilities and the foundations of the health and care system; it is not enough to push one sector if a crisis emerges. But the 4IR technologies can impact considerably on the industrial and the health sectors of African countries. Section 5 on Conclusions and Policy Recommendations emphasizes that strong governance and policy reforms will be needed to advance the level of these capabilities and to increase the resilience of economic and social sectors in times of crisis.

3 The Strategy

We can derive from Unit 1 five strategic conclusions:

Strategy 1: It is necessary to link more deeply digital transformation in Africa with the development of productive capacities so that a virtuous circle is emerging

The links between digital transformation and developing productive capacities should be strengthened. The Digital Strategy for Africa of the African Union (AU) analyses the four Foundation Pillars of the Strategy (enabling environment, policy and regulation; digital infrastructure; digital skills and human capacity; and digital innovation and entrepreneurship), the six Critical Sectors (digital industry; digital trade and financial services; digital government; digital education; digital health; and digital agriculture), and the six Cross-cutting Themes (digital content & applications; digital ID; Emerging Technologies; cybersecurity; privacy and data protection; and research and development). All these issues are relevant for the development of productive capacities. The three basic elements of productive capacities (see United Nations 2006) are Productive Resources (natural resources, human resources, financial resources, physical capital), Entrepreneurial Capabilities (core competences and technological capabilities), and Production Linkages (backward and forward linkages, flows of information and exchange of experience, resource flows such as human capital and financial capital, territorial production clusters, global value chains, links between foreign and domestic entrepreneurs, and links between large firms and SMEs). These three pillars show the static potential but more important is the dynamic potential as the productive resources, the entrepreneurial capabilities, and the production linkages are created, developed, and transformed over time. Digital transformation (according to the Digital Transformation Strategy for Africa) will contribute to the development of the productive capacities (by speeding up structural change and accumulation of resources), while the development of productive capacities will push the digital transformation (by demand, supply, and transmission effects). A virtuous circle takes place between these two poles of the development strategy. Digital transformation has the potential to accelerate in many ways the development of productive capacities, while these development processes will push the digital transformation. All this is made clear in Unit 1, by referring to many examples of how to get to the virtuous circle. What is needed is to combine two strategies – a Digital Transformation Strategy and a Strategy for the Development of Productive Capacities.

Strategy 2: Digital entrepreneurship and digital start-up ecosystems need a more supportive government, but also depend on more intensive production linkages

It is not enough to create islands of digital enterprises and places where digital start-ups can develop. Such incubators, accelerators, hubs, and clusters are important but need to be embedded into a framework which is addressing the two core pillars of the concept of productive capacities (creation of entrepreneurial capabilities and utilization of production linkages). The digital entrepreneurs and the founders of digital start-ups need the core competencies and the technological capabilities for their enterprise, but they also need the various production linkages to grow. All the production linkages (which were mentioned above) have relevance for developing digital entrepreneurship and digital start-up ecosystems. The links to large companies, the links to domestic and to foreign companies, the links to regional and global value chains, the links to technology and science centres, the links with sector export and lobbying associations, and the links to government agencies matter; but also the links with competitors, suppliers, and partners of the same industrial sector matter. As it is revealed in the essays of Unit 1 there are various digital enterprise ecosystems in Africa which are of a quite different development level; they have a distinct evolutionary history, and they show a diverse internal structure and a different attractiveness for newcomers from outside. Of great relevance are the policy implications of the three Tier ecosystems: Tier 1 (“maturing” ecosystems), Tier 2 (“incipient” ecosystems), and Tier 3 (“learning” ecosystems). Although these ecosystems are at a different development level, enterprises in all of them need homegrown digital solutions for success rather than orienting themselves on the objectives, strategies, and images of the “Silicon Valley model”. Also, it is necessary to look beyond the showcases, and beyond the widely advertised success cases. Most important is the ability of entrepreneurial and advisory actors in digital ecosystems to manage ecosystem bottlenecks (markets and infrastructures, entrepreneurial knowledge and mentorship, labour and talent, hubs and support organizations, and access to funding). The cases for digital start-ups and digital enterprises in Unit 2 show that just accepting this advice on managing bottlenecks separates winners and losers among digital entrepreneurs.

Strategy 3: The developmental role of transnational entrepreneurs from Africa is increasing and they have a role in the digital transformation process

Transnational entrepreneurs emerged in recent times, demonstrating that they can establish with success firms in Africa and in European countries. They are also contributing to the digital transformation by supplying digital tools of relevance to the two markets, such as e-drones (for transporting medicine or other high-value products) and e-robots (for maintaining equipment in wind parks or offshore oil production facilities). Such entrepreneurs are learning in and from both markets, and they apply their competencies through their established or new enterprises in

culturally different locations. They contribute to the development of productive capacities via entrepreneurial capabilities and production linkages. Their entrepreneurial competencies are widened through the exposure to conditions in diverse cultural locations, what is leading them to personal strength and resilience. They establish many production linkages which result from activities in home countries, in host countries, and in third countries. They benefit from these comparative overviews and experiences with different cultures and systems. As such entrepreneurs are part of various networks (in the home country, in the host country, in the ethnic group, and in networks of third countries), they can accumulate knowledge and experience via these networks in all the countries where they have business relations and personal relations. These entrepreneurial capabilities are not very much researched and so policy frameworks may underestimate the importance of such transnational entrepreneurs. In times of digital transformation such experiences of African entrepreneurs will be of great value for large and for small companies, for foreign and domestic investors, but they will also impact positively on regional start-up ecosystems as founders, as partners, or as advisors. When assessing the Digital Transformation Strategy for Africa, one can see that these transnational entrepreneurs can contribute to all the Foundation Pillars, to all the Critical Sectors, and to all the Cross-cutting Themes. These Themes, like digital content & applications; digital ID; Emerging Technologies; cybersecurity; privacy and data protection; and research and development, are full of complexity and many cultural contexts and institutional varieties need to be considered. The transnational entrepreneurs can contribute to these difficult issues by their understanding of the cultural differences between the locations where they are working, and so they contribute to the digital transformation in Africa and globally. Developing promotion and support programmes for these entrepreneurs may be very useful and beneficial for digital hubs and digital strategies in Africa, but also globally.

Strategy 4: Digital transformation strategies are needed for established and for new enterprises to develop policies for remote areas and for vulnerable social groups in Africa

A digital transformation strategy needs to be comprehensive and should cover measures for all established large, medium, and small firms whatever the economic sector is, but should give special emphasis to the development of start-ups. Start-ups develop along various distinct phases and support is needed over the full growth cycle. Ease of doing business is a key issue, but there is a gap with measures to support the growth of firms in Africa. Especially those firms need support which have an outreach to remote rural areas and to vulnerable social groups. This agenda may be part of the firms' business objectives or a consequence of the growth of firms over time. Remote rural areas are neglected with digital infrastructure, have a limited pool of digital entrepreneurs, and as well other

foundation pillars for digital transformation may be weaker. Also, the foundation pillars for vulnerable social groups are largely inactive. For the start-ups much more attention should be given to firms which can support remote rural areas and vulnerable social groups; some pilot projects exist, but they do not spread to a larger scale. Specific importance may be given to Start-up Acts and to clear and implementable digital agendas. Only few countries have written, legalized, and implemented Start-up Acts and only few countries have digital agendas which emphasize measures for people in remote rural areas and for vulnerable social groups. Of great importance is a comprehensive view of the financial sector, which is comprising banks, insurance companies, social safety funds, and microfinance institutions. There is some change towards the digital world observed for the established banks via the use of mobile money apps and online credit applications, but also the other financial institutions need more consideration in a digital transformation strategy. Digital transformation with regard of the social safety systems allows for a greater acceptance of specific allocation tools, as the high mobile money penetration allows it to reach a greater number of targeted beneficiaries for welfare measures. New enterprises have a specific role for e-health, for edtech, for fintech, for agritech, and for other economic fields which are relevant for remote rural areas and for vulnerable social groups. Digital labour market information, weather forecasts, medical advice, and online retail services play a growing role. Remote areas and vulnerable social groups can benefit from special measures to support such online services, but these e-services have a significant role for the whole economy, mainly for the city economies. In Unit 1 of this volume we find examples of local African innovations for e-health (medical checks, transmission of medical data, and therapy measures), and in Unit 3 we find information how universities in Africa can reach with digital services remote rural areas and vulnerable social groups. 4IR technologies are used in various ways to facilitate the spread of such services to the remote areas and to the vulnerable groups. The ambitious AfCFTA project gives hope that such technologies and the related digital agendas will be transferred to other African nations.

Strategy 5: Strengthening the technological capability and the digital readiness of firms in Africa should become a key objective of industrial policy to support critical sectors

Various indexes on technological capabilities and digital advances show that African countries have quite different levels of development in this regard. When looking at the Network Readiness Index (NRI), the Global Innovation Index (GII), and the Competitive Industrial Index (CII) we see that the diversification of the industrial base and the speed of digital transformation are changing in a positive direction but with quite different success. Critical industrial sectors, such as inputs and equipment for the agriculture sector, production of medical equipment and pharmaceutical products, transport vehicles and parts, and construction

equipment, are in its further development based on advanced technological and digital competences. The COVID-19 pandemic has brought new awareness that these capabilities and competences are of importance for a quick industrial supply response, especially for the development, the production, and the distribution of vaccines and medical drugs, but also for the provision of personal protective equipment (PPE). It is observed that the technological capabilities and the digital readiness determine the ability of a country to produce vaccines, medical drugs, and medical equipment. So far, the COVID-19 pandemic has brought with it for Africa some positive changes, but also some disappointing experiences. The informal sector was mobilized, the repurposing of industries to produce PPE has occurred, and some coordination between firms of various African countries and with R&D institutions took place. Africa has managed to develop an African Union (AU) strategy to organize for a collective response to the pandemic, along the earlier successful Ebola containment strategy. But the limits of the industrial base of Africa are obvious, what follows from the limited technological and digital capabilities. Fragmented markets in Africa and the high dependence on China and India for basic medical substances and drugs are problems to be overcome via the project of the AfCFTA. Africa is increasingly using excellent local R&D institutions for medical research, for ICT development, for developing green agriculture, and for many other important fields. The links between these R&D excellence centres, industrial firms, and national, regional, and continental governance institutions for the execution of industry policies are still too weak. There is need for a further strengthening of key institutions, such as the Africa CDC (the network of African Centres for Disease Control and Prevention). It can be emphasized that actors in African countries can learn a lot from successful experiences in other African countries. Therefore, a combination of strategies is necessary: a strategy to develop critical industrial sectors via a new industrial policy, a strategy for developing technological and digital capabilities via a human skills programme for industry, and a strategy to push the digital transformation for all sectors of the economy and the society via the Digital Transformation Strategy of the African Union. Obviously, the digital transformation strategy needs a much deeper coordination with human skills development strategies and industry development strategies at the level of the AfCFTA.

References

Accenture, Various authors from Software & Platforms Strategy, 2022, Tuning into Africa's digital transformation, February 26, 2022, access for download: <https://www.accenture.com/us-en/insights/software-platforms/africa-digital-transformation>

- AfDB/African Development Bank (2021). African Economic Outlook 2021 - From Debt Resolution to Growth Recovery: The Road Ahead for Africa. Abidjan: African Development Bank. Retrieved January 25, 2022, from: https://www.afdb.org/sites/default/files/documents/publications/afdb21-01_aeo_main_english_complete_0223.pdf
- African Development Bank (AfDB)/Asian Development Bank (ADB)/European Bank for Reconstruction and Development (EBRD)/Inter-American Development Bank (IDB), 2018, *The Future of Work, Regional Perspectives*, Washington, D. C.: Inter-American Development Bank, 118 pages, Chapter 2 (The Future of work in Africa); access for download: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/The-Future-of-Work-regional_perspectives.pdf
- Andrews, Dan/Giuseppe Nicoletti/Christina Timiliotis, 2018, OECD Economics Department Working Papers No. 1476, 8 November 2018, Digital technology diffusion: A matter of capabilities, incentives or both?; to be accessed with the link: [https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP\(2018\)24&docLanguage=En](https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP(2018)24&docLanguage=En)
- ANTIC/Agence Nationale des Technologies de l'Information et de la Communication, 2019, Cameroon's digital transformation, ANTIC sets stage for evaluation; for download: <https://www.antic.cm/index.php/en/component/k2/item/379-cameroon-s-digital-transformation-antic-sets-stage-for-evaluation.html>
- APRI (Africa Policy Research Institute), 2021, "What is Africa's Digital Agenda"; see the Annual Report 2021 of APRI (Africa Policy Research Institute) for the discussion about the theme; to be accessed for download: <https://afripoli.org/what-is-africas-digital-agenda>
- AU/ African Union (AU), 2020, *The Digital Transformation Strategy For Africa (2020 – 2030)*, May 18, 2020, 53 pages, African Union: Addis Ababa, Ethiopia; for the download of the document: <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>, and: <https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf>
- AUC/OECD, 2021, *Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs*, AUC/African Union Commission, Addis Ababa/OECD Publishing, Paris; access: <https://www.oecd.org/dev/africa-s-development-dynamics-2021-0a5c9314-en.htm>
- Banga, K./D. W. te Velde, 2018, *Digitalisation And The Future Of Manufacturing In Africa*, SET (Supporting Economic Transformation), March 2018, 81 pages, published by ODI/DFID; access for download: https://set.odi.org/wp-content/uploads/2018/03/SET_Digitalisation-and-future-of-African-manufacturing_Final.pdf
- Bayuo, B./R. Bamford/B. Baah/J. Mwaya/Ch. Gakuo/S. Tholstrup, 2022, *Supercharging Africa's Startups: The Continent's Path to Tech Excellence*, Tony Blair Institute For Global Change, 61 pages; access for download: <https://institute.global/sites/default/files/articles/Supercharging-Africa-s-Startups-The-Continent-s-Path-to-Tech-Excellence.pdf>

- BCG (Boston Consulting Group), 2020, “The Race for Digital Advantage in Africa”, 09 March 2020; access for download: <https://www.bcg.com/de-de/publications/2020/race-digital-advantage-in-africa>
- Bolat, E./N. D. Taura, September 10, 2019; Digital technologies are transforming African businesses, but obstacles remain; in: *The Conversation*; access for download: <https://theconversation.com/digital-technologies-are-transforming-african-businesses-but-obstacles-remain-120005>
- Cariolle, Joël, 2020, Digital spillovers and SMEs’ performance in Sub-Saharan Africa, Policy Brief/Note Brève 210, September 2020, FERDI/fondation pour les études et recherches sur le développement international; access for download : <https://ferdi.fr/dl/df-hGhDeAbF83yexQhmNEoJdW8b/ferdi-b210-digital-spillovers-and-smes-performance-in-sub-saharan-africa.pdf>
- Cariolle, Joël/David A. Carroll II, 2020, Digital Technologies for Small and Medium Enterprises and job creation in Sub-Saharan Africa, FERDI/fondation pour les études et recherches sur le développement international, 106 pages ; download for access: <https://hal.archives-ouvertes.fr/hal-03004583/document>
- Dahir, A. L./Y. Kazeem, 2017, Homegrown technology is being used to help millions at risk from a devastating famine in Africa, Quartz Africa, March 23, 2017; access for download: <https://qz.com/africa/938093/homegrown-technology-is-being-used-to-help-millions-at-risk-from-a-devastating-famine-in-africa/>
- Dailey, N., 2022, Business Insider Africa, “The ‘new FANG’ trade will be in commodities amid market turmoil sparked by Russia’s war in Ukraine, says wealth manager”, released on March 23, 2022; access for download: <https://africa.businessinsider.com/markets/the-new-fang-trade-will-be-in-commodities-amid-market-turmoil-sparked-by-russias-war/bw5n7b0>
- Disse, S./Ch. Sommer, 2020, Digitalisation and its Impact on SME Finance in Sub-Saharan Africa: Reviewing the Hype and Actual Development, Discussion Paper, 4/2020, 65 pages; access for download: https://www.die-gdi.de/uploads/media/DP_4.2020.pdf
- Dobson, St./P. Jones/D. Agyapong/G. Maas, Eds., 2021, *Enterprising Africa, Transformation through Entrepreneurship*, Routledge/Taylor & Francis Group; for information: <https://www.routledge.com/Enterprising-Africa-Transformation-through-Entrepreneurship/Dobson-Jones-Agyapong-Maas/p/book/9781138371231>
- EC/European Commission/Africa Europe Alliance, 2019, New Africa-Europe Digital Economy Partnership, Accelerating the Achievement of the Sustainable Development Goals, report released on 13/06/2019, 73 pages, Africa Europe Alliance for Sustainable Investment and Jobs, founded in 2018; access for download: https://ec.europa.eu/international-partnerships/system/files/new-africa-eu-digital-economy_en_0.pdf
- EIB/European Investment Bank, 2021, The rise of Africa’s digital economy, The European Investment Bank’s activities to support Africa’s transition to a digital economy, 96 pages, Luxembourg: February 2021, EIB; access for download: https://www.eib.org/attachments/thematic/study_the_rise_of_africa_s_digital_economy_en.pdf

- FES/Friedrich Ebert Stiftung, 2020, What is Digitalization?, Opportunities and Challenges in East Africa, April 2020, FES, Rwanda, 18 pages; access for download: <http://library.fes.de/pdf-files/bueros/ruanda/16158.pdf>
- Friederici, N., Wahome, M., Graham, M., 2020. Digital Entrepreneurship in Africa: How a Continent Is Escaping Silicon Valley's Long Shadow. Access: https://library.oapen.org/bitstream/handle/20.500.12657/43517/external_content.pdf?sequence=1&isAllowed=y, and: <https://doi.org/10.7551/mitpress/12453.001.0001>
- Gupta, A./Ch. Shinde/A. Dey/R. Patel/Ch. Patel/V. Kumar/M. Patel, 2019, Honey Bee Network in Africa: Co-creating a Grassroots Innovation Ecosystem in Africa, Working Paper 178, zef/Centre for Development Research, University of Bonn, Bonn, February 2019, 62 pages; access for download: https://bonndoc.ulb.uni-bonn.de/xmlui/bitstream/handle/20.500.11811/9629/ZEF_Working_Paper_178.pdf?sequence=1&isAllowed=y
- IDS/Institute of Development Studies, 2016, Can Digital Jobs Solve Africa's Unemployment Crisis?, Rapid Response Briefing, Issue 13, January 2016; <https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/8835/RRB13.pdf?jsessionid=D05FBFBCAD98717545E0E07CBE90F77D?sequence=1>
- ITU/International Telecommunication Union, 2021, Digital Trends in Africa 2021, Information and communication technology trends and developments in the Africa region 2017-2020, ITU Publications Africa, 76 pages; access for download: https://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-DIG_TRENDS_AFR.01-2021-PDF-E.pdf
- J-PAL (The Abdul Latif Jameel Poverty Action Lab), 2020a, Can digital technology help create a more gender-equal society?, Posted on 8 December 2020 by Thokozile Malaza and Nidhi Parekh; access for download: <https://www.povertyactionlab.org/blog/12-8-20/can-digital-technology-help-create-more-gender-equal-society>
- J-PAL (The Abdul Latif Jameel Poverty Action Lab), 2020b, Overcoming under-subscription of welfare programs: Digital solutions to low take up, Posted on 24 November 2020 by Aimee Hare; access for download: <https://www.povertyactionlab.org/blog/11-24-20/overcoming-under-subscription-welfare-programs-digital-solutions-low-take>
- Kuo, Lily. 2015. "Video: Ory Okolloh Explains Why Africa Can't Entrepreneur Itself out of Its Basic Problems." In: Quartz Africa, September 15, 2015. Access: <https://qz.com/africa/502149/video-ory-okolloh-explains-why-africa-cant-entrepreneur-itself-outof-its-basic-problems/>
- Leke, A./L. Signe, 2019, Spotighting opportunities for business in Africa and strategies to succeed in the world's next big growth market, Report, Brookings, Friday, January, 2019; access for download: <https://www.brookings.edu/research/spotlighting-opportunities-for-business-in-africa-and-strategies-to-succeed-in-the-worlds-next-big-growth-market/>
- Melia, E., 2020, African Jobs in the Digital Era, Export Options with a Focus on Online Labour, 90 pages, Publisher: DIE/Deutsches Institut für Entwicklungspolitik/German

- Development Institute, Bonn 2020; access for download: https://www.die-gdi.de/uploads/media/DP_3.2020.pdf
- Melia, E., 2019, The Impact of Information and Communication Technologies on Jobs in Africa, A Literature Review, 54 pages, Publisher: die/Deutsches Institut für Entwicklungspolitik/German Development Institute, Bonn 3/2019, access for download: https://www.die-gdi.de/uploads/media/DP_3.2019.pdf
- Möbius, M./U. Wunsch 2020, East Africa Digital Entrepreneurship Ecosystem in Higher Education, Kampala, November 2020, 101 pages, GIZ/CENIT@EA: <https://www.giz.de/en/downloads/giz2021-en-entrepreneurship-higher-education.pdf>
- Nanfuka, J./INET/Institute for New Economic Thinking, 2022, Digital Access and Economic Transformation in Africa, March 2022, INET, Africa Paper Series Number 4, 19 pages; access for download: https://www.ineteconomics.org/uploads/papers/Digital-Access-Africa_Draft-Section-Nov-9_CT120222_Clean34.pdf
- Ngoasong, M. Z., 2015, Digital Entrepreneurship in Emerging Economies: The role of ICTs and local context. In: 42nd AIB-UKI Conference, 16-18 April 2015, Manchester Metropolitan University, UK, 28 pages; access for download: <http://oro.open.ac.uk/44695/1/AIB-UK%20-%20Digital%20Entrepreneurship%20-%20Final.pdf>
- OECD, 2019, Digitalisation and productivity: a story of complementarities, OECD Economic Outlook, Volume 2019, Issue 1, with the link for download: <https://www.oecd.org/economy/growth/digitalisation-productivity-and-inclusiveness/>
- Phamodi, S., Ed./M. Power/A. Singh, 2021, Making ICT Policy in Africa, An Introductory Handbook, fesmedia Africa, Friedrich Ebert Stiftung, 76 pages, Windhoek, Namibia; access for download: <http://library.fes.de/pdf-files/bueros/africa-media/18173.pdf>
- Pichai, S., 2022, How companies can help accelerate Africa's digital transformation, February 07, 2022, Sundar Pichai as CEO of Google and Alphabet; access for download: <https://blog.google/around-the-globe/google-africa/africa-digital-transformation/>
- Roberts, T., 2018, A new digital imperialism and how to respond to it, Opinion, IDS/Institute of Development Studies, 25 April 2018; access for download: <https://www.ids.ac.uk/opinions/a-new-digital-imperialism-and-how-to-respond-to-it/>
- SDSN/Sustainable Development Solutions Network/Bill & Melinda Gates Foundation/Ministère De L'Economie, Des Finances Et De La Relance, 2021, Accountability Report 2021: G7 Partnership for Women's Digital Financial Inclusion in Africa, September 2021, 31 pages; access for download: <https://static1.squarespace.com/static/5b4f63e14eddec374f416232/t/614b908a22248f652bb6cc1b/1632342167775/Accountability+Report+2021-4.pdf>
- Singh, R. M./J. Said, 2020, Harnessing Digital Technology for Africa's Economic Recovery and Transformation, November 2020, 26 pages, Tony Blair Institute For Global Change; access for download: <https://institute.global/advisory/harnessing-digital-technology-africas-economic-recovery-and-transformation>

- Stuart, John, 2022, Digital Development in Africa – What is Working and What Isn't, tralac/trade law centre, tralac blog, 27 February 2022, 5 pages; access for download: <https://www.tralac.org/documents/blogs/4468-tralac-blog-stuart-digital-development-in-africa-27022022/file.html>
- Taura, N. D./E. Bolat/N. O. Madichie, 2019, Digital Entrepreneurship In Sub-Saharan Africa, Challenges, Opportunities and Prospects, Palgrave Studies Of Entrepreneurship In Africa; see for information: <https://link.springer.com/book/10.1007/978-3-030-04924-9>
- Tee, N., 2022, The State of Tech Start-ups in Africa, Contentfly Blog, January 24, 2022; access for download: <https://contentfly.com/blog/the-state-of-tech-startups-in-africa-2>
- Tricks, N., 2017, Smarter Aid: Why digital cash transfers are the future, Oxfam, Views & Voices, Oxfam.Org.UK, May 18, 2017; access for download: <https://views-voices.oxfam.org.uk/2017/05/smarter-aid-why-digital-cash-is-the-future/>
- Umeh, E., 2021, Digital Transformation in Africa Requires Homegrown Solutions, in: Harvard Business Review, December 15, 2021; access for download: <https://hbr.org/2021/12/digital-transformation-in-africa-requires-homegrown-solutions>
- UNCTAD, 2018, The Least Developed Countries Report 2018, Entrepreneurship for structural transformation: Beyond business as usual, 190 pages, United Nations: New York and Geneva, access for download: https://unctad.org/system/files/official-document/ldcr2018_en.pdf
- UNECA/ATPC/FES/UN Human Rights Office, 2019, Digital Trade In Africa, Implications for Inclusion and Human Rights, 152 pages; United Nations Economic Commission for Africa (UNECA)/African Trade Policy Centre (ATPC)/Friedrich Ebert Stiftung (FES)/United Nations Human Rights Office of the High Commissioner (OHCHR), access for download: https://archive.uneca.org/sites/default/files/PublicationFiles/dthr_en_full_rev3.pdf
- United Nations, 2006, The Least Developed Countries Report 2006, Developing Productive Capacities, Prepared by UNCTAD (United Nations Conference On Trade And Development), New York and Geneva: United Nations; access: <https://unctad.org/webflyer/least-developed-countries-report-2006>, and: https://unctad.org/system/files/official-document/ldc2006_en.pdf
- United Nations, 2021, UNCTAD Productive Capacities Index, Methodological Approach and Results, Prepared by UNCTAD (United Nations Conference On Trade And Development), Geneva: United Nations; access: https://unctad.org/system/files/official-document/aldc2020d3_en.pdf
- Unwin, T./R. Holloway, 2019, Can digital technologies really be used to reduce inequalities?, Development Matters, 28 February 2019; access for download: <https://oecd-development-matters.org/2019/02/28/can-digital-technologies-really-be-used-to-reduce-inequalities/>
- World Bank, 2020, E-Conomy Africa 2020”, a study of Google and IFC/International Finance Corporation; access for download: <https://www.ifc.org/wps/wcm/connect/e358c23f-afe3-49c5-a509-034257688580/e->

Conomy-Africa-2020.pdf?MOD=AJPERES&CVID=nmuGYF2

WBG/World Bank Group, accessed 2022, “The Digital Economy For Africa (DE4A) Initiative” from the World Bank: <https://www.worldbank.org/en/programs/all-africa-digital-transformation>

WBG/World Bank Group, 2017, Building Tomorrow’s Africa Today, “West Africa Digital Entrepreneurship Programme” (WADEP), An Initiative of the Digital Economy for Africa (DE4A), 97 pages, Washington D. C.: The World Bank; see for download:

<https://documents1.worldbank.org/curated/pt/963641556793151009/pdf/West-Africa-Digital-Entrepreneurship-Program-An-Initiative-of-the-Digital-Economy-for-Africa-DE4A.pdf>

WEF/World Economic Forum, 2022, Regional Action Group for Africa, Attracting Investment and Accelerating Fourth Industrial Revolution Adoption in Africa, White Paper, January 2022, 29 pages; access for download:

https://www3.weforum.org/docs/WEF_Attracting_Investment_and_Accelerating_Fourth_Industrial_Revolution_Adoption_in_Africa_2022.pdf

Wohlmuth, Karl, 2019, Technological Development, Structural Change and Digital Transformation in Africa, Berichte aus dem Weltwirtschaftlichen Colloquium der Universität Bremen, Nr. 128, IWIM/Institute for World Economics and International Management, Universität Bremen, 98 pages; access for download:

https://www.karl-wohlmuth.de/files/dateien/188_wohlmuth_digital_transformation_africa_layout_blu_e_series_number_128_9_2019.pdf

Building Productive Capacities and Digitalization in Sub-Saharan Africa

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1 Introduction

Building new productive capacities and fully utilizing existing ones would help enable countries to overcome their development constraints and achieve structural transformation in the long run. Technological capabilities are key to increase productivity and to boost the levels of competitiveness necessary to build new and to wholly use existing productive capacities. This process is mutually reinforcing as productive capacities also play a role in the digitalization of a country. Although some advances in productive capacity-building have been rolled back by the effects of COVID-19, the pandemic has also accelerated the digitalization process. The spread of COVID-19 across the globe has necessitated all countries to heavily invest in their digital and technological futures to accelerate their recovery efforts, to increase their resilience to future crises, and to enhance efforts to meet the goals and targets of their respective national development agendas. As digitalization spreads to various sectors of the economy, it is important and timely to look at its broader relationship with productive capacities and as part of a broader set of inclusive industrial policies. Understanding these linkages can provide essential insights for policy makers to ensure that countries' paths towards recovery are built on firm foundations and consider the necessary prerequisites for achieving long-term, sustainable development.

In reflecting the above, this paper presents a theoretical framework to explain the relationship between productive capacities and digitalization. The framework is applied and tested for 49 Sub-Saharan African countries. Specifically, the study

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investigates whether an increase in productive capacities would support the improvement of digitalization levels in Sub-Saharan African countries and vice versa. The results of the empirical analysis seem to confirm the existence of a positive relation between the two variables, in a way that could be referred to as a virtuous circle. To the authors' best knowledge, this relationship has not before been defined or empirically tested.

The paper is structured as follows: Section 2 contains a brief review of the definition and discussion of the role of digitalization in the current literature. Section 3 starts by discussing a theoretical basis for the existing relationship between the digital economy and the productive capacities. It then moves to analyse key indicators and measurements of the digital economy, as well as the productive capacities. Using a K-means cluster analysis, the section groups all countries, for which data is available, according to their similarities in productive capacity development and in digitalization. Unsurprisingly, Sub-Saharan African countries are mostly found in the grouping with the lowest productive capacities and with the lowest capacity to use, adopt and adapt technologies. The relationship between digitalization and productive capacity is further empirically tested in section 4. Section 5 concludes.

2 Digitalization in the literature

Multiple definitions of digitalization are found in the recent economic literature. Ritter and Pedersen (2019) define it as the application of digital technologies. Others argue that the digitalization describes how information technologies (IT) or digital technologies can be used to improve existing business processes (Verhoef et. al, 2019), while others include the “networking of all sectors in the economy, as well as collecting relevant information in order to evaluate options to improve the businesses’ performances” as core components of digitalization process (Schallmo et al., 2017: 4). Depending on the level of economic development of given country, digitalization needs may also differ: In developed countries, findings from the recent literature indicate that digitalization supports productivity and has a positive effect on growth; while in emerging markets, digitalization’s effects are mainly on employment, and on the related balance between job creation and job destruction (Aly, 2020). Digital platforms and technologies can help skilled young people to access opportunities; they have the potential to assist young entrepreneurs in making and receiving payments and accessing finance (Porter et. al, 2018; Kabbani, 2021). Yet, digitalization is not a panacea, and youth needs specific preparation to enter the labour market, more so to gain the competencies and professional skills demanded by an increasingly digital workforce, i.e., digital literacy, and information and communications technology (ICT) communication skills, among others. Promoting the acquisition

of digital skills alongside lifelong learning can help unemployed workers of all ages to take up new occupations in which more jobs are available (ILO, 2020). A recent study on Africa's Development Dynamics (AUC/OECD, 2021) finds that in Central Africa, the mismatch between skills and the digitalized labour market in the region explains why the region is lagging so far behind in terms of job creation. Despite a gradual improvement in educational attainment, the skills mismatch among young people means that they are unable to take full advantage of the use of new technologies or to move out of vulnerable and temporary employment situations. Azu et. al. (2020) constructed a panel of 15 ECOWAS countries, covering the period from 1994 to 2018, that investigated the impact of the digital economy or digitalization (as proxied by telephone subscription and internet penetration rate) on youth unemployment in West Africa. The study indicates that digitalization tends to reduce youth unemployment in the region in both the short-run and long-run, but other structural economic factors should be considered in the design of policies to support youth labour market engagement, including an appreciation of training, technical skills development, and the strengthening of other competencies demanded by the current labour market conditions.

Digitalization is not just enabled by the available technical equipment and the applications, but also by the quality of the broader infrastructure network, the existence of high-quality education opportunities and training, and by robust ICT regulations (Fuchs and Horak, 2006). Digitalization, as described above, is also seen as separate from the technical processes of digitization, by which information is converted from analogue to digital flows. (Brennen and Kreiss, 2014).

Technological capacities and digitalization in least developed countries (LDCs) and in Africa have been broadly addressed in the literature. Most studies have focused on the relationship between digitalization and economic development, and especially on the productivity and economic growth effects of ICT use in Africa. Sarkar, Pick and Johnson (2015) study the factors that affect ICT utilization and the digital divide in Africa. In addition to their consideration of traditional ICT variables, their empirical study also assesses broadband and the use of social media technologies. They show that gross national income per capita is the dominant factor for ICT use. Fuchs and Horak (2006) provide examples of internet usage in Ghana and South Africa, and they examine the level of Internet usage and the Human Development Index (HDI) to show the link between the level of social development and the digital gap.

Gerhan and Mutula (2010) utilize the E-Readiness of the University of Botswana to study the role of ICT in development. As it is the only University in the country, it proxies the country's development level. In the University of Botswana, the internet connectivity is poor: the bandwidth for internet traffic is 26 megabits per second (Mbps) against 382,000 Mbps in the United States. The authors show that after the introduction of an IT component, the dissertation

completion rate, the time for research and publication turnaround, the course offerings and the enrolment in online courses were higher. Moreover, improvements in classroom communication and overall positive impacts on student performance were noted. Blijnaut (2009) shows the role of socio-economic standards in South Africa. When comparing population groups white South Africans are found to have a higher user rate of both internet and cell phones. He argues that concerted efforts to close the digital divide by empowering citizens to become proficient computer users is critical.

The literature also explores the potential of digitalization and digital technologies in enhancing more modern industrial policies. Solomon and van Klyton (2020) examine rates of individual, business, and government usage of ICTs, as captured by the Networked Readiness Index (NRI). For a sample of 39 African countries between 2012 and 2016, they find that social networks and government ICT usage are positively related to economic growth. Although some other components of individual usage like mobile phone subscriptions and internet usage are also positively related, they are not statistically significant. They argue that individual usage leads to growth because it fosters human capital and increases productivity. They also highlight that the lack of enabling conditions on the continent hinders ICT-related benefits from accruing to businesses. Donou-Adonsou (2018) shows that in Sub-Saharan African countries with better access to education, internet usage contributes to economic development, while mobile phones do not. Kyem and LeMaire (2006) discuss the mobile phone boom in Africa and argue that mobile phones are not just a means of connectivity; they are also an agent in facilitating economic development, as well as democratic processes. Polikanov and Abramova (2003) analyse the digital technology situation in Africa and make recommendations on how to close the existing digital divide. They show that, in Africa, the literacy rate and the computer skills rates are low and that there are no clear national programmes for internet development. They argue that with pan-African integration, with a growing youth population, and with the active engagement of public, international, and private sectors the gap can be closed. Oughton (2021) suggests various policy options and argues that leapfrogging to 4G is the least-cost option in the unconnected regions in six East and West African countries. He also highlights the importance of a shared rural network, particularly in remote places. Interestingly, De Melo and Twum (2021) find that backward global value chain (GVC) participation has a positive link with mobile phone subscriptions. Asongu and Odhiambo (2019) look at the relation of foreign direct investment, IT, and economic growth in Sub-Saharan Africa. This study finds that internet and mobile phone usage affect foreign direct investment (FDI), which leads to improved economic growth dynamics, with internet-based models offering higher returns than mobile phone-based models. They also highlight the importance of complementary policies to be implemented alongside ICT policies. Srinuan and Bohlin (2011) perform a meta-analysis of articles

published between 2001 and 2010 on the issue of the digital divide, concluding that the challenge is multi-faceted, and they require a multi-dimensional response. They argue that the digital divide is not restricted to access to the technological infrastructure, but also to the social infrastructure that supports ICT, which includes socio-demographic factors, such as gender, education, age, location, and institutions. As such, the literature seems to highlight that coherent and coordinated efforts to strengthen digitalization can be used as part of a broader set of strategies that could comprise a renewed and modern approach to industrial policy formulation and implementation towards more inclusive and sustainable development goals.

3 Digital economy and Productive Capacities

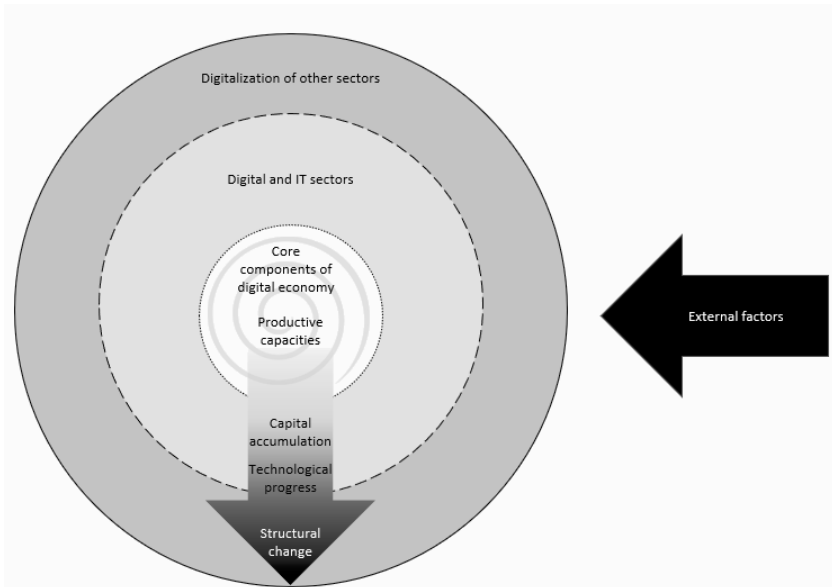
3a Defining a new relationship

The digital economy, and the digitalization process it brings about, are inseparable from the functioning of any economy, including in Sub-Saharan Africa. UNCTAD (2019) defines the main components of the digital economy as: (i) a core process, which comprises the foundational components of the digital economy, including innovation, technologies and enabling infrastructures; (ii) digital and information technology sectors, which produce key products or services that rely on core digital technologies, including digital platforms, mobile applications and payment services; and (iii) digitization of other sectors where digital products and services are increasingly used. These components of the digital economy contribute to the creation of spillover effects and other intangible outcomes that benefit all the spheres of the economy.

The core process of the digital economy requires domestic productive capacities to be already in place and new ones to be built to support the development of the other components during the digitalization process. UNCTAD (2006:61) defines productive capacities as “the productive resources, entrepreneurial capabilities and production linkages which together determine the capacity of a country to produce goods and services and enable it to grow and develop”. They are built through three interrelated processes: capital accumulation, technological progress, and structural change. Capital accumulation is the process of maintaining and increasing stocks of natural, human, and physical capital through investment and education. Achieving technological progress is the process of introducing new goods and services, new or improved methods, equipment, or skills to produce goods and services, and new and improved forms of organizing production through innovation. Structural change is the movement of labour and other productive resources from low to high productivity sectors. At any point in time, the core components of the digital economy rely on and are

defined by a country's existing productive capacities. For the economy to develop and to strengthen the digital and IT sectors as well as the other sectors of the economy where digital products are used, productive capacities need to evolve through the above-mentioned processes (see Chart 1). External factors also play a direct and indirect role in influencing the rate and speed at which countries manage to develop their digital economy. They can have a direct impact on digitalization prospects through more traditional forms, such as official development assistance (ODA), regional and international trade agreements, public private partnerships (PPP), FDI, and technology transfers from countries that are digitally more advanced, to name a few; and through more innovative ones, such as access to global digital platforms and data value-chains, software-based technologies, and ledger technologies, among others. Furthermore, external factors can have an indirect impact on domestic productive capacity-building and productivity changes and can have spillover effects on the remainder of the economy.

Chart 1: Digital economy and productive capacities

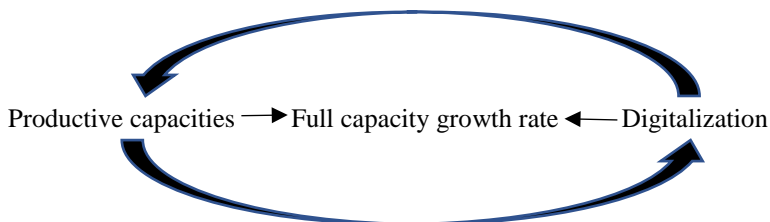


Source: Authors' elaboration.

The potential and full-capacity growth rate of an economy over time is determined by the growth and development of its productive capacities (UNCTAD, 2006). An economy's potential growth rate will not be achieved unless productive capacities

are not only created but also fully used. Digitalization, through digital platforms, mobile applications, and services, plays an important role in supporting value creation, basically by using the productive capacities at the domestic level. It further supports it through the creation of regional and international linkages and improvements in the sphere of education and science, which further contribute to the full utilization of productive capacities. This creates a virtuous circle, as illustrated in Chart 2. When productive capacities are underemployed or are being inefficiently utilized, it is possible for an increase in output to occur through shifts in resource reallocation or by inducing a higher rate of utilization of existing resources and capabilities, through digitalization. In so doing, the latter facilitate the process of economic growth directly, as well as indirectly, through its productive capacity-building effects. Similarly, when domestic productive capacities increase to their complete potential, they have a growth-enhancing effect directly, as well as indirectly, through the effects it has on digital technologies, innovation, and its related spillover effects to other non-IT sectors.

Chart 2: Virtuous circle between productive capacities development and digitalization



Source: Authors' elaboration.

3b Data and Indicators - The case of Sub-Saharan Africa

Sub-Saharan Africa is lagging relative to other more developed countries in terms of its digitalization process and the extent of its productive capacities. Although the region starts from a low level, some improvements are clearly visible. Concerning the digital economy, the number of mobile subscriptions, which was a mere 0.2 per 100 people in 1996, rose to 12 per 100 people in 2005, increased to 87.2 per 100 people in 2019. In 2000, only 0.8 percent of the population were internet users, while in 2018, the figure rose to 20.8 percent of the population, on average, and in some countries, it exceeded 55 percent (World Bank, World Development Indicators). Furthermore, pushed by COVID-19, many new companies have exponentially expanded their offers using digital technologies.

This is the case, for example, of Kenya's Twiga Foods⁴, which aggregates demand via mobile phones from thousands of roadside stalls and supplies them with higher quality products every day; of Ghana's mPharma⁵, which distributes reliable medicine through its digital supply chain; and Nigeria's Kobo⁶, which provides a matching tech platform for shippers and truck operators for long trips, among other transport and logistics services (Financial Times, 8/12/2020)⁷.

Building and maintaining the digital economy is infrastructure heavy. To work effectively, it needs reliable, efficient, and affordable electricity, as well as good transmission and distribution channels. It further needs good education and targeted training to function, as well as a skilled workforce capable of operating the related equipment and servicing and maintaining hardware and infrastructure when needed. In Sub-Saharan Africa, connectivity among existing ICT infrastructure systems is weak; the costs are high, and the quality of powerlines is not optimal (Polikanov and Abramova, 2003). Furthermore, more than two-thirds of the global population without access to electricity are based in the region (World Bank, 2016 Sustainable Energy for All⁸). With the ongoing fourth industrial revolution (4IR), Africa will need enhanced ICT infrastructure to develop its productive capacities and to enable the region to compete in global markets. This requires both capital and investment. There is a strong appetite from foreign and regional investors to invest in Sub-Saharan African energy and construction projects. According to McKinsey's estimates (2020), as much as 550 \$ billion could be deployed by international investors to finance part of Sub-Saharan Africa's infrastructure needs: 40 percent of infrastructure spending would come from Africa's own government resources, followed by development finance institutions (24 percent), and bilateral investment from China (20 percent), while private sector support would make up for the rest.⁹

According to the Infrastructure Consortium for Africa (ICA), in 2018 investments to improve the quality of African infrastructure services passed the

⁴ See on Twiga Foods: <https://twiga.com/>

⁵ See on mPharma: <https://mpharma.com/>

⁶ See on this company: <https://www.kobo360.com/NG/de/>

⁷ See "Covid is accelerating a quiet technology revolution in Africa"; for download Financial Times, December 8, 2020: <https://www.ft.com/content/8845a8fb-ae12-423b-a7c9-6cfb5c149827>

⁸ See from World Bank "Africa Far from Sustainable Energy for All, But Showing Signs of Progress", World Bank February 17, 2016; for download: <https://www.worldbank.org/en/news/feature/2016/02/17/africa-far-from-sustainable-energy-for-all-but-showing-signs-of-progress>

⁹ See: McKinsey & Company, "Solving Africa's infrastructure paradox", March 6, 2020; for download of article: <https://www.mckinsey.com/business-functions/operations/our-insights/solving-africas-infrastructure-paradox>

threshold of 100 \$ billion, with a 24 percent increase over the 2017 levels. African governments are the majority investors (37 percent), followed by China (25 percent), the ICA members (20 percent), and the private sector (12 percent). 100.8 \$ billions were invested mostly in the energy sector, while ICT investments comprised only 7 \$ billions of the total. The investments were geographically concentrated mostly in Western and Southern Africa. The biggest investor in the energy sector was China with 42 percent of total investments. In contrast, ICT investment was largely undertaken by the private sector which represented 68 percent of total investment in the sector (ICA, Infrastructure Financing Trends in Africa - 2018). There are reasons for this trend: “Despite the African infrastructure projects performing better than in other world regions in recent years thanks to the tougher selection process, the private sector still has a high-risk perception of Africa”. (OECD, 2021: 29).

Attempting to measure the extent of digitalization in Sub-Saharan Africa, several indices have been used, including the Readiness for Frontier Technologies Index (RFTI) of UNCTAD¹⁰, the Network Readiness Index (NRI) of the Portulans Institute¹¹, the Digital Opportunity Index (DOI) of the International Telecommunications Union (ITU)¹², and the Global Innovation Index (GII), produced by Cornell University¹³. Interestingly, these indicators all include the same fundamental variables, such as fixed phone or mobile phone usage, internet broadband coverage, and investments in the ICT sector.

An analysis of the above indices shows that Sub-Saharan African countries are generally confined to the bottom half of overall performance rankings. Moreover, Sub-Saharan African countries occupy more than 50 percent of the lowest 30 places in ranking tables. According to the RFTI, which shows the countries’ capacities to use, adopt and adapt frontier technologies, 25 out of 30 bottom countries are in Sub-Sahara Africa. Although, when solely looking at the ICT component of the Index, the above number decreases to 18. This is clearly a sign that Sub-Saharan African countries have a stronger ICT capacity relative to

¹⁰ See UNCTAD 2021 for this index. The remaining broad components beside of ICT deployment are skills, R&D activity, industry activity, and access to finance. See for the download of the UNCTAD “Technology And Innovation Report 2021”:

https://unctad.org/system/files/official-document/tir2020_en.pdf

¹¹ See about the NRI index: <https://networkreadinessindex.org/> and:

https://networkreadinessindex.org/wp-content/uploads/reports/nri_2021.pdf

¹² See about the DOI: <https://www.itu.int/ITU-D/ict/doi/index.html>

¹³ See about the most recent GI report:

https://www.wipo.int/global_innovation_index/en/2021/?gclid=EAlaIqobChMI5_jYgLB M9AIVcZBoCR1dhA8fEAAYASAAEGLU_D_BwE

other components of the Index, namely, skills, R&D activity, industry activity and access to finance (UNCTAD, 2021).

According to the NRI, which is composed of the technology, people, governance, and impact pillars, including contributions to the Sustainable Development Goals (SDGs), 22 Sub-Saharan African countries are found in the bottom 30 places of the ranking (Network Readiness Index 2020, Portulans Institute).

Using the DOI and the GII, the results are very similar: 25 and 17 countries in Sub-Saharan Africa are found amongst the bottom 30 places, respectively. The DOI was established in 2006 and was designed to track progress in closing the digital divide. During that year, Mauritius led Sub-Saharan Africa as the 58th ranked country globally. It was followed by Seychelles (62nd), South Africa (86th), and Botswana (100th) (ITU/UNCTAD, World Information Society Report 2007: Beyond WSIS/World Summit on the Information Society).

Interestingly, according to the GII, which ranks countries according to their innovation capacities and innovation success, Sub-Saharan Africa has the highest number of economies with above-expected performances, namely South Africa, Kenya, Malawi, Rwanda, United Republic of Tanzania, Niger, Madagascar, and Mozambique. Furthermore, eight countries have generated the expected results aligned with their level of development, including: Mauritius, Senegal, Zimbabwe, Cabo Verde, Nepal, Burkina Faso, Uganda, and Togo. Kenya holds a record of being an “innovation achiever” (p. xxiii) for 10 consecutive years, together with India, the Republic of Moldova, and Viet Nam. Kenya’s performance is driven by higher expenditure on R&D and the country’s active use of ICTs and organizational model creation. Botswana leads in education spending, and Mozambique leads in its performance as captured by the general investment indicator in the region (Cornell University et al. 2020)

Developing productive capacities in Sub-Saharan Africa is not a choice, rather it is a necessity for the region and a precondition for building resilience, diversifying their economies, and accelerating the kind of structural transformation needed for the region to reap the benefits of the Fourth Industrial Revolution (4IR). It is through building new productive capacities and fully utilizing the existing ones that governments and private agents can contribute to the digitalization of their countries. It is stated by UNCTAD: “At present, the world is characterized by a widening gap between the under-connected and the hyper-digitalized countries” (UNCTAD, 2019: xv). For example, on average, only one in five people uses the internet in the least developed countries (LDCs), the vast majority of which are placed in Africa. The average number of internet users is four times higher in developed countries. If other areas of the digital divide are considered, for example, “the capabilities for harnessing digital data and frontier technologies, the gap is considerably wider” (ibid, p. xvi). Furthermore, the basic weakness of human resources, indicated by low secondary school enrolment,

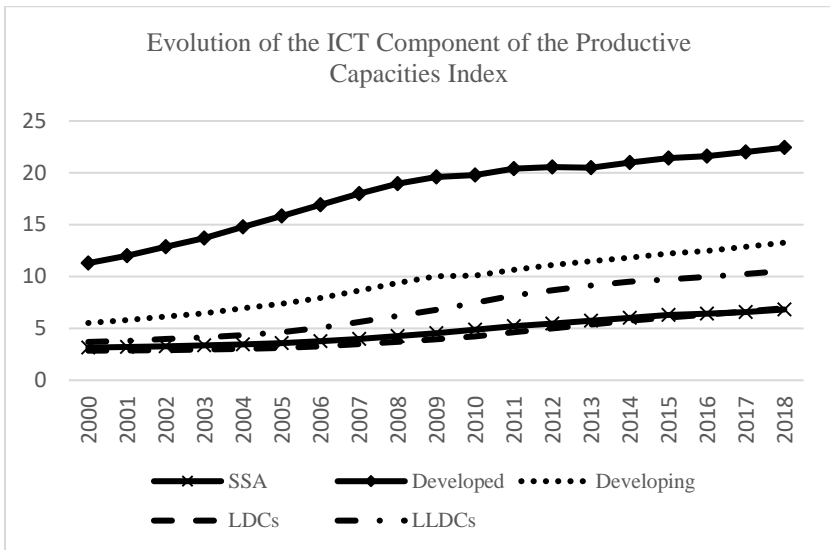
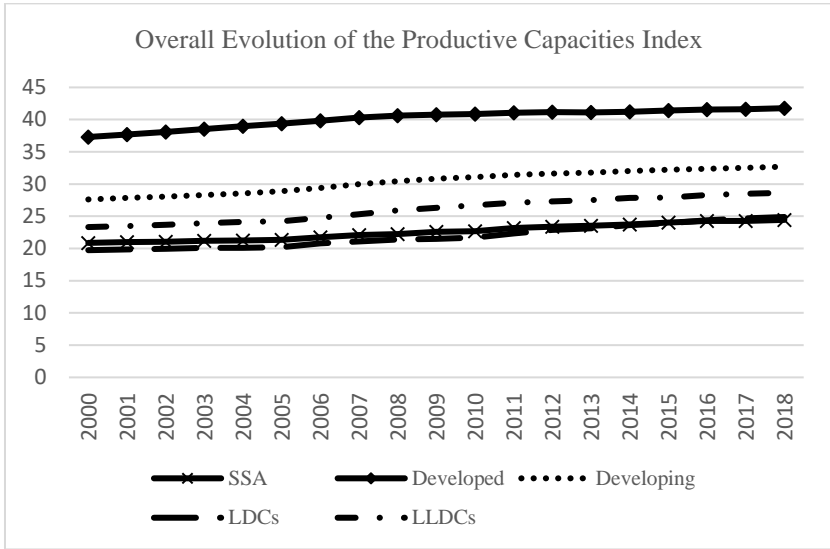
makes the social foundation for building technological capabilities unstable. According to UNESCO statistics, although Sub-Saharan Africa increased its net secondary school enrolment ratio from 20.7 percent in 2000 to 35 percent in 2018, it remains significantly below the OECD average of 89 percent.¹⁴ It is therefore vital to address and start closing these divides as soon as possible in order not to exacerbate the already high inequalities that characterize the region's development.

To measure and benchmark the status of productive capacity development in Sub-Saharan Africa, UNCTAD's Productive Capacities Index (PCI) is used. The latter is a multi-dimensional, composite index, which summarizes the state of productive capacities by computing scores that range between 0 and 100. For statistical and measurement purposes, the overall PCI index is further broken down into the following eight categories: information and communication technologies (ICTs), structural change, natural capital, human capital, energy, transport, the private sector, and institutions (UNCTAD, 2020b). In 2018, Sub-Saharan African countries had a Productive Capacities Index median score of 23.7, being below the global median of 29.1, and far below the highest value of 50.5 for the United States. When looking solely at the ICT component of the Productive Capacities Index (PCI), the above findings do not change. The global median amounts to 13, almost double the Sub-Saharan African median level of 6.2¹⁵. In Chart 3 we find the trend for PCI and the ICT component for various country groups.

¹⁴ See on the UNESCO secondary school enrolment data for Sub-Saharan Africa: <http://uis.unesco.org/sites/default/files/documents/fs37-leaving-no-one-behind-how-far-on-the-way-to-universal-primary-and-secondary-education-2016-en.pdf>, and: <http://uis.unesco.org/en/topic/education-africa>

¹⁵ The economic groups have been created according to UNCTAD's classification. For this exercise, the Sub-Saharan African region consists of 49 countries, and they have been excluded from their economic groups for this analysis. Data have been extracted from UNCTADstat.org.

Chart 3: The evolution of the PCI and of the ICT component of the PCI for various country groups



Source: UNCTAD.

The ICT scores within the region vary significantly. In 2018, Seychelles had the highest score with 17.1, while Eritrea had the lowest with 3.1. Seychelles was followed by Mauritius (16.8), South Africa (11.3), Cabo Verde (11.3), and Botswana (10.2). Taking the global median as a reference point, only two Sub-Saharan countries (Seychelles and Mauritius) have a positive difference.

3c K-means cluster analysis

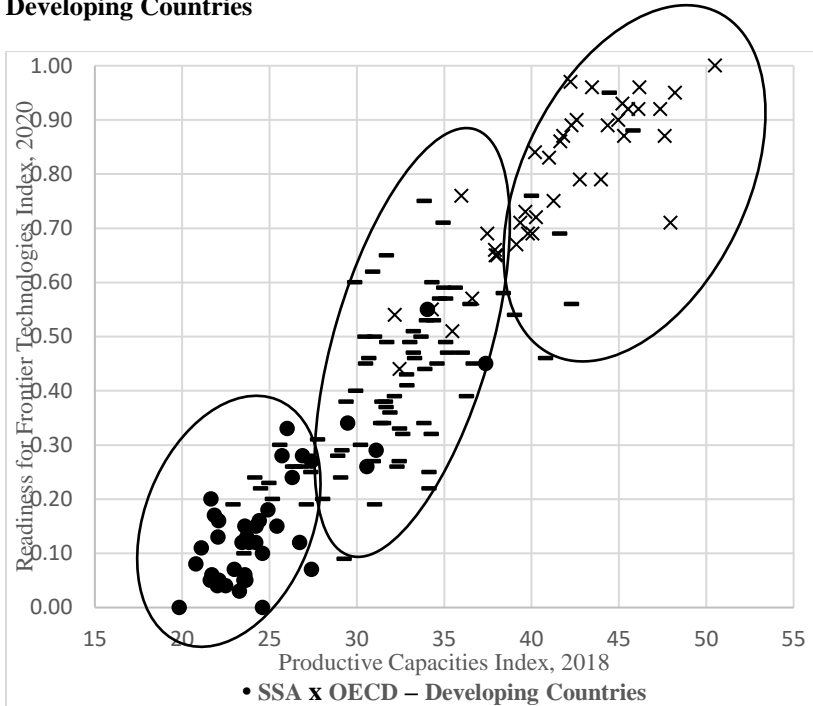
Aiming at grouping countries according to their similarity in productive capacities development, a K-means cluster analysis was run for all available economies.¹⁶ Such an analysis is used to group the observations for the 193 countries into clusters: each observation belongs to the cluster with the nearest cluster centre. To identify the optimal number of clusters, various methods can be used. As the number of variables is low, this paper has used the elbow cluster method which minimizes the within-cluster sum of square (see Annex 1 for more information on the method and on the results). The optimal number of clusters found for the PCI index is three. The first cluster is composed of 65 countries, 42 of which are Sub-Saharan African countries. This means the 65.6 percent of the first cluster consists of Sub-Saharan African countries, where Chad has the lowest value with 17.1. Seven Sub-Saharan African countries are placed in the second cluster, containing developing countries, namely Botswana, Lesotho, Namibia, Cabo Verde, South Africa, Seychelles, and Mauritius. No Sub-Saharan African country is included in the third cluster. When the same K-means cluster analysis was run for the ICT component of the PCI solely, the optimal number of three clusters was also found. As expected, 91.8 percent of the Sub-Saharan African countries belong to the first cluster, with Eritrea being the country with the lowest recorded ICT value. There are only four countries in the second cluster: Cabo Verde, South Africa, Seychelles, and Mauritius. Cabo Verde has the minimum value in this cluster with 11, while Uruguay with 19 has the highest value. This analysis has clearly shown the extent of the divide in the productive capacities stock across economies.

A third K-means cluster analysis was run simultaneously for the PCI and UNCTAD's Readiness for Frontier Technologies Index (RFTI), which shows the countries' capacities to use, adopt and adapt technologies (UNCTAD, 2021). Again, the optimal cluster number was found to be equal to three. The United States is the highest ranked country in both indices. It is followed by developed countries and developing countries of Europe, but the ranking changes across the different indices. This K-means analysis only relies on data for 158 countries, because of following the number of countries for which the Readiness for Frontier

¹⁶ See as an introduction to the K-means cluster analysis: https://uc-r.github.io/kmeans_clustering

Technologies Index is available. When plotted, a linear relationship seems apparent from Chart 4. Clearly, those countries with a low PCI score have a low RFTI performance, while those with a high PCI score also have a high RFTI value. Unsurprisingly, Sub-Saharan African countries are mostly found in the first cluster in the bottom left corner, which is composed of countries with low PCI and low RFTI values.

Chart 4: PCI and RFTI variables in Sub-Saharan Africa, OECD, and Developing Countries



Source: Authors' calculations. Note: the circles represent the three groupings.

4 Empirical Analysis

To examine the relationship between digitalization and productive capacities three fixed effects models¹⁷ were developed over the period 2000 to 2018. The first two

¹⁷ Hausmann Tests, calculated for the three models, confirm that fixed effects models are appropriate for the analysis, with χ^2 results significant at 1 percent.

models attempt to examine the possible effect that productive capacities, and other variables, have on digitalization in 49 Sub-Saharan African countries. Although the analysis of a causal relationship is beyond the scope of this paper, the third model attempts to look at the possible effect of digitalization on productive capacities. While productive capacities are proxied by UNCTAD's PCI, measuring digitalization is difficult as the impact from the use of digital technologies may also result from spillover effects (UNCTAD, 2019). As mobile phones in Africa are widely used as means of trade (i.e., mobile money is a popular way of payment) and the share of internet users is a globally accepted measurement of digitalization (UNCTAD, 2020a), this paper uses both the above variables as proxies for digitalization. Other variables could have been considered, but data availability has seriously restricted the choice at disposal. The variables used, however, match those found in the literature on this topic in Africa.

The specification for the first two models is as follows, where β are the coefficients, c are the countries, t is the time, δ captures the fixed effects and ε is the error term

$$Digital_{c,t} = \alpha + \beta_1 PCI_{c,t} + \beta_2 Open_{c,t} + \beta_3 Edu_{c,t} + \beta_4 Elect_{c,t} + \beta_5 FDI_{c,t} \\ + \beta_6 YUE_{c,t} + \beta_7 PopU_{c,t} + \beta_8 Pop_{c,t} + \delta_c + \varepsilon$$

Digital is proxied by the number of mobile subscriptions per 100 habitants in the first model, and by the internet user percentage in the population in the second model. As discussed in section 2, the remaining independent variables are: trade openness as a percentage of GDP (*Open*), secondary education enrolment rate (*Edu*), access to electricity (*Elect*), FDI flows as percentage of GDP (*FDI*), youth unemployment rate (*YUE*), urban population share (*PopU*), and adult population share (*Pop*). Differently from the younger share of the population, who tends to use mobile phones and internet connectivity for consumption purposes, the share of the population aged between 25 and 40 (*Pop*) is assumed to be more prone to use digital technologies for productive purposes. The empirical analysis covers 49 Sub-Saharan African countries. The details and limitations regarding the variables can be found in Annex 2.

As shown in table 1, the elasticity of the PCI is positive and highly significant. A 10 percent increase in the PCI would lead to a 73 percent increase in mobile subscriptions and to 23 percent increase in the number of internet users. These results provide some supporting evidence to the theoretical relationship developed in section 2. The development of productive capacities is key to support the domestic digitalization process in Sub-Saharan Africa, starting from the

development of its core components through to the digitalization of other sectors of the economy.¹⁸

Furthermore, trade openness, secondary education and electricity have positive elasticities, as expected, although only the electricity variable is statistically significant. A 10 percent increase in electricity access would lead to a 7 percent increase in mobile subscriptions and a 3 percent increase in the share of internet users. Although these may seem like small numbers, they are not negligible. The implications of these findings, when considered at a population level, is particularly important for public policy guidance, given the population dynamics in Sub-Saharan Africa (including the already large and growing young population) and the role that the digital economy is expected to continue to play in the global system. They provide a clear indication of the importance of having good basic infrastructure at the national level to further support the digitalization process.

The elasticity for the FDI variable is insignificant¹⁹. This could have been expected as the share of the ICT sector in the FDI inflows is only 7 percent in the region (The Infrastructure Consortium for Africa, 2018). Sundaram et al. (2011) argue that FDI generally flows to the mining sector in Africa and hardly influences the development of activities in other sectors.

When we look at the youth unemployment variable, as expected, the elasticity is negative, but it is only significant in relation to the number of mobile subscriptions. A 10 percent increase in the share of youth unemployment decreases the number of mobile subscriptions by 10.3 percent. The elasticities for the adult population and for the urban share of the population are both positive and statistically significant. A 10 percent increase in the urban population would lead to a 38 percent increase in mobile subscriptions and an 8 percent rise in the share of internet users. A 10 percent increase in the share of the population between 25 and 40 years leads to a 40 percent increase in mobile subscriptions and a 12 percent rise in the share of internet users.

¹⁸ A collinearity exercise has been carried out between the variables used in the models. For the fixed effects models, correlation matrices of coefficients have been studied and can be supplied upon request. The matrices generally show low values for the correlations between the coefficients. It needs to be mentioned that all correlations are below the 0.6 multicollinearity threshold (Allison, 1998: 114). A full description of the variables and data availability considerations are discussed in Annex 2. Sensitivity analyses have been made to check the robustness of the results (see Annex 3 for the results).

¹⁹ A lagged FDI variable was also included in the models (not shown), but the coefficients remain statistically insignificant.

Table 1: Fixed Effects Results

	Mobile Subscriptions	Internet Users
PCI	7.301 (8.22)**	2.274 (5.66)**
Open	0.083 (1.65)	0.024 (1.79)
Edu	0.238 (1.75)	0.070 (0.94)
Elect	0.710 (3.79)**	0.322 (4.19)**
FDI	0.008 (0.09)	-0.084 (1.95)
YUE	-1.034 (3.29)**	-0.021 (0.16)
PopU	3.820 (7.05)**	0.757 (3.43)**
Pop	4.041 (3.68)**	1.161 (2.02)*
Constant	-396.106 (14.40)**	-103.910 (6.92)**
R ²	0.78	0.53
N	410	407
F test	F(8,364)=162.26 Prob > F =0.0000	F(8,374)=62.37 Prob > F =0.0000
F test that all u _i =0	F(37,364)=34.58 Prob > F =0.0000	F(38,374)=10.43 Prob > F =0.0000

* p < 0.05; ** p < 0.01

Source: Authors' calculations

To test the hypothesis that building productive capacities has a growth-enhancing effect on digitalization, as discussed in section 2, a third fixed effect model is constructed, as follows:

$$\begin{aligned} ProdCap_{t,c} = & \alpha + \beta_1 Digit_{t,c} + \beta_2 ICTServ_{t,c} + \beta_3 Edu_{t,c} + \beta_4 GVC_{t,c} \\ & + \beta_5 FDI_{t,c} + \beta_6 Open_{t,c} + \beta_7 Innov_{t,c} + \beta_8 MobComp_{t,c} + \delta_c \\ & + \varepsilon \end{aligned}$$

The productive capacity (*ProdCap*) variable has been proxied by UNCTAD's PCI. As before, the *Digit* variable is proxied by the number of mobile subscriptions (*MobSubs*) and by the share of internet users. *ICTServ* represents the share of ICT services exports as a percentage of total services exports. Furthermore, global value chain (*GVC*) participation, innovation (*Innov*), and mobile competition (*MobComp*) have been included as independent variables. The latter shows if there is competition in the mobile service suppliers' market. The variable takes the value of 0 if there is a monopoly, 1 if there is a duopoly, 2 if there is partial competition, and 4 if there is full competition. Details on the variables can be found in Annex 2. Table 2 summarizes the results of the model. As the dependent variable is a multidimensional index, only the sign and the statistical significance of the elasticities are examined.

The first column of table 2 contains the elasticities of the two proxies for digitalization. As expected, the elasticities for both mobile subscriptions and internet users are both positive and highly significant. These results, combined with those of table 1, reinforce the idea developed in section 2 of a virtuous circle between digitalization and productive capacities building at the domestic level, which would in turn fuel the full-capacity growth rate at the domestic level.

The existence of competition in the mobile market does not seem to significantly affect the PCI, and so being not unsimilar to the share of ICT services exports. FDI flows and openness to trade, although positive, do not seem to significantly affect the process of productive capacity building either. On the other hand, as expected, the elasticity for secondary school enrolment is positive and statistically significant. Interestingly, the innovation elasticity is positive, as expected, but statistically insignificant. This finding may simply reflect the current technological backwardness of most of African countries.

The elasticity on participation in a global value chain is surprisingly negative and significant in Sub-Saharan Africa. It was expected that greater GVC participation could bring knowledge and technology spillovers, as well as higher productivity levels and possible investment, which would have positively affected the development of domestic productive capacities. One possible reason for this negative coefficient could be due to the high forward participation rate of Sub-Saharan African countries in GVCs. The effect of backward participation is positive on productivity and diversification in the economy. However, the effect

of the forward participation depends on the type of processes and sectors considered. A GVC in research and design would probably have positive, productivity-enhancing effects, whereas a high level of participation in upstream processes with raw material and unprocessed agricultural exports could lead to lower or negative effects in the productivity of the economy (Conde et al., 2015) and on its productive capacities. According to recent research by (de Melo and Twum, 2021), Africa is participating generally in the GVCs related to fuel, mineral resources, and agriculture, although their share is also increasing in transport equipment and wholesale trade.

Table 2: Fixed Effects Results

	Prodcap	Prodcap	Prodcap
MobSubs	0.028 (17.45)**	0.017 (6.07)**	0.003 (0.70)
InternetUsers	0.029 (4.68)**	0.018 (2.16)*	0.047 (4.01)**
MobComp		0.085 (0.81)	0.202 (1.30)
ICTServ		-0.002 (0.69)	-0.002 (0.60)
Edu		0.053 (6.20)**	0.031 (2.05)*
GVC		-0.044 (5.03)**	-0.032 (3.25)**
FDI		0.012 (1.38)	0.015 (0.69)
Open		-0.003 (0.70)	0.007 (0.98)
Innov			0.406 (1.23)
Constant	21.040 (409.87)**	21.940 (32.72)**	21.584 (14.91)**
R ²	0.66	0.67	0.50

N	740	298	171
F test	F(2,698)=670.19 Prob > F =0.0000	F(8,262)=65.18 Prob > F =0.0000	F(9,139)=15.18 Prob > F =0.0000
F test that all $u_i=0$	F(39,698)=200.9 7 Prob > F =0.0000	F(27,262)=74.5 0 Prob > F =0.0000	F(22,139)=35.9 3 Prob > F =0.0000

* $p < 0.05$; ** $p < 0.01$

Source: Authors' calculations

5 Conclusions and Policy Recommendations

This paper has developed a novel theoretical framework on the relationship between productive capacities and the digitalization process, applying it to the case of Sub-Saharan Africa. Although the analysis of a causal relationship was beyond the scope of this study, the empirical analysis has shown that an increase in productive capacities would support the improvement of digitalization levels in Sub-Saharan African countries. The results of the three fixed effects models applied to a sample of 49 SSA countries confirm the positive relationship between digitalization (as proxied by mobile phone usage and the share of internet users) and productive capacities, which are captured by the UNCTAD Productive Capacities Index (PCI). This follows the expected results developed in the paper's theoretical model. The first two specifications reveal that a 10 percent increase in the PCI would lead to a 73 percent increase in mobile subscriptions and to a 23 percent increase in the number of internet users, respectively. The hypothesis that building productive capacities has a growth-enhancing effect on digitalization is tested in the application of the third fixed effects model. In that case, mobile phone subscriptions, internet usage, and secondary enrolment all have a positive and statistically significant effect on the level of productive capacities. The analysis contained herein has further shown that an improvement in digitalization is positively and significantly linked to enhancements in productive capacities, in a virtuous circle. To the authors' best knowledge, this relationship has not before been theoretically defined or empirically tested.

To jumpstart the process of structural transformation based on digital technologies, Sub-Saharan African countries should focus on the holistic and multi-dimensional aspects of their productive capacity development. In turn, policies to support this process can be viewed as part of a new generation of more inclusive and sustainable approaches to industrial policy formulation and implementation. This includes efforts at macro, meso, and micro-levels to

strengthen human capital through education and training, boost innovation, enhance research and development, facilitate access to financing, and improve other building blocks being necessary to diversify into and to compete in new activities.

New technologies and the advancement of digitalization may enable Sub-Saharan Africa to leapfrog stages of industrialization. While this could be beneficial per se, governments need to be wary of the social repercussions and anticipate eventual rises in digitalization-driven inequality. A future extension of the research underlying the paper could consider how the domestic digital strategies, if available, play a role in affecting the development of national productive capacities. This is likely to be important as countries adopt the African Union's Digital Transformation Strategy for Africa (2020-2030). The latter recognizes the unique economic development opportunities that digitalization can foster across virtually every economic sector from industry, trade, and financial services to education, health, and agriculture. From a policy perspective, the African Union's approach clearly articulates the need for a common, coordinated response built on solidarity and action at various regional, national, and local levels. This cooperation, including with development partners, the private sector in Africa, local and foreign investors, and with civil society, is needed to reap the benefits of digitalization and the fourth industrial revolution (4IR), and share them with Africa's growing population in an inclusive and sustainable manner. The strategy, however, is silent on the critical investments and action programmes needed to ensure that the entire continent is well-equipped with the pre-requisite infrastructure, skills, and training to make the necessary digital linkages and to ensure the safe, secure, and affordable access to and the use of digital technologies, both for consumption and productive economic uses. Governments should target policies aimed at creating a reliable, professional, and geographically representative skilled maintenance workforce for digital infrastructure. In addition, an integrated and comprehensive plan as well as a roadmap for linking digitalization with the aspects of productive capacities is needed in the African Union strategy. This is a critical missing piece as productive capacities are the drivers of long-term inclusive growth and key contributor to the digitalization process.

References

- Allison, P. (1998). *Multiple Regression, A Primer*. SAGE Publications, Inc.
- Aly, H. (2020). Digital transformation, development and productivity in developing countries: is artificial intelligence a curse or a blessing?. In: *Review Of Economics And Political Science*, ahead-of-print(ahead-of-print. doi: 10.1108/rep-11-2019-0145

- African Union Commission (AUC)/Organization for Economic Cooperation and Development (OECD) (2021). *Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs*, AUC, Addis Ababa/OECD Publishing, Paris, <https://doi.org/10.1787/0a5c9314-en>.
- Archibugi, D., Denni, M., & Filippetti, A. (2009). The technological capabilities of nations: The state of the art of synthetic indicators. In: *Technological Forecasting And Social Change*, 76(7), 917-931. doi: 10.1016/j.techfore.2009.01.002
- Asongu, S., & Odhiambo, N. (2019). Foreign Direct Investment, Information Technology and Economic Growth Dynamics in Sub-Saharan Africa. In: *Telecommunications Policy*, 44(1). doi: 10.2139/ssrn.3417047
- Azu, N. P., Jelivov, G., Aras, O. & Isik, A. (2020). "Influence of digital economy on youth unemployment in West Africa." In: *Transnational Corporations Review*, 13:1, 32-42, DOI: 10.1080/19186444.2020.1849936.
- Blignaut, P. (2009). A Bilateral Perspective on the Digital Divide in South Africa. In: *Perspectives On Global Development And Technology*, 8(4), 581-601. doi: 10.1163/156915009x12583611836091
- Brennen, S. & Kreiss, D. (2014) Digitalization and digitalization. In: *Culture Digitally*, 8. <https://culturedigitally.org/2014/09/digitalization-and-digitization/>
- Conde, C., Heinrigs, P., & O'Sullivan, A. (2015). *Tapping the Potential of Global Value Chains for Africa* (pp. 71-85). Geneva: The World Economic Forum.
- Cornell University, INSEAD & the World Intellectual Property Organization (WIPO). (2020). *Global Innovation Index - Who Will Finance Innovation?* Ithaca, Fontainebleau, and Geneva.
- de Melo, J., & Twum, A. (2021). Prospects and Challenges for Supply Chain Trade under the Africa Continental Free Trade Area (AfCFTA). In: *Journal Of African Trade*. doi: 10.2991/jat.k.210105.001
- Donou-Adonsou, F. (2018). Technology, education, and economic growth in Sub-Saharan Africa. *Telecommunications Policy*, 43(4), 353-360. doi: 10.1016/j.telpol.2018.08.005
- Financial Times (FT), 8/12/2020, "Covid is accelerating a quiet technology revolution in Africa"; for download *Financial Times*, December 8, 2020: <https://www.ft.com/content/8845a8fb-ae12-423b-a7c9-6cfb5c149827>
- Fuchs, C., & Horak, E. (2006). Africa and the digital divide. In: *Telematics And Informatics*, 25(2), 99-116. doi: 10.1016/j.tele.2006.06.004
- Gerhan, D., & Mutula, S. (2010). Testing a recent model of ICT in development: Botswana and its university. In: *Information Technology For Development*, 13(2), 177-197. doi: 10.1002/itdj.20060
- The Infrastructure Consortium for Africa (ICA) Secretariat c/o African Development Bank. (2018). *Infrastructure Financing Trends in Africa – 2018*. Abidjan, Côte d'Ivoire.
- International Labour Organization (ILO). (2020). *Global Employment Trends for Youth 2020: Technology and the future of jobs*. International Labour Office – Geneva: ILO, 2020.

- International Telecommunication Union (ITU) & United Nations Conference on Trade and Development (UNCTAD). (2007). World Information Society Report: Beyond WSIS (World Summit on the Information Society).
- Kabbani, Nader (2021). "How Will Digitalisation Affect Youth Employment in Mena?" Washington, D.C.: Brookings Institute. <https://www.brookings.edu/opinions/how-will-digitalization-affect-youth-employment-in-mena/>.
- Khayyat, N., & Lee, J. (2015). A measure of technological capabilities for developing countries. In: *Technological Forecasting And Social Change*, 92, 210-223. doi: 10.1016/j.techfore.2014.09.003
- Kyem, P., & LeMaire, P. (2006). Transforming Recent Gains in the Digital Divide into Digital Opportunities: Africa and the Boom in Mobile Phone Subscription. In: *The Electronic Journal Of Information Systems In Developing Countries*, 28(1), 1-16. doi: 10.1002/j.1681-4835.2006.tb00189.x
- Makles, A. (2012). Stata Tip 110: How to Get the Optimal K-Means Cluster Solution. In: *The Stata Journal: Promoting Communications On Statistics And Stata*, 12(2), 347-351. doi: 10.1177/1536867x1201200213
- McKinsey & Company (2020). "Solving Africa's infrastructure paradox", March 6, 2020; for download of article: <https://www.mckinsey.com/business-functions/operations/our-insights/solving-africas-infrastructure-paradox>
- Mergel, I., Edelman, N., & Haug, N. (2019). Defining digital transformation: Results from expert interviews. In: *Government Information Quarterly*, 36(4), 101385. doi: 10.1016/j.giq.2019.06.002
- Organisation for Economic Co-operation and Development (OECD). (2021). Improving public finance, boosting infrastructure. In: *Summit on Financing African Economies*. Paris, May 2021. Download of Background Paper: https://www.oecd.org/dev/africa/Financing-Summit-for-Africa_Background-paper.pdf
- Oughton, E. (2021). Policy options for digital infrastructure strategies: A simulation model for broadband universal service in Africa. Cornell University.
- Polikanov, D., & Abramova, I. (2003). Africa and ICT: A Chance for Breakthrough?. In: *Information, Communication & Society*, 6(1), 42-56. doi: 10.1080/1369118032000068778
- Porter, G., Hampshire, K., de Lannoy, A., Bango, A., Munthali, A., Robson, E., Tanle, A., Abane, A., and Owusu, S. (2018). "Youth Livelihoods in the Cellphone Era: Perspectives from Urban Africa". In: *J. Int. Dev.*, 30: 539– 558. doi: 10.1002/jid.3340.
- Portulans Institute. (2020). *The Network Readiness Index - Accelerating Digital Transformation in a post-COVID Global Economy*.
- Ritter, T., & Pedersen, C. (2019). Digitization capability and the digitalization of business models in business-to-business firms: Past, present, and future. In: *Industrial Marketing Management*, 86, 180-190. doi: 10.1016/j.indmarman.2019.11.019
- Sarkar, A., Pick, J., & Johnson, J. (2015). Africa's digital divide: Geography, policy, and implications. In: *2015 Regional Conference of the International Telecommunications*

- Society (ITS): "The Intelligent World: Realizing Hopes, Overcoming Challenges". Calgary: International Telecommunications Society (ITS).
- Schallmo, D., Williams, C., & Boardman, L. (2017). Digital Transformation of Business Models — Best Practice, Enablers, and Roadmap. In: *International Journal of Innovation Management*, 21(08), 1740014. doi: 10.1142/s136391961740014x
- Solomon, E., & van Klyton, A. (2020). The impact of digital technology usage on economic growth in Africa. In: *Utilities Policy*, 67, 101104. doi: 10.1016/j.jup.2020.101104
- Srinuan, C., & Bohlin, E. (2011). Understanding the digital divide: A literature survey and ways forward. In: 22nd European Regional Conference of the International Telecommunications Society (ITS 2011). Budapest.
- Sundaram, J., Schwank, O., & von Arnim, R. (2011). Globalization and development in Sub-Saharan Africa. DESA Working Paper No. 102, ST/ESA/2011/DWP/102, February 2011. For Download: https://www.un.org/esa/desa/papers/2011/wp102_2011.pdf
- United Nations Conference on Trade and Development (UNCTAD). (2006). The Least Developed Countries Report 2006 – Developing Productive Capacities. Geneva: United Nations. https://unctad.org/system/files/official-document/ldc2006_en.pdf
- United Nations Conference on Trade and Development (UNCTAD). (2019). Digital Economy Report. Value Creation and Capture: Implications for developing countries. Geneva: United Nations.
- United Nations Conference on Trade and Development (UNCTAD). (2020a). The Least Developed Countries Report 2020 - Productive Capacities for the New Decade. Geneva: United Nations.
- United Nations Conference on Trade and Development (UNCTAD) (2020b) Productive Capacities Index: Methodological Approach and Results.
- United Nations Conference on Trade and Development (UNCTAD). (2021). Technology and Innovation Report 2021- Catching technological waves: Innovation with equity. United Nations Publications.
- United Nations Conference on Trade and Development (UNCTAD) (2006). The Least Developed Countries Report: Developing Productive Capacities. Geneva: United Nations. <https://unctad.org/webflyer/least-developed-countries-report-2006>.
- United Nations Conference on Trade and Development (UNCTAD) Statistics: UNCTADstat.org (<https://unctadstat.unctad.org/EN/>)
- United Nations Educational, Scientific and Cultural Organization (UNESCO), Education in Africa, UNESCO and UNESCO Institute for Statistics (UIS), Paris. Download: <http://uis.unesco.org/en/topic/education-africa>
- Verhoef, P., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2019). Digital transformation: A multidisciplinary reflection and research agenda. In: *Journal Of Business Research*, 122, 889-901. doi: 10.1016/j.jbusres.2019.09.022
- World Bank, World Development Indicators, Washington D.C.

- World Bank. (2020). World Development Report 2020: Trading for Development in the Age of Global Value Chains. Washington, D.C.: World Bank. Download from <https://www.worldbank.org/en/publication/wdr2020/brief/world-development-report-2020-data>
- World Bank (2016), Sustainable Energy for All (SE4ALL) initiative of the United Nations. “Africa Far from Sustainable Energy for All, But Showing Signs of Progress”, World Bank February 17, 2016; see for download: <https://www.worldbank.org/en/news/feature/2016/02/17/africa-far-from-sustainable-energy-for-all-but-showing-signs-of-progress>
- World Economic Forum (2019). The Global Competitiveness Report 2019. Geneva, Switzerland. Download from: https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

Annex 1: The Cluster Analysis

To identify the appropriate number of clusters, the elbow method is used. For 10 values, the k clustering algorithm has been calculated, $k \in (1,10)$. Then, for each k, the within cluster sum of square (WSS) is calculated. A scree plot is created with the WSS values, according to the number of clusters. The optimal k value corresponds to the point where there is a kink in the curve. Using the matrix of WSS values, the k number with the highest difference between two groups before the differences diminish is taken as the optimal number (Makles A., 2012). As can be observed from table A.1, after the clustering group 3 the difference decreases slower with each additional group. This signifies that adding an additional group to the analysis will not improve the result. It follows that the optimal K is equal to 3.

Three separate cluster analyses have been studied to show the place of Sub-Saharan African countries in the areas of productive capacities, ICT, and frontier technologies. The first analysis uses only the PCI variables, while the second analysis looks at its ICT component solely. The third analysis shows the location of the African countries, in relation to the rest of the world, by using both the PCI variable and the RFTI variable together.

The first cluster is composed of 65 countries, where Chad has the lowest value with 17.1 and Honduras has the highest value, 28.0. The mean equals 24 and the standard deviation is 2.5. This is the cluster that typically includes the low-income countries. The second cluster is composed of 87 developing countries. Guatemala has the minimum value with 28.9, and Slovakia has the maximum value with 37. The central point of this cluster is 33, where the standard variation is 2.3. Lastly, the third cluster, which consists of generally developed countries, has 44 members. The United States have the highest value (50.5) and Greece has the lowest value (37.9), while the standard deviation is 3.2.

When carrying out the cluster analysis when taking account of the ICT variable, 3 clusters of 86, 70 and 39 members have been created. Eritrea has the lowest value in the first cluster with 3.1, and Morocco has the highest value with 10.7, where the standard deviation is 1.9. The second cluster also starts with a Sub-Saharan country, namely Cabo Verde with 11. Uruguay has the highest value in this cluster with 19, and the standard deviation of the cluster is 2.3. The third cluster has a standard deviation of 4.1, where the United Arab Emirates have the lowest value (19.7) and Bermuda has the highest value (36.1). For both analyses the standard deviation of the third cluster is slightly higher. This is potentially explained by the wide distribution of the developed countries' PCI and ICT values caused by differentiation.

Table A.1: Matrices of WSS (within cluster sum of square)

Clustering PCI		Clustering ICT		Clustering PCI & RFTI	
k	WSS	k	WSS	k	WSS
1	156.7854	1	154.3985	1	312.7854
2	56.9748	2	62.9748	2	104.0057
3	21.2741	3	31.3276	3	45.6368
4	14.7718	4	25.0141	4	31.1202
5	12.7481	5	27.8607	5	23.1928
6	9.7694	6	22.6776	6	18.2765
7	8.6622	7	19.4047	7	16.6755
8	8.0888	8	19.4138	8	16.5644
9	7.6410	9	19.0882	9	14.1691
10	7.6625	10	19.9922	10	12.7944

Annex 2: The Variables

The dataset consists of 49 Sub-Saharan African countries. The observations of the variables belong to the period from 2000 to 2018. However, some datapoints remain unavailable for some indicators across various countries and years. Mobile subscription data are lacking for Comoros, Djibouti, Mauritania, Somalia, and Sudan. Internet users' data are unavailable for Botswana, Cabo Verde, Central African Republic, Chad, Mozambique, and Nigeria. Mobile and International Mobile Telecommunications (IMT) competition data are unavailable for Comoros, Djibouti, Mauritania, Somalia, and Sudan. Cote d'Ivoire also lacks IMT competition data. GVC participation observations are unavailable for Comoros, Guinea-Bissau, Equatorial Guinea, Sao Tome and Principe, and Senegal. Innovation has a shorter period of observation and lacks data for 12 countries, namely Comoros, Central African Republic, Congo, Djibouti, Equatorial Guinea, Eritrea, Togo, Niger, Sao Tome and Principe, South Sudan, and Sudan. The variable for ICT service exports also lacks information for Eritrea, Ghana, Central African Republic, Chad, Equatorial Guinea, Liberia, and Somalia. FDI observations of Central African Republic and Somalia are unavailable. Trade openness observations of Eritrea and secondary education observations of Zambia are unavailable.

The Innovation variable utilized is drawn from the Global Competitiveness Index of the World Economic Forum (WEF). To calculate the variable, the WEF

uses 7 components including capacity for innovation, quality of scientific research institutions, and company spending on R&D. However, the index only contains data from 2008 to 2018, which limits the extent of the analysis when used.

In addition to data unavailability for certain countries, some observations are missing for some variables. If the missing values are between two variables, an average of the closest values have been taken. If the missing values are at the end of the period, the last value is taken for the remaining years.

Table A.2: Variable definition and summary statistics

Variable	Obs.	Mean	St. Dev.	Period	Source
PCI	913	22.58	4.28	2000-18	UNCTAD
Productive Capacities Index					
Mobile Subscriptions	826	43.78	42.25	2000-18	ITU
Mobile cellular subscriptions per 100 habitants					
Internet Users	838	8.20	11.71	2000-18	World Bank
Internet Users (% of total population)					
Trade Openness	654	76.24	44.11	2000-18	UNCTAD
Trade Openness as percentage of GDP (goods and services)					
Secondary Education	692	43.12	22.46	2000-18	World Bank
Secondary School Enrolment (% gross)					
Electricity	881	37.07	225.37	2000-18	World Bank
Access to electricity (% of total population)					
FDI	870	4.87	8.56	2000-18	World Bank
Foreign Direct Investment (% of GDP)					
Youth Unemployment	912	14.97	13.26	2000-18	World Bank
Youth unemployment rate (percentage in population aged between 15-25)					
Urban Population	919	62.10	6.21	2000-18	UNCTAD
Population living in urban areas (% of population)					
Adult Population	919	19.78	2.31	2000-18	UNCTAD
Population of citizens aged between 25 and 40 as % total population					
ICT Service Exports	699	9.18	18.89	2000-18	World Bank
ICT service exports (% of total service exports)					
GVC Participation	836	48.40	79.39	2000-18	World Bank
Global Value Chain participation rate					
Innovation	336	2.94	0.36	2008-18	WEF
Innovation component of the Global Competitiveness Index					

Annex 3: The Sensitivity Analyses

For sensitivity analyses, the one-at-a-time method is used in this study. One variable is taken out at a time, and changes have been monitored. In the last columns, the competition variables of the dependent variables have been added to see if there is a change.

There are small changes in the magnitude of the coefficients. In tables A.3 and A.4, PCI generally have higher values. The trade openness coefficient has also values being higher than its initial value. In the model with mobile subscriptions as dependent variable, it is lower when electricity, FDI and PCI are excluded. Secondary education's coefficient is generally around its initial value. It is higher when in the model with mobile subscriptions the population, trade and PCI variables are excluded. The electricity coefficient is lower when trade and PCI variables are excluded in the model with mobile subscriptions and generally in the model with internet users. FDI's coefficient is negative when population variables are excluded in the model with mobile subscriptions. When the mobile competition variable is added to the model, it has a coefficient equal to -0.954, which is not statistically significant. The other coefficient values are almost the same. On the other hand, the competition variable in the model with internet users has a coefficient value of 2.966, which is statistically significant.

When looking at the sensitivity analysis of the model with PCI as a dependent variable, reported in table A.5, the mobile subscriptions variable has the highest coefficient values when innovation and internet users' variables are excluded. The internet users' variable has around the initial high coefficients as in the original models. The mobile competition's coefficient becomes negative when the internet users' variable is excluded. The education variable has the highest effect when the innovation variable is excluded and the lowest effect when the ICT service exports variable is excluded. On the other hand, GVC participation is positive when secondary education is excluded. A negative relation can be seen between them from the correlation matrix, although it is not high to affect the analysis. FDI's coefficient is close to zero when the internet users' variable is excluded, and the trade openness variable has negative coefficients when innovation and education variables are excluded. Although innovation has the highest coefficients, they are not statistically significant. As in the studied models, internet users, education and GVC participation have statistically significant models for all the model specifications.

Table A.3: Sensitivity Analysis of the Model with Mobile Subscriptions

	Mobile Subs.	Mobile Subs.	Mobile Subs.	Mobile Subs.	Mobile Subs.	Mobile Subs.
PCI	6.933	9.210	7.083	7.300	8.251	7.179
	(7.73)**	(10.02)**	(7.57)**	(8.47)**	(9.68)**	(8.04)**
Trade Openness	0.087	0.083	0.134	0.079	0.054	0.088
	(1.69)	(1.51)	(2.64)**	(1.63)	(1.10)	(1.72)
Secondary Education	0.388	0.674	0.295	0.243	0.211	0.255
	(2.94)**	(5.05)**	(2.07)*	(1.82)	(1.54)	(1.85)
Electricity	0.962	1.353	0.977	0.707		0.682
	(5.43)**	(7.49)**	(5.16)**	(3.86)**		(3.59)**
FDI	-0.006	-0.079	0.021		0.026	0.008
	(0.06)	(0.77)	(0.22)		(0.27)	(0.09)
Youth Unemployment	-0.849	-0.428		-1.026	-1.357	-1.094
	(2.69)**	(1.30)		(3.32)**	(4.44)**	(3.42)**
Urban Population	4.350		4.526	4.430	5.429	4.654
	(7.45)**		(7.74)**	(7.90)**	(10.38)**	(7.83)**
Adult Population		3.613	0.868	4.086	5.560	4.067
		(3.06)**	(0.82)	(3.88)**	(5.37)**	(3.69)**
Mobile Competition						-0.954
						(0.56)
Constant	-322.738	-310.523	-367.631	-394.810	-452.002	-397.983
	(16.73)**	(11.43)**	(12.82)**	(14.66)**	(19.46)**	(14.17)**
R ²	0.77	0.74	0.76	0.78	0.77	0.78
N	410	410	424	424	415	407
* p < 0.05; ** p < 0.01						

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	Mobile Subs.	Mobile Subs.	Mobile Subs.	Mobile Subs.
PCI	9.409	8.235		7.179
	(12.06)**	(9.87)**		(8.04)**
Trade Openness	0.153		0.079	0.088
	(3.55)**		(1.43)	(1.72)
Secondary Education		0.432	0.517	0.255
		(3.42)**	(3.61)**	(1.85)
Electricity	0.452	1.072	1.155	0.682
	(2.98)**	(6.43)**	(5.93)**	(3.59)**
FDI	0.068	0.005	0.113	0.008
	(0.76)	(0.05)	(1.09)	(0.09)
Youth Unemployment	-0.975	-1.202	-0.995	-1.094
	(3.38)**	(4.27)**	(2.91)**	(3.42)**
Urban Population	4.540	2.681	5.768	4.654
	(9.86)**	(6.26)**	(9.60)**	(7.83)**
Adult Population	6.269	0.739	3.023	4.067
	(6.39)**	(0.88)	(2.55)*	(3.69)**
Mobile Competition				-0.954
				(0.56)
Constant	-482.970	-297.367	-288.681	-397.983
	(23.27)**	(13.53)**	(10.96)**	(14.17)**
R ²	0.78	0.79	0.74	0.78
N	545	549	410	407
* p < 0.05; ** p < 0.01				

Table A.4: Sensitivity Analysis of the Model with Internet Users

	Internet Users	Internet Users	Internet Users	Internet Users	Internet Users
PCI	2.249	2.378	2.284	2.161	2.670
	(5.58)**	(5.94)**	(5.68)**	(5.52)**	(6.89)**
Trade Openness	0.132	0.160	0.086	0.070	0.050
	(1.94)	(2.59)**	(1.15)	(0.95)	(0.67)
Secondary Education	0.028	0.021	0.035	0.028	0.017
	(2.10)*	(1.52)	(2.66)**	(2.16)*	(1.26)
Electricity	0.372	0.389	0.351	0.321	
	(5.10)**	(5.55)**	(4.63)**	(4.26)**	
FDI	-0.086	-0.092	-0.078		-0.088
	(1.97)*	(2.13)*	(1.91)		(2.07)*
Youth Unemployment	-0.008	0.026		-0.023	-0.124
	(0.06)	(0.19)		(0.17)	(0.92)
Urban Population	0.491		0.728	0.640	1.082
	(1.76)		(2.62)**	(2.31)*	(4.14)**
Adult Population		0.934	0.148	1.230	1.926
		(1.64)	(0.28)	(2.23)*	(3.49)**
IMT Competition					
Constant	-81.385	-85.662	-93.128	-104.489	-131.890
	(8.06)**	(6.93)**	(6.26)**	(7.08)**	(9.92)**
R ²	0.53	0.53	0.53	0.53	0.51
N	407	407	421	421	412

* p < 0.05; ** p < 0.01

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	Internet Users	Internet Users	Internet Users	Internet Users
PCI	2.587	3.019		2.753
	(7.82)**	(9.09)**		(5.83)**
Trade Openness	0.168		0.205	0.008
	(2.85)**		(2.79)**	(0.09)
Secondary Education		0.010	0.030	-0.068
		(0.78)	(2.14)*	(1.93)
Electricity	0.260	0.093	0.434	0.234
	(4.46)**	(1.50)	(5.63)**	(2.38)*
FDI	-0.090	-0.052	-0.056	-0.020
	(2.39)*	(1.33)	(1.24)	(0.23)
Youth Unemployment	-0.173	-0.118	-0.029	-0.101
	(1.60)	(0.98)	(0.21)	(0.50)
Urban Population	0.096	0.919	0.793	1.213
	(0.55)	(4.73)**	(2.71)**	(3.05)**
Adult Population	-0.194	2.612	1.063	0.710
	(0.56)	(5.60)**	(1.77)	(1.12)
IMT Competition				2.966
				(2.27)*
Constant	-63.123	-149.932	-68.080	-199.671
	(6.45)**	(16.43)**	(4.79)**	(6.82)**
R ²	0.56	0.58	0.49	0.59
N	543	542	407	267
* p < 0.05; ** p < 0.01				

Table A.5: Sensitivity Analysis of the Model with PCI

	ProdCap	ProdCap	ProdCap	ProdCap	ProdCap
Mobile Subscriptions	0.017	0.004	0.004	0.004	0.011
	(6.07)**	(0.73)	(0.75)	(0.75)	(3.15)**
Internet Users	0.018	0.045	0.0048	0.048	0.048
	(2.16)*	(3.90)**	(4.07)**	(4.07)**	(5.21)**
Mobile Competition	0.085	0.197	0.190	0.190	0.180
	(0.81)	(1.27)	(1.24)	(1.24)	(1.39)
ICT Service Export	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.69)	(0.80)	(0.65)	(0.59)	(0.80)
Secondary Education	0.053	0.033	0.030	0.035	
	(6.20)**	(2.17)*	(2.02)*	(2.35)*	
GVC Participation	-0.044	-0.031	-0.032		0.001
	(5.03)**	(3.20)**	(3.31)**		(1.49)
FDI	0.012	0.018		0.019	0.019
	(1.38)	(0.84)		0.87	(1.01)
Trade Openness	-0.003		0.007	0.005	-0.001
	(0.70)		(1.09)	0.76	(0.18)
Innovation		0.395	0.390	0.505	0.444
		(1.19)	(1.18)	(1.52)	(1.62)
Constant	21.940	22.018	21.684	19.448	21.247
	(32.72)**	(15.98)	(15.09)**	(14.83)**	(21.52)**
R ²	0.67	0.49	0.49	0.49	0.52
N	298	171	171	181	242
* p < 0.05; ** p < 0.01					

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	ProdCap	ProdCap	ProdCap	ProdCap
Mobile Subscriptions	0.008	0.003	0.021	
	(1.75)	(0.71)	(5.61)**	
Internet Users	0.0037	0.050		0.052
	(3.35)**	(4.22)**		(5.43)**
Mobile Competition	0.159		-0.013	0.204
	(1.01)		(0.08)	(1.31)
ICT Service Export		-0.002	-0.003	-0.02
		(0.67)	(0.94)	(0.549)
Secondary Education	0.018	0.031	0.031	0.035
	(1.30)	(2.04)*	(2.10)*	(2.53)*
GVC Participation	-0.034	-0.032	-0.038	-0.032
	(3.39)**	(3.30)**	(3.46)**	(3.27)**
FDI	0.009	0.012	-0.000	0.016
	(0.68)	(0.54)	(0.01)	(0.74)
Trade Openness	0.003	0.006	0.005	0.007
	(0.48)	(0.93)	(0.83)	(1.00)
Innovation	0.300	0.317	0.694	0.410
	(0.95)	(0.97)	(2.12)*	(1.24)
Constant	22.273	22.373	21.092	21.519
	(17.01)**	(16.98)**	(14.80)**	(14.92)**
R ²	0.44	0.49	0.42	0.49
N	198	171	212	171
* p < 0.05; ** p < 0.01				

How African Digital Entrepreneurship Ecosystems are Escaping Silicon Valley's Long Shadow?

Michel Wahome, Nicolas Friederici & Mark Graham *

1 Introduction

In 2020, the authors published *Digital Entrepreneurship in Africa – How a Continent is Escaping Silicon Valley's Long Shadow*.¹ This chapter extracts and synthesises key findings that relate directly to the theme of this year's African Development Perspectives Yearbook, and it develops them into suggestions for proponents and cultivators of the digital entrepreneurship ecosystems. The findings and recommendations are derived from several years of research on the structures, the relations, and the growth patterns of digital entrepreneurship in select African cities. Our objective was to examine the reality behind taken-for-granted discourse and practice around digital entrepreneurship, particularly given the anticipation over the prospects of the fourth industrial revolution (4IR) for Africa (Ndung'u and Signé, 2020) and the critiques about the “fetishization of entrepreneurship” (Kuo, 2015). By examining and comparing the emergence of digital entrepreneurship in various African contexts we aimed to produce a clear-sighted analysis unclouded by conventional narratives of success or failure in the digital economy (Friederici et al., 2020). We draw predominantly from the Geonet research project, which was funded by the European Research Council (ECR) and was based at the Oxford Internet Institute (OII) between 2013 - 2019. As researchers and contributors to Geonet, we conducted studies of the digital entrepreneurship landscapes in 11 African cities. This involved the thematic analysis of data derived from 202 in-depth research interviews conducted between January 2017 and March 2018. We also drew from Geonet's quantitative mapping and digital outsourcing work, from Graham's previous project on the business process outsourcing (BPO) sector in Kenya and Rwanda (Mann et al., 2015; Mann and Graham, 2015), from Friederici's doctoral research that investigated digital entrepreneurship in Kigali, Accra, and Harare, and from Wahome's doctoral research on Nairobi. This chapter focusses its discussion on research findings about the kinds of

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¹ See: Friederici et al. 2020

ecosystems that support digital entrepreneurship. The factors that shape entrepreneurial success are linked to geographical and sociological variables. We calculated that through comparative analysis we could identify common, overarching attributes and that a piece of research that could draw on data from different cities, rather than from single-site, exemplary case studies, could produce recommendations that could be re-purposed for specific locales. Thus, we logged the attributes of cities that are building a reputation as the continent's digital economy hubs and contrasted them with those that do not have that reputation but are otherwise notable/capital cities in their nations and regions. We wished to catalogue and to understand the specific factors that led some cities to become digital entrepreneurship hubs, and then to find out the blocks and barriers that prevented others from doing so. The following cities were selected to facilitate both close and distant comparison: Abidjan, Ivory Coast; Accra, Ghana; Addis Ababa, Ethiopia; Dakar, Senegal; Johannesburg, South Africa; Kampala, Uganda; Kigali, Rwanda; Lagos, Nigeria; Maputo, Mozambique; Nairobi, Kenya; and Yaoundé, Cameroon. One of our key arguments is that one single-site acts as the blueprint for the imaginary of most digital entrepreneurship ecosystems around the world. Because its influence looms so large, Silicon Valley is a 'silent' object of comparison in research on digital technology commercialisation. One of our findings is that a shared attribute of these sites is the extent to which Silicon Valley shapes the expectations and visions of success within their ecosystems. We found that success can be defined in a multitude of ways in a digital ecosystem. For us, the ability to localise, and then to scale, in terms of market size and geographical spread, was our most reliable indicator of entrepreneurial success. The ecosystems that could help start-ups to achieve this, in turn, were the most successful ecosystems.

After the Introduction in section 1 we look in section 2 on African Digital Enterprise Ecosystems, in section 3 on the Tier 1 Ecosystems, in section 4 on the Tier 2 Ecosystems, in section 5 on the Tier 3 Ecosystems, in section 6 on the issue of How Firms Can Learn to be Successful, in section 7 on the Suggestions for Policymakers, and in the final section 8 we present Conclusions and Summary.

2 African Digital Enterprise Ecosystems

Since entrepreneurial ecosystems are “ongoing processes of the development and flow of entrepreneurial resources. . . . The presence and circulation of these resources helps explain how ecosystems evolve and transform over time and allows us to distinguish between strong, well- functioning ecosystems and weaker, poorly- functioning ones” (Spigel and Harrison, 2018, p 152). We compared within and across groups to ascertain which attributes facilitated the accumulation and dispersal of these resources. We looked for generalizable patterns. and as well

at how contexts modulated popular ecosystem frameworks to shape different outcomes. Despite Silicon Valley's influence, and the emergence of various models like lean start-up², triple helix³ and others, these ecosystems reflect their local contexts rather than supposedly universal logics of digital economies. The result of this analysis was a three-tier ecosystem hierarchy. Established 'maturing' ecosystems (Tier 1), 'incipient' ecosystems (Tier 2), and 'learning' ecosystems (Tier 3) can be distinguished. We assigned ecosystems to the tiers according to how well-developed their digital economy was, and we based this assessment on:

- A. the existence of three typologies of organization that are mainstays in digital ecosystems, namely: start-ups, angel investors, and hubs,
- B. the number of established digital companies, and how well the ecosystems had addressed five 'ecosystem bottlenecks': (1) markets and infrastructures, (2) entrepreneurial knowledge and mentorship, (3) labour and talent, (4) hubs and support organizations, and (5) access to funding.

Specific information about the rationale for and the quality of these criteria is detailed in the sections that follow.

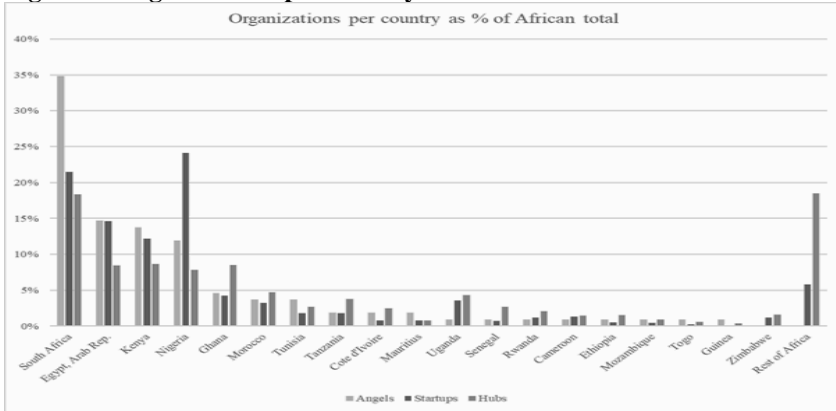
2.1 Organisations

It is important to note that start-ups are not the only kind of digital economy enterprises, but that their increased emergence within a locale suggests that there is an 'enabling environment' that grows start-ups into mature companies. Successful start-ups are enabled to mature and are the ultimate proof of a thriving ecosystem. Our interest in hubs is based on management literature regarding the topic that hubs are a popular metric for ecosystem health (Friederici, 2017a, 2016). Even though we also use this metric, we problematise its value (in the next paragraph). The third category of organisations, the angel investors, is a potent sign, suggesting not only the existence of 'disposable' capital but also of trust in the future profitability of enterprises. The data on these organisations is represented diagrammatically in Figure 1.

² See on the definition: <http://theleanstartup.com/principles>

³ See on the definition: <https://www.igi-global.com/dictionary/triple-helix/40797>

Figure 1: Organizations per country as % of African total



Source: Friederici et al. 2020, Digital Entrepreneurship in Africa: How a Continent is Escaping Silicon Valley’s Long Shadow (2020)

Notice the difference in the degree of skewedness between the organizational types (i. e., the distribution of angel investors across Africa is skewed much more extremely than the distribution of hubs). In addition, the degree of inter-relatedness between the number of organizations within an ecosystem is much less than one might expect. The organizations almost seem to exist independently of one another so that the number of support organizations (like hubs) does not necessarily reflect the number of start-ups, or the number of angel investors. What we found was that, just like high entrepreneurship rates, the existence of numerous hubs is not always a good sign. High entrepreneurship rates may be indicative of low employment prospects. Hubs, in turn, are an indicator of the effect of “the discourse”, which considers accelerators, hubs, and labs as key factors for the success of locales like Silicon Valley and Nairobi. In Africa, Nairobi’s iHub has largely driven the “legend” of hubs. Locales aspiring to similar success establish these organisations with the expectation that their existence will lead to the desired network effects. These networks, however, while facilitated by dedicated physical spaces, are in reality reflecting existing relationships and shared goals that cannot be reproduced along with the buildings. It is unwise to assume that growth in numbers of hubs is evidence of a rise in digital entrepreneurship (Bayen and Giuliani 2018; Bright and Hruby 2015). A growing body of empirical evidence (Friederici, 2017b; Littlewood and Kiyumbu, 2018; Rodrigues et al., 2018) suggests that such an understanding is problematic.

There is a category of organization that we did not use as a metric, but that has a great influence on the trajectory of an ecosystem, and that is the large telecommunications company or ‘telco’. The reason we did not integrate state and/or

private sector telcos into the development of the tiers is that all ecosystems will have one (or several). It is the attitude of the telco towards the digital enterprise economy, rather than its presence, that will influence the trajectory of an ecosystem. Large telecommunications companies provide the fundamental infrastructures of mobile connectivity and other basic services. Their mobile network infrastructure is often fundamental to the operation of a start-up's products. In addition, because of their market position, telecommunications conglomerates also often act as gatekeepers to the market. In some locales they were the backbone of the financial and payments intermediation infrastructure. We did not emphasise payments and financial services as an individual bottleneck, rather we included it in our reflections on bottleneck #1, markets and infrastructures (see below). Within that reflection, we subsume the role of telcos in the context of the socio-technical infrastructures of the digital economy. Kenya's M-Pesa, provided by Safaricom, the largest telecommunications company of the country, is a good example of how telcos can influence the ability of start-ups to access markets. M-Pesa is a fundamental payments infrastructure for other digital platforms in Kenya. In contrast, in Maputo (Mozambique), where digital payments infrastructures are not yet established at a similar level, entrepreneurs need to rely on cash-on-delivery or credit cards for payments. The effect of a telco that is willing to 'play ball' is transformative to an ecosystem. Telcos also often funded pitching competitions and hackathons to encourage local technologists. Start-ups cannot survive on their own, they require the support of a variety of organisations.

2.2 Bottlenecks

The bottlenecks we identified represent customisation of Isenberg's framework for categorising entrepreneurial resources (Isenberg 2014 about defining an entrepreneurship ecosystem) to reflect the contexts that we were studying. Listed in order of their importance, the bottlenecks are: (1) markets and infrastructures, (2) entrepreneurial knowledge and mentorship, (3) labour and talent, (4) hubs and support organizations, and (5) access to funding (Isenberg 2014). In truth, these factors will be distinctive in any given ecosystem, but we believe that there are systematic barriers that emerge at distinct stages of any ecosystems evolution (Mack and Mayer, 2016). In addition, Isenberg's framework is familiar to policy-makers and practitioners and therefore allows us to be in dialogue with them. What we are arguing is that ecosystems mature by eliminating these bottlenecks. Tier 1 ecosystems, like Johannesburg, Lagos, and Nairobi, have therefore been the most successful at addressing the bottlenecks. Followed by Tier 2 ecosystems, like Abidjan, Accra, Dakar, Harare, Kampala and Yaoundé, and Tier 3 ecosystems, like Addis Ababa, Kigali, and Maputo, these are the ecosystems which managed less removal of bottlenecks. What may differ is the ways in which these bottle-

necks structure the experiences of entrepreneurs, and therefore the specific strategies that have been deployed to address the bottlenecks may differ. The elimination of bottlenecks requires the deployment of entrepreneurial resources. When it comes to supporting early-stage, digital enterprises, the best-resourced region has been, and remains, Silicon Valley. Much of the discourse about Silicon Valley has presumed that its attributes are replicable in other locales. This assumption needs to be re-evaluated (Katila et al., 2019; Wahome and Graham, 2020; Welter et al., 2019). Mobilising entrepreneurial resources to support nascent, digital technology companies is a particular attribute of Silicon Valley. In the same way one can mention that nascent pharmaceutical companies are likely to find tailor-made resources in the Boston-Cambridge triangle in the United States.

Markets and infrastructures represent the primary bottleneck. In fact, resolution of the associated issues would place all the cities we name within the Tier 1 category (leaving us with the task to develop other metrics for measuring their development). If entrepreneurs had access to substantial, ready markets then many of their problems would resolve over time. Unfortunately, access is often determined by expensive infrastructures - these are physical as well as social systems (Mayntz and Hughes, 1988). M-Pesa, which we have used as an example of vital payments intermediation infrastructure, is also a case example of why digital technologies cannot be conceived as acting in lieu of other 'analogue' infrastructure. Former Safaricom CEO, Michael Joseph, credits the success of M-Pesa to the human resource in the form of thousands of M-Pesa agents operating even in the most remote parts of Kenya (Joseph, 2017). Without actual human personnel to collect physical currency, and to verify the identities of senders and receivers, the M-Pesa technology would not have been as ubiquitous and widespread as it is. Ubiquity is fundamental to its success. Financing and managing the socio-technical system that M-Pesa represents could only have been achieved by a large telco. In addition, addressable local market sizes are determined by physical local infrastructures (both digital and analogue infrastructures, like roads and power networks). Should a firm develop a product that is of interest to urban and rural dwellers, they are constrained by the infrastructural factors. Only well-resourced enterprises were able to address urban and rural areas at the same time or cater to customers abroad at scale.

Bottlenecks #2 through to #5 shape digital entrepreneurship in Africa across all the tiers. As a region, Africa does not hold a significant proportion of the world's stock of the immobile resources represented by these bottlenecks. These include software engineering talent, specialized technological knowledge, risk investment, organizational and personal networks, flexible and risk-friendly worker and entrepreneurial attitudes (Benner, 2008; Saxenian, 1994; Storper et al., 2015). The sections 3 to 5 that follow represent advice for policymakers and entrepreneurs in different ecosystem tier categories about how to mature out of these issues.

3 The Tier 1 Ecosystems

Tier 1 ecosystems (Nairobi, Lagos, and Johannesburg) are all (a) large cities (b), that represent major economic and trade hubs, (c) in populous African countries, (d) with relatively high mobile and internet penetrations, and (e) a GDP per capita that is around or above the African average. This means that start-ups have access to a sizeable market, which addresses the first and primary bottleneck. Markets and infrastructures, however, continue to be a bottleneck when firms seek to extend beyond local markets. Access to global markets is reliant on the infrastructures of global finance like international credit card schemes. Firms on the continent often have trouble being able to accept payments from credit card holders abroad. Countries where facilities like Paypal operate have an advantage over places where receiving international payments is almost impossible. Entrepreneurs reported how they try to disguise their location to have access to international payments infrastructure.

Even though Tier 1 ecosystems are notable for their performance in addressing bottlenecks, they were far from completely resolved. Bottleneck #2 (entrepreneurial knowledge and mentorship) in particular, is one that hampers the growth of Tier 1 ecosystems. Although academic and policy literature often emphasize a “lack of skills” as a key constraint for African innovation and development (Blimpo et al. 2017; Carmody 2013; Venables 2009), they have rarely recognized entrepreneurial knowledge as a particular type of expertise that is essential for ecosystems evolution. Entrepreneurial knowledge is an understanding of how to operate and to grow a venture and how to do so in a given local context (Spigel 2017). Such knowledge is largely tacit and contextual. Those who observe a lack of skills often misdiagnose it as a lack of education. Some other observers may conclude that it is a lack of ‘talent’. While there was a shortage of specialist technical talent, a professional group we found to exist across all ecosystems was made of technologists: software developers and engineers, working either as freelancers for local and distant clients or as employees of local digital enterprises. In some Tier 1 ecosystems, there even seemed to be a glut of software developers. It was often reported, however, that the quality of expertise was mixed. This means when experts decry the lack of talent, one should not imagine a dearth of individuals. Rather one should imagine a large cohort of actors, whose skills vary. Entrepreneurial knowledge can barely be acquired from codified and standardized information (books, media, online courses, etc.). And while some people are more predisposed to entrepreneurship, it is also possible for people to acquire entrepreneurial knowledge through learning. The issue is that entrepreneurial knowledge is location-specific and space-bound: it cannot easily be transferred across distances. Any business or management course is likely to provide important skills, but entrepreneurial knowledge builds mostly from entrepreneurs’ direct experience with setting up a digital enterprise and from their face- to-face interactions with others

who have this knowledge. This means that experienced entrepreneurs who can act as mentors or angel investors are vital to ecosystems. This cycling of existing experiential and situational entrepreneurial knowledge by mentors interacting with newcomers has been identified as a key process in ecosystem evolution (Mack and Mayer 2016; Spigel and Harrison 2018).

In Africa, digital entrepreneurship is largely a fledgling industry and overwhelmingly a young person's arena. This means that there has not been an accumulation of local digital business wisdom and the development of mentorship networks is yet to be fully established. Until this knowledge begins to collect like sediments, there will not be a strong substrate of entrepreneurial knowledge to which digital firms can attach and build their own ideas and models. Respondents often recounted war stories that revealed the peculiar constraints of their locales. Sometimes even seeming to take pride in these constraints since it demonstrated their firm's hardiness and their personal abilities to overcome circumstances that were not ideal. There is no doubt that there is a body of entrepreneurial knowledge that is accumulating in these ecosystems, but it remains to be seen whether this knowledge will nourish and benefit succeeding generations of start-ups. According to Storper et al. (2015), relational resources are an important, yet overlooked entrepreneurial resource. These include lead and networking organizations, institutionalized organizational practices, and both dense and wide co-specialized networks. None of these relational resources is easy to generate, and none of them is commodified or easily commodifiable. Infrastructure is a necessary pre-requisite, but the relational aspect is one that needs to germinate and to grow on its own. Focus should be not on innovation hubs but on modern versions of incubators, such as structured mentorship programmes and accelerators (see Pauwels et al. 2016 for a definition and review). Sometimes, all it takes is one charismatic individual to seed these networks, but it will take a community of such actors to maintain growth and evolution.

Digital entrepreneurship ecosystems can also benefit from the lessons of other industry sectors; however, the digital economy often seems very invested in its novelty, which can be observed in almost an unwillingness to be likened to other sectors. This is true even though digital products are often 'enablers' in other industries. Sometimes we came across entrepreneurs who had worked in other industries and become digital entrepreneurs because they had observed a need in their former industries. For example, a software engineer in Maputo who had previously worked in a bank, was leaving there to develop banking software that he was now selling to his former employer. This was the rare exception; most of the entrepreneurs we encountered had not worked for a previous employer, and therefore did not have any insider knowledge of an industry. Given that established industry players were anchor customers in many ecosystems, this kind of knowledge was often a key to success. As we discussed in the sub-section on or-

ganisations, large telecommunication companies (telcos) can be key infrastructural facilitators for start-ups, but the relationship was and still is often adversarial. In many of these locales, Telcos were positioned as incumbents to become unseated by emergent upstarts (Wahome, 2020). In Abidjan, a manager at Orange expressed incredulity about Safaricom making its M-Pesa API (Application Programming Interface) freely available—which they saw as not reflecting good business sense. Of course, start-ups having to rely on the infrastructure of an established incumbent do not consider this always as beneficial as it means that the conglomerate is able to stifle competition. Symbiotic relationships with industry, on the contrary, were extremely beneficial.

Entrepreneurs in Africa would likely have listed the lack of investment capital as their number 1 bottleneck as it is the issue that they raised most consistently in their interviews. It is clear why capital, or lack of it thereof, can feel like the most significant constraint when one observes how venture capital has shaped the success of global companies like Uber and Facebook—allowing them to secure market positions, and to survive on venture funds for years all while generating losses. It is undeniable that risk financing in digital enterprises is growing immensely across Africa. Year-on-year growth rates are in double- or triple-digit percentage points in most reports tracking such investments, but one observes that growth is focussed on Tier 1 ecosystems, further cementing their positions. While these numbers also include growth in local angels and investors, local capital is often not patient enough to support the strategy of financing firms for a decade so that it can secure a market share. Instead, Africa's digital entrepreneurs need to prove themselves in the market much quicker and begin to rely on their revenues much sooner. The cushion provided by “patient capital” (capital for investments not expecting quick profits) to new enterprises can only support the maturity of the ecosystem, considered as a whole.

4 The Tier 2 Ecosystems

Tier 2 ecosystems (Abidjan, Accra, Dakar, and Kampala) lack some of: (a) large cities (b) that represent major economic and trade hubs (c) in populous African countries (d) with relatively high mobile and internet penetrations and (e) a GDP per capita that is around or above the African average. Thus, tackling the local market and infrastructure issues is key to the development of the ecosystem. As we mentioned in the previous section, many entrepreneurs pointed to a lack of capital as their primary constraint. An emphasis on early-stage financing rather than revenue was particularly conspicuous among novice entrepreneurs in nascent ecosystems - the group that is least likely to access such financing. The bottlenecks that we ranked higher than funding would, if resolved, reduce enterprises' operating costs (for example, the infrastructure issues), or are the kind that money cannot

buy (the acquisition of tacit entrepreneurial knowledge). The longer one had been exposed to the ecosystem, however, the more one became aware that capital could not necessarily buy firms out of those constraints. African enterprises do not usually find large addressable homogenous markets in their vicinity, as both infrastructures and demand for digital products are limited. Those who were yet to come to this realisation continued to internalise and espouse specific objectives and to pitch their products and firms to investors rather than customers. When it came to describing their processes and goals, they described their plans for acceleration, funding round successes, and their paths to global scale. Just because there is a disconnect between these expectations and their real prospective market, this does not mean that this sort of performativity is not always an important part of being a digital entrepreneur. Speaking this language was a way that entrepreneurs conveyed competence. Some successful entrepreneurs have been able to, for instance, talk the talk about the “bottom of the pyramid” and/or bridging the “valley of death” and are attracting support for their activities, while being cognitive of their more realistic strategies.

Tier 2 ecosystems are most faced with the challenge of bottleneck #3. In particular, a missing middle of skill and talent (Grugulis and Stoyanova, 2011). A central issue is that enterprises often require not just software developers but software engineers, who are able to build compelling digital products, to participate in the venture’s strategizing, and to lead teams of junior developers. In Tier 2 Ecosystems developers, self-taught and otherwise, existed in relatively large numbers. Some were highly skilled, but many did not show the application and comprehensive skillset required for product development. In turn, the few highly skilled and experienced engineers that exist command high prices for their labour, pricing out most digital enterprises from their expertise, leaving enterprises to try their luck with an often professionally inexperienced pool of technologists. Those who could not afford to hire from this pool of freelancers sometimes reported that the developers that they encountered did not show readiness for professional interactions like fulfilling commitments and on time delivery. In a clear pattern, talented developers often get paid among the highest monthly incomes available to young urban professionals (e.g., about \$500 in Addis Ababa or \$2,000 in Accra). The technologists we interviewed were keenly aware of the concrete financial value of their skills. Many technologists alternate between part-time and short-term employment and freelance work, depending on the options they can find locally and online at any given point of time. They commanded fees and a work-life that are aspirational, therefore influencing others to opt for a similar career path. Across Africa, freelance developers often told us that they were motivated by “creating something”, “making easy money”, and “preferring independence”.

Especially talented technologists often established a local base of loyal customers and iteratively increased their portfolios through online freelancing.

Thereby, they were ‘going global’. An advantage of online freelancing is that income opportunities are less affected by local economic issues, like currency fluctuations or economic downturns. The technologists we interviewed were sceptical of general digital labour platforms, such as Upwork, citing the risk that clients would not pay, the piecemeal nature of the work, and low hourly wages. Instead, they obtained international contracts either through personal contacts or specialized software developer platforms, such as Toptal⁴ or LinkedIn and Slack groups. For the most talented and experienced, online freelancing provided much better job opportunities compared to regular employment at local corporations or startups. In some cases, entrepreneurial freelancing was a precursor to the establishment of digital enterprises. Thus, the freelancing consultant can also be considered an entrepreneurial actor, particularly since some freelancers had become so successful as to employ other developers. One of the best funded digital enterprises in Africa, Andela⁵, essentially runs teams of technologists that can be hired by global companies. They are meeting a demand for software developers by pooling, and training hundreds of potentials hired in Ghana, Nigeria, Rwanda, Kenya, and Uganda. They refer to this form of market intermediation as acting as a ‘talent accelerator’.

In addition to the scarcity of highly skilled technologists, we found variations in the size of the pools of entrepreneurial workers. Entrepreneurial workers refer to staff who have entrepreneurial knowledge. Digital enterprises often have malleable organizational structures and engage in constant knowledge exchange, requiring workers to be flexible and engage in professional communities beyond the enterprise (Auschra et al. 2017; Benner 2008; Ibert 2004). Ultimately, even employees who are not executives may be required to adopt an entrepreneurial approach, as they design products, share risks, get rewarded through company shares rather than salaries, and partake in strategic decisions (Neff, 2012). We found a critical mass of such workers to exist in tier 1 ecosystems (Lagos, Nairobi, and Johannesburg). Kigali was an exceptional tier 3 ecosystem in which we found some entrepreneurial workers, potentially due to Rwanda’s concerted push to institute entrepreneurial ideas across society (Root, 2016). This was demonstrating that it is possible for an ecosystem to develop this capacity.

⁴ See about their working principles: <https://www.toptal.com/>

⁵ See about their working principles: <https://andela.com/>

5 The Tier 3 Ecosystems

Tier 3 ecosystems (Kigali, Addis Ababa, and Maputo) lack most of (a) large cities (b) that represent major economic and trade hubs (c) in populous African countries (d) with relatively high mobile and internet penetrations and (e) a GDP per capita that is around or above the African average. Of these three cities, Addis Ababa's status as a Tier 3 city may come as a surprise as it should meet the criteria for a sizeable market share. It is a case that allows us to discuss the impact of government ideology on entrepreneurial endeavour. Ethiopia's government has kept tight reigns on the proliferation of the infrastructures of connectivity (Gagliardone, 2016). The effect of this is also a testament to the importance of infrastructure to the establishment of a digital enterprise economy. One of the narratives emerging from ICT4D discourses is that infrastructural insufficiencies represent market opportunities that can be exploited by digital entrepreneurs. Some African digital enterprises are inspired by these narratives around supposedly vast rural development and market potentials at the "bottom of the pyramid". Narratives are often crafted by international development actors who are enthused about the distances that mobile broadband can span. But the technologies of connectivity are not a panacea. Entrepreneurs report that they experience difficulties turning these expectations into sustainable businesses. Digital or digitized value chains that reach rural customers (especially subsistence farmers) fundamentally depend on analogue connectivity (e.g., transportation infrastructure, face-to-face interactions, etc.). This implies that distribution cost per customer often becomes prohibitive for the most remote areas, and that businesses' understanding of rural consumers remains limited. Often technologists make assumptions about market readiness based on rates of uptake of mobile technologies and other digital services. Low rates of uptake of technologies often reflect an inability to take into account end user capabilities (Wyche and Steinfield, 2016). Digital enterprises thus suffer from rural market access challenges that are surprisingly similar relative to those of analogue businesses. These infrastructural issues in all their forms are the reason that African digital enterprises are confined to fragmented small local markets. Market and infrastructures as a group is the first bottleneck not only because of the many forms it takes but also because it is one bottleneck that cannot be addressed by the entrepreneurs themselves. The expectation that infrastructural issues should be resolved by entrepreneurs, particular in low-GDP contexts, should be replaced with an appreciation of the constraints that they face.

6 How Firms Can Learn to be Successful

The previous sections have elaborated on the specific problems faced by each ecosystem tier. Ultimately, ability of ecosystems to nurture digital economies is reflected in and measured by the success of individual firms. In turn, the success of a start-up will be reflected in its revenues and its longevity, which is reflecting the individual firm's capabilities. Interim metrics are used to make predictions about a firm's future. Tech start-up discourse often assesses digital firms by the originality of their breakthrough technology or their business models. New technologies are expected to create new markets. In fact, in the locales we studied, novelty or 'disruption' should not be of paramount concern. A technology is disruptive if it can unseat an incumbent technology, again often because it contains some novel element. Many of the technologies developed represent adaptations to existing technologies (Mulwa and Ndati, 2013; Odumosu, 2017). The ability to scale geographically was the most important attribute to watch for. Another common metric for a firm's viability is whether it is selling products overseas or 'going global'. When emphasise is on scaling, we mean a strong local position, which may or may not be followed by global growth. A popular metric of success is the amount of venture funding that an enterprise can attract. The average African digital enterprise, according to our findings, does not grow exponentially, does not scale internationally, and does not attract venture capital. We have reiterated that entrepreneurs tended to highlight the lack of capital as their main hindrance. Awareness of the other bottlenecks amongst entrepreneurs and other ecosystem actors, like hub managers and investors, was widespread but understanding of the implications for their firm and the appropriate counterstrategies varied across the spectrum of entrepreneurs that we spoke to. To be successful firms in Africa needed to pay greatest attention to their markets and surmounting any infrastructural hindrances to a growing market share, as otherwise venture capital was only delaying inevitable failure. The recommendations that follow therefore emphasise factors that support the development of local, contextually relevant technologies and enterprises. We view the production of locally relevant use-cases, that can be taken up quickly by local markets, as offering the greatest promise for African entrepreneurs and their societies.

6.1 Localise

African entrepreneurs who are successful are hyperlocal in their orientation, meaning that they did not (immediately) set their sights on global markets. No matter how many borders a firm can cross, localisation is the key to success. This contrasts with conventional expectations around internet connectivity and its ability to bridge geographical divides and to globalise information and markets (Friederici, 2016). To be successful, digital entrepreneurs identify opportunities in their

environments, which they pursue in an iterative experimental process until their resources run out or until they arrive at a product- market fit.

6.2 Disrupt Analogue Supply Chains

In some cases, resolving analogue supply chain issues and tackling processes that were a hindrance for them and others, led to profitable businesses. Quite often, these issues were caused by infrastructural blocks that require state-led intervention.

6.3 Adapt Digital Technologies to Local Contexts

Digital enterprises who were aware of their contexts were creatively and productively applying and adapting digital technologies to their local economic, social, and political contexts. This has many of the wished-for positive socio-economic effects (e.g., improved efficiencies and service quality, high-quality job creation, etc.), but not at the rate and scale that the widespread narratives about African digital entrepreneurship suggest. These technologies do not need to be novel. In some cases, they represented novel use-cases of established technologies.

Some entrepreneurs who described a lucrative buy-out as their preferred exit deliberately developed companies that mirrored services offered by major global companies - be they ride hailing platforms, merchant point-of-sale software, or logistics and distribution software. The reach of financial technology (e.g., PayPal), of ride sharing (e.g., Uber), and of e-commerce providers (e.g., Alibaba) has been increasingly global, but without reaching every internet-connected place. Local competitors in these digital product markets can persist (e.g., Little Cab⁶ vs. Uber in Nairobi/Kenya, or Paga⁷ vs. PayPal in Nigeria), while this is not the case for, say, social network sites (e.g., now-defunct Pan-African Mxit⁸ vs. Facebook and WhatsApp). Massive digital scaling effects exist within the globally standardized digital layers of the former products, but they do not entirely overwhelm analogue scaling constraints, allowing local solutions to survive wherever those constraints are too burdensome for the foreign entrant. In their best-case scenarios, some entrepreneurs envision situations where they achieve local successes and attract the attention of their global “doppelganger” who then seeks to merge with or purchases their company to gain a footprint in the local market.

⁶ See on Little Cab: <https://little.bz/ke/>

⁷ See on Paga: <https://www.mypaga.com/>

⁸ See on the story: <https://panafricanvisions.com/2012/11/mxit-south-africas-social-media-sensation/>

6.4 Identify with One of Four Types of Digital Value Creation

We found that there were four typologies of digital value creation that most firms used for finding success in (see table 1).

Table 1: Four types of value creation using digital technologies

Type	Summary
Digital production	Creation of a digital artifact
Information processing	Editing, integrating, and analysing existing information
User interconnection	Allowing users to share and to collaborate
Market intermediation	Connecting buyers and suppliers

Source: Friederici et al., Digital Entrepreneurship in Africa: How a Continent is Escaping Silicon Valley's Long Shadow (2020)

Digital production: To some extent, all digital entrepreneurship involves digital production but not all digital production is entrepreneurial (i.e., market-opportunity-oriented). Types of non-entrepreneurial digital production include some types of digital labour, commitments to GitHub (the world's largest collaborative software development platform)⁹, and posts on Stack Overflow (a global software developer knowledge platform)¹⁰.

Information processing: Charging small commission fees to one side of a platform market being interested in relaying information to the consumers of the other side was a more viable approach.

User interconnection: Investing in local assets that have value for corporate customers in high-income countries, such as labour, market knowledge, or a unique cultural artifact (like an online game with African characters). Outsourcing companies were dominant in this category.

Market intermediation: The last-mile platform may be the most promising strategy. Here, enterprises blend a digital platform back-end with an analogue structure to reach end users with limited digital infrastructure access.

6.5 Linear Scaling and Smart Specialisation

Many of those we interviewed, who had achieved long-term success, had done so in the 'old-fashioned' way - building their business for one customer or contract at a time. For scaling at distance, so-called smart specialization strategies may be what is needed. Digital entrepreneurs should not enter already commodified and

⁹ See for more information: <https://github.com/>

¹⁰ See for more information: <https://stackoverflow.com/>

already competitive sectors. If they do, they should be prepared for cost pressure and again for small-scale growth. The key questions are: What can be locally produced (a) that cannot or can only hardly be replicated elsewhere, (b) that will be needed elsewhere, and (c) that can be transported or duplicated there at relatively low cost? The answers to these questions could result in a specialization that can be locally nurtured. This does not have to be a product. It could be a product component, a business, a value-creation model, a cultural practice, or even a particular sector of the digital economy (e.g., marketing).

6.6 Value Entrepreneurial Workers

In the section on “Tier 2 Ecosystems” we discussed the importance of entrepreneurial workers. Soft skills are often valued just as highly as technical skills in digital entrepreneurship ecosystems. Retaining and developing entrepreneurial workers should be part of an enterprises’ growth plan. Tacit, experience-based, and locality-specific entrepreneurial knowledge may be the most important entrepreneurial resource. It cannot be imported; it is part of the locality. The lean start-up and other strategies may be useful templates, but entrepreneurs need to conduct deep and sophisticated local adaptations. An ethos of mentorship and apprenticeship to share this knowledge should be embedded into the relational networks.

6.7 Learn from Users

Paying attention to users, not only as data points that demonstrate market share, can yield information about how else to derive value from digital products (von Hippel, 2009). The nature of internet-enabled technologies means that the lion’s share of value creating activity (e.g., content production and data generation) is done by users and not by the enterprise itself (Amit and Han 2017; Enders et al. 2008; Teece 2018). In a digital world, many users move from being consumers to indispensable co-producers of value (Baldwin and von Hippel 2011; Ramírez 1999). Instead of creating a finished product and selling it to a passive recipient, digital enterprises become facilitators or orchestrators of users’ collective and often unintentional value creation (Amit and Han 2017; Amit and Zott 2015; Eisenmann, Parker, and Van Alstyne 2006). Some of the most celebrated products emerging out of Africa reflect use cases which were developed by users. M-Pesa is a prominent example - users had been sending airtime to one another as a form of currency prior to the development of mobile money transfer and mobile payment functionalities (Joseph, 2017; Suri and Jack, 2016). Twiga Foods¹¹, which

¹¹ See on this business model: <https://twiga.com/>

fills supply chain gaps in agricultural markets, began through the observation of food waste in local informal markets and grew from the suggestions made by traders. A counter example is the mixed success of market information services that seek to empower farmers with pricing information so that they are not at the mercy of middlemen. Failing to understand that users might privilege interpersonal relationships and the affordances of their products translates into poor uptake (Wyche and Steinfield, 2016). This kind of market information can only be acquired through experience and direct engagement with users.

6.8 Value Local Knowledge

Market knowledge is a competitive advantage. The development of local and contextually relevant technologies is dependent on this knowledge. Local actors need to keep in mind that global companies have the resources that allow them to grab a market share even without this knowledge and with less locally appropriate products. Should a global competitor appear in their market, smart specialisation (see sub-section 6.5) and the skills of entrepreneurial workers (see sub-section 6.6) will be the only way that they can hold them off and perhaps demonstrate that it is in the global competitors' best interest to buy them out. Astute entrepreneurs understood the concept of market traction in digital entrepreneurship (Nicoll, 2000), in which even unprofitable and non-paying users may have value. These entrepreneurs were banking on global actors being aware of the value of local entrepreneurial knowledge.

6.9 Build Your Business Model on Enterprise Customers

Digital enterprises located in small, low-income countries where consumers and small businesses have low disposable incomes do not have access to the kinds of digital mass markets that are needed to make direct-to-consumer (B2C business models) viable. Because large businesses (banks, insurances, hospitals, etc.) are typically the only actors with high enough willingness to pay for digital products, they represent the customers which digital enterprises in those ecosystems focus on (B2B business models). Business-to-business (B2B) models are more successful because they are dependent on the size of the contract, rather than on their number. B2C models that rely on the sales model are difficult to sustain in these small markets. B2B models can also scale through word-of-mouth and using good relationships to customers and partners, while B2C models often require that firms invest in marketing.

6.10 Build on Relations and Construct Network Effects

Our previous reflections on hubs may suggest that we do not think that they are useful; in fact, they are only useful in the capacity to build relationships. One good hub is better than many that do not produce desired network effects. The social realities of hubs are immensely complex, and hub managers and funders struggle to fully understand the strengths and weaknesses of the strategic options at their disposal. Nevertheless, assembling entrepreneurial communities, which give members a sense of collective identity and meaning, has been found to be a most transformative outcome of hubs (Friederici 2017a; Marchant 2018). Hubs have also become the first points of contact for foreigners entering a given entrepreneurial ecosystem, and they thus serve an important orientation function (Littlewood and Kiyumbu 2018). They can also be boundary organizations in which indigenous creative traditions are blended with foreign ideas and technologies (Eglash and Foster 2017). In the end, hubs do have a role to play, and that role is particularly pronounced in “Tier 1 ecosystems”.

7 Suggestions for Policymakers

Digital connectivity and technologies, like the infrastructures of yore, have been co-opted into national and international development rhetoric. A country like Rwanda has even built its national narrative around the futures that information and communications technologies and ecosystems represent. Political campaigns in Kenya have been built on the imaginaries of modernity and democratic reform that can be symbolized by a ‘digital government’. Whatever the underlying vision, policymakers can contribute to the development of digital economy ecosystems by paying attention to the following recommendations.

7.1 Strategic Infrastructure Investments

It should be noted that infrastructures of connectivity, such as affordable broadband and physical infrastructure (roads, hub buildings, offices, tech parks, etc.), are necessary preconditions for digital entrepreneurship, but they do not themselves represent resources for the entrepreneur. It rarely makes sense to pour resources into physical infrastructure, such as incubators and tech parks. Such infrastructure is usually useless if it is not complemented by various soft factors, especially participation by key entrepreneurs. Infrastructure only generates value when it is in (collective) use, which itself depends on entrepreneurial actions. Instead, by providing robust public services and setting standards, governments can create the conditions for supportive entrepreneurial regimes.

7.2 Material Support

The local smart specialization (mentioned in sub-section 6.7) and the local competitive advantage (see in sub-section 6.8) can be nurtured by giving entrepreneurs material resources, in the form of small business loans, but they need to be invested with care and strategic discernment. In addition, entrepreneurs cannot be expected to turn these into economic development in a short time frame. Policymakers may also be glad to know that strategies that have been successful in sectors like agriculture and rural development can also support digital entrepreneurs. Small business loans, entrepreneurship training and the like can also smooth the business environment for digital entrepreneurs. One entrepreneur in Nairobi was trialling a SACCO (Savings and Credit Cooperative Organization) for digital enterprises. Even if a SACCO for digital enterprises is not viable as a financing mechanism, associations (or similar groups) can be used to coordinate within ecosystems and across to other ecosystems, in Africa and beyond. Governments are best placed to support entrepreneurs with lenient small business loans that do not require assets as collateral.

7.3 Legislative and Programmatic Support

We discussed how, despite smart specialisation, local companies might not be able to withstand the expansion of global companies. The answer may lie in protectionist regulatory frameworks that make it more expensive for global companies to enter local markets. These laws could incentivise partnering with local firms, or the mergers and buy-outs that some firms seem to anticipate. Given that B2B models seem to be the most successful, policymakers could also incentivise procurement practices that prefer local firms, not only for government agencies but as well for local corporations. They could also seek to develop match-making programmes if they observe that natural networks do not exist between the industry sector and the local digital economies.

7.4 Support Digital Work

Even when the local job market cannot accommodate everyone, not everyone can, or should, be an entrepreneur. Given the importance that previous work experience had on how successful entrepreneurs are, there is much to be said for policymakers focussing on increasing the number of jobs in digital sectors, rather than on entrepreneurship rates. Moreover, importantly, the gains from digital entrepreneurship concentrate in just a few hands. Extreme care thus needs to be taken in allocating public resources to what is essentially a private sector arena.

7.5 Cultivate Support from Relevant Enabling Overseas Actors

The issues that prevent African entrepreneurs from other sectors to participate in global markets will also challenge digital entrepreneurs. International credit card schemes are shy about including African geographies. Foreign direct investment in the form of venture capital is difficult to secure in Africa. Solutions to these issues will require changes in global governance institutions and are also likely to require adaptations at the local level that consider local politics, regulatory regimes, and other factors that circumscribe how business is conducted in a particular locale.

7.6 Advice for International Development Practice

The previous suggestions have been made with local policymakers in mind. Many of the observations tailored to local-level actors have salience for international funders and international development actors. Digital economies have attracted the interest of the international development industry because they are seen as a possible source of livelihoods and improvements to the wellbeing of under-resourced communities. There is also the thinking that if African entrepreneurs can capture even a small segment of lucrative global markets, it will have impacts that have a positive reverberation in the local economies. The idea of a more inclusive global economy is indeed appealing, however, digital technologies by themselves cannot resolve existing historic, social, and physical impediments. A pitfall that development funders should avoid is funding photo opportunities. The potential for this is particularly high when hype develops. Digital entrepreneurship is not an activity that typically spreads its gains widely. There are exceptions, but that is the general rule. It is typically an economic activity conducted by educated elites in urban areas. If this is not the cohort of people that are being targeted by development efforts, then other modalities of service delivery may be more appropriate. It is important to always consider that digital goods also represent added costs to households. Entrepreneurial, profit-making business models may not be the best way to deliver services to low-income populations. In addition, the digital economy is not immune to exploitative business models which at first blush may appear to promote aspects of inclusion - but open customers up to data extraction, surveillance, and targeted marketing that may change their consumption patterns (Wahome, 2020). Therefore, development resources are likely much better spent on lasting and sustainable investments in communities and infrastructures. Even when technologies are designed specifically to generate good social outcomes, issues related to affordances and uptake could translate into mixed or poor results (Wyche and Steinfield, 2016). Therefore, we also encourage investment in monitoring and evaluation. Rather than attempting to replicate results across locales, it is better to view every intervention as unique and to closely monitor projects *in*

situ by using locally adjusted baselines. Process evaluations, as an example, that not only focus on outcomes but also on the design of interventions and how they engage with relevant parties, can prevent reliance on taken-for-granted assumptions built on external expectations.

8 Conclusions and Summary

This chapter acts as an Executive Summary and collates the findings of our book, *Digital Entrepreneurship in Africa – How a Continent is Escaping Silicon Valley’s Long Shadow*, into a set of recommendations for various actors in Africa’s digital entrepreneurial ecosystems. Our objective was to clarify the prevalent discourse around digital economies in Africa, which has generally fallen into two camps - optimism and enthusiasm about its trajectory on the one side and disappointment that expectations are not being met on the other side. An outcome of this inquiry is that it lends itself to the generation of strategic advice, even though this was not necessarily our goal at the outset. These recommendations are predicated on our overarching view that

1) The objective of replicating the success of other digital economies is compelling, but it often appeared to us that most interlocutors are too removed from the realities of digital entrepreneurs to design helpful and effective interventions. We encourage a greater respect for context, and for traditional infrastructural barriers to economic development.

2) The entrepreneurs who are successful in these ecosystems are hyperlocal in their orientation, meaning that they did not (immediately) set their sights on global markets.

3) The existence of digital technologies does indeed change the trajectory of global society; however, to expect that digital technologies and associated entrepreneurial endeavour can resolve pre-existing infrastructural issues is a big ask. The fundamental issues that plague other sectors often cannot be surmounted by digital technologies.

4) Rather than anticipating what digital entrepreneurship can achieve in their locales, policymakers are best advised to seek to understand the dynamic and complex nature of digital entrepreneurship and pay attention to what digital entrepreneurs say that they need.

References

- Amit, Raphael, and Xu Han. 2017. “Value Creation through Novel Resource Configurations in a Digitally Enabled World.” In: *Strategic Entrepreneurship Journal* 11 (3):228– 242. Download: <https://doi.org/10.1002/sej.1256>.

- Amit, Raphael, and Christoph Zott. 2015. "Crafting Business Architecture: The Antecedents of Business Model Design." In: *Strategic Entrepreneurship Journal* 9 (4): 331–350. <https://doi.org/10.1002/sej.1200>.
- Auschra, Carolin, Timo Braun, Thomas Schmidt, and Jörg Sydow. 2017. "Patterns of Project-Based Organizing in New Venture Creation: Projectification of an Entrepreneurial Ecosystem." In: *International Journal of Managing Projects in Business* 12 (1): 48–70. Download: <https://doi.org/10.1108/IJMPB-01-2018-0007>.
- Bakker, S., Van Lente, H., Meeus, M., 2011. Arenas of expectations for hydrogen technologies. In: *Technol. Forecast. Soc. Change* 78, 152–162. Download: <https://doi.org/10.1016/j.techfore.2010.09.001>
- Baldwin, Carliss, and Eric von Hippel. 2011. "Modelling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation." In: *Organization Science* 22 (6): 1399–1417. Download: <https://doi.org/10.1287/orsc.1100.0618>.
- Bayen, M., & Giuliani, D. (2018, March 20). 1000 Tech Hubs are Powering Ecosystems in Asia Pacific and Africa. Retrieved March 20, 2018, access from <https://www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/1000-tech-hubs-are-powering-ecosystems-in-asia-pacific-and-africa>
- Benner, C., 2008. *Work in the new economy: flexible labour markets in Silicon Valley*, 1st ed. ed, The information age series. Wiley, John Wiley & Sons, Incorporated, Wiley-Blackwell, Hoboken.
- Blimpo, Moussa Pouguintimpo, Michael Minges, Wilfried A. Kouamé, Theophile Thomas Azomahou, Emmanuel Kwasi Koranteng Lartey, Christelle Meniago, Mapi M. Buitano, and Albert G. Zeufack. 2017. "Leapfrogging: The Key to Africa's Development— from Constraints to Investment Opportunities." Working Paper 119849, World Bank, Washington, DC. Access: <http://documents.worldbank.org/curated/en/121581505973379739/Leapfrogging-the-key-to-Africas-development-from-constraints-to-investment-opportunities>.
- Bright, J., & Hruby, A. (2015). *The Next Africa: An Emerging Continent Becomes a Global Powerhouse*. New York: Thomas Dunne Books.
- Carmody, Pádraig. 2013. "A Knowledge Economy or an Information Society in Africa? Thintegration and the Mobile Phone Revolution." In: *Information Technology for Development* 19 (1): 24–39. Access: <https://doi.org/10.1080/02681102.2012.719859>.
- Enders, Albrecht, Harald Hungenberg, Hans-Peter Denker, and Sebastian Mauch. 2008. "The Long Tail of Social Networking: Revenue Models of Social Networking Sites." In: *European Management Journal* 26 (3): 199–211. Access: <https://doi.org/10.1016/j.emj.2008.02.002>.
- Eglash, Ron, and Ellen K. Foster. 2017. "On the Politics of Generative Justice: African Traditions and Maker Communities." In: *What Do Science, Technology, and Innovation Mean from Africa?*, edited by Clapperton Chakanetsa Mavhunga, 117–135. Cambridge, MA: MIT Press

- Eisenmann, Thomas. R., Geoffrey Parker, and Marshall W. Van Alstyne. 2006. "Strategies for Two- Sided Markets." In: *Harvard Business Review* 84 (10). Access: <https://hbr.org/2006/10/strategies-for-two-sided-market>.
- Friederici, Nicolas. 2017a. "Innovation Hubs in Africa: Assemblers of Technology Entrepreneurs." Dissertation, Oxford Internet Institute, University of Oxford. Access: <https://ora.ox.ac.uk/objects/uuid:2e5c9248-15b4-450a-958a-0ce87cf6e263>.
- Friederici, N., 2017b. *Africa's Digital Revolution: A Researcher's Perspective*. Afridigest.
- Friederici, N., 2016. How the internet is failing to drive economic development where promised. In: *The Conversation*. URL <http://theconversation.com/how-the-internet-is-failing-to-drive-economic-development-where-promised-70447> (accessed 7.24.17).
- Friederici, N., Wahome, M., Graham, M., 2020. *Digital Entrepreneurship in Africa: How a Continent Is Escaping Silicon Valley's Long Shadow*. Access: <https://doi.org/10.7551/mitpress/12453.001.0001>
- Gagliardone, I., 2016. *The politics of technology in Africa: communication, development, and nation-building in Ethiopia*. Cambridge University Press, Cambridge.
- Grugulis, I., Stoyanova, D., 2011. The missing middle: communities of practice in a free-lance labour market. In: *Work Employ. Soc.* 25, 342–351. Access: <https://doi.org/10.1177/0950017011398891>
- Joseph, M., 2017. M-Pesa: the story of how the world's leading mobile money service was created in Kenya [WWW Document]. URL <https://www.vodafone.com/content/index/what/technology-blog/m-pesa-created.html> (accessed 9.4.18).
- Graham, Mark. 2015. "Contradictory Connectivity: Spatial Imaginaries and Technomediated Positionalities in Kenya's Outsourcing Sector." In: *Environment and Planning A*, 47 (4): 867– 883. Access: <https://doi.org/10.1068/a140275p>.
- Graham, Mark, Casper Andersen, and Laura Mann. 2015. "Geographies of Connectivity in East Africa: Trains, Telecommunications, and Technological Teleologies." In: *Transactions of the Institute of British Geographers* 40 (3): 334– 349.
- Graham, Mark, and Laura Mann. 2013. "Imagining a Silicon Savannah? Technological and Conceptual Connectivity in Kenya's BPO and Software Development Sectors." *Electronic Journal of Information Systems in Developing Countries* 56 (April).
- Garud, R., Schildt, H., Lant, T.K., 2014. *Entrepreneurial Storytelling, Future Expectations, and the Paradox of Legitimacy* (SSRN Scholarly Paper No. ID 2471304). Social Science Research Network, Rochester, NY.
- Hill, T. L., and Ram Mudambi. 2010. "Far from Silicon Valley: How Emerging Economies Are Re- shaping Our Understanding of Global Entrepreneurship." In: *Journal of International Management* 16 (4): 321– 327. Access: <https://doi.org/10.1016/j.intman.2010.09.003>.
- Ibert, Oliver. 2004. "Projects and Firms as Discordant Complements: Organisational Learning in the Munich Software Ecology." *Research Policy* 33 (10): 1529–46. Access: <https://doi.org/10.1016/j.respol.2004.08.010>

- Isenberg, Daniel J. 2014. "What an Entrepreneurship Ecosystem Actually Is." In: *Harvard Business Review*, May 12, 2014. Access: <https://hbr.org/2014/05/what-an-entrepreneurialecosystem-actually-is>.
- Jorgensen, U., Sorensen, O.H., 1999. Arenas of Development - A Space Populated by Actor-worlds, Artefacts, and Surprises. In: *Technol. Anal. Strateg. Manag.* 11, 409–429. Access: <https://doi.org/10.1080/095373299107438>
- Joseph, Michael. 2017. "M- Pesa: The Story of How the World's Leading Mobile Money Service Was Created in Kenya." Vodafone, March 6, 2017. Access: <https://www.vodafone.com/content/index/what/technology-blog/m-pesa-created.html>.
- Katila, S., Laine, P.-M., Parkkari, P., 2019. Sociomateriality and Affect in Institutional Work: Constructing the Identity of Start-Up Entrepreneurs. In: *J. Manag. Inq.* 28, 381–394. Access: <https://doi.org/10.1177/1056492617743591>
- Kuo, Lily. 2015. "Video: Ory Okolloh Explains Why Africa Can't Entrepreneur Itself out of Its Basic Problems." In: *Quartz Africa*, September 15, 2015. Access: <https://qz.com/africa/502149/video-ory-okolloh-explains-why-africa-cant-entrepreneur-itself-outof-its-basic-problems/>.
- Littlewood, David C., and Wilkister L. Kiyumbu. 2018. "'Hub' Organisations in Kenya: What Are They? What Do They Do? And What Is Their Potential?" In: *Technological Forecasting and Social Change* 131 (June): 276– 285. Access: <https://doi.org/10.1016/j.techfore.2017.09.031>.
- Mack, Elizabeth, and Heike Mayer. 2016. "The Evolutionary Dynamics of Entrepreneurial Ecosystems." In: *Urban Studies* 53 (10): 2118– 2133. Access: <https://doi.org/10.1177/0042098015586547>.
- Mann, L., Graham, M., 2015. *The Domestic Turn: Business Processing Outsourcing and the Growing Automation of Kenyan Organisations* (SSRN Scholarly Paper No. ID 2604582). Social Science Research Network, Rochester, NY.
- Mann, L., Graham, M., Frederici, N., 2015. *The internet and business process outsourcing in East Africa*. Oxford Internet Institute, University of Oxford, Oxford, United Kingdom.
- Marchant, E., 2018. "Anyone Anywhere: Narrating African Innovation in a Global Community of Practice." Dissertation, University of Pennsylvania. Access: <https://repository.upenn.edu/edissertations/2746>.
- Mayntz, R., Hughes, T., 1988. *The Development of large technical systems / Renate Mayntz, Thomas P. Hughes (editors).*, Frankfurt am Main: Boulder, Colo.: Campus Verlag; Westview Press.
- Mulwa, M., Ndati, N., 2013. Integrated Marketing Communication and Technology Adoption: A Case of Safaricom's M-PESA Mobile Money Transfer Services in Kenya. In: *Afr. J. Sci. Technol. Innov. Dev.* 5, 363–371. Access : <https://doi.org/10.1080/20421338.2013.829297>
- Ndung'u, N., Signé, L., 2020. *The Fourth Industrial Revolution and digitization will transform Africa into a global powerhouse* 15. Brookings, Foresight Africa 2020, Series. Access: <https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/>

- Neff, G., 2012. *Venture labour: work and the burden of risk in innovative industries, Acting with technology*. MIT Press, Cambridge, Mass.
- Nicoll, D.W., 2000. Users as Currency: Technology and Marketing Trials as Naturalistic Environments. In: *Inf. Soc.* 16, 303–310. Access: <https://doi.org/10.1080/019722400457261>
- Odumosu, T., 2017. *Making Mobiles African*, in: *What Do Science, Technology, and Innovation Mean from Africa?* The MIT Press, Cambridge, Massachusetts.
- Pauwels, Charlotte, Bart Clarysse, Mike Wright, and Jonas Van Hove. 2016. “Understanding a New Generation Incubation Model: The Accelerator.” In: “Technology Business Incubation,” edited by Sarfraz Mian, Wadid Lamine, and Alain Fayolle. Special issue, *Technovation* 50-51 (April): pages 13-24. Access: <https://doi.org/10.1016/j.technovation.2015.09.003>.
- Ramírez, Rafael. 1999. “Value Co- production: Intellectual Origins and Implications for Practice and Research.” In: *Strategic Management Journal* 20 (1): 49-65. Access: [https://doi.org/10.1002/\(SICI\)1097-0266\(199901\)20:1<49::AID-SMJ20>3.0.CO;2-2](https://doi.org/10.1002/(SICI)1097-0266(199901)20:1<49::AID-SMJ20>3.0.CO;2-2).
- Rodrigues, G., Csíkszentmihályi, C., Mwesigwa, D., Mukundane, J., Kasprzak, M., 2018. *Social Tech Ecosystems in Sub-Saharan Africa*. Madeira Interactive Technologies Institute. Access: <https://doi.org/10.5281/zenodo.1244086>
- Root, T., 2016. Rwanda’s Start-up Generation. In: *Va. Q. Rev.* 92, 152–171.
- Saxenian, A., 1994. *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Harvard University Press, Cambridge, MA.
- Spigel, Ben. 2017. “The Relational Organization of Entrepreneurial Ecosystems.” In: *Entrepreneurship Theory and Practice* 41 (1): 49– 72. Access: <https://doi.org/10.1111/etap.12167>.
- Spigel, Ben, and Richard Harrison. 2018. “Toward a Process Theory of Entrepreneurial Ecosystems.” In: *Strategic Entrepreneurship Journal* 12 (1): 151– 68. Access: <https://doi.org/10.1002/sej.1268>.
- Storper, M., Kemeny, T., Makarem, N., Osman, T., 2015. *The Rise and Fall of Urban Economies: Lessons from San Francisco and Los Angeles*, 1st ed, Innovation and technology in the world economy. Stanford University Press, Stanford Business Books, Palo Alto.
- Suri, Tavneet, and William Jack. 2016. “The Long- Run Poverty and Gender Impacts of Mobile Money.” In: *Science* 354 (6317): 1288– 1292. Access: <https://doi.org/10.1126/science.aah5309>.
- Teece, David J. 2018. “Profiting from Innovation in the Digital Economy: Enabling Technologies, Standards, and Licensing Models in the Wireless World.” In: *Research Policy* 47 (8): 1367– 1387. Access: <https://doi.org/10.1016/j.respol.2017.01.015>.
- Van Lente, H., 1993. *Promising Technology. The Dynamics of Expectations in Technological Developments*. University of Twente.
- Venables, Anthony J., 2009. “Rethinking Economic Growth in a Globalizing World: An Economic Geography Lens.” *African Development Review* 21 (2): 331–51. Access: <https://doi.org/10.1111/j.1467-8268.2009.00212.x>.

- Wahome, M., 2020 “Fabricating Silicon Savannah.” Dissertation, University of Edinburgh. Access: <https://era.ed.ac.uk/handle/1842/37212>
- Wahome, M., Graham, M., 2020. Spatially shaped imaginaries of the digital economy. In: *Inf. Commun. Soc.* 23, 1123–1138.
- Welter, Friederike. 2011. “Contextualizing Entrepreneurship— Conceptual Challenges and Ways Forward.” In: *Entrepreneurship Theory and Practice* 35 (1): 165– 184. Access: <https://doi.org/10.1111/j.1540-6520.2010.00427.x>.
- Welter, F., Baker, T., Wirsching, K., 2019. Three waves and counting: the rising tide of contextualization in entrepreneurship research. In: *Small Bus. Econ.* 52, 319–330.
- Wyche, Susan, and Charles Steinfield. 2016. “Why Don’t Farmers Use Cell Phones to Access Market Prices? Technology Affordances and Barriers to Market Information Services Adoption in Rural Kenya.” In: *Information Technology for Development* 22 (2): 320– 333. Access: <https://doi.org/10.1080/02681102.2015.1048184>
- von Hippel, E., 2009. Democratizing Innovation: The Evolving Phenomenon of User Innovation. In: *International journal of innovation science*, 1(1), pp.29–40.
- Zook, Matthew A. 2002. “Grounded Capital: Venture Financing and the Geography of the Internet Industry, 1994– 2000.” In: *Journal of Economic Geography* 2 (2): 151– 77. Access: <https://doi.org/10.1093/jeg/2.2.151>.
- Zook, Matthew A. 2005. *The Geography of the Internet Industry*. Oxford, UK: Blackwell Publishing.
- Zook, Matthew A. 2009. “Internet, Economic Geography.” In: *International Encyclopaedia of Human Geography*, vol. 5, ed. R. Kitchin and N. Thrift, 555– 561. Oxford: Elsevier.
- Zook, Matthew A., and Michael H. Grote. 2017. “The Microgeographies of Global Finance: High- Frequency Trading and the Construction of Information Inequality.” In: *Environment and Planning A: Economy and Space* 49 (1): 121– 140. Access: <https://doi.org/10.1177/0308518X16667298>.

On the Cultural Sphere of Transnational Entrepreneurship: Evidence from Digital Business Development of African Entrepreneurs

Jörg Freiling¹

1 Introduction

While there is consent in literature about the positive impact of transnational entrepreneurs on host country entrepreneurship development, cases of high cultural distance between home and host countries of transnational entrepreneurs are largely unknown. This study addresses this gap by raising the question how the (cross-)cultural peculiarities of transnational entrepreneurship in case of high cultural distance influence the business development of transnational entrepreneurs. A single case study of a Ghanaian entrepreneur with businesses in Ghana and Germany makes a first step towards responding via explorative empirical fieldwork. The findings reveal considerable obstacles for the African entrepreneur to business development and unique assets primarily of the cultural kind as well as fundamental strengths to advance business development.

There is growing evidence that transnational entrepreneurs spark regional development through innovative business models. Entrepreneurship research already spent much attention to understand the peculiarities of transnational entrepreneurs. There is already some evidence of the roots of this specific innovation potential. While certain scholars point to the mixed embeddedness of transnational entrepreneurs (Kloosterman et al., 1999; Kloosterman, 2010), others mention cognitive factors that relate to the migration path like intercultural competencies (Harima et al., 2016). Also, the specific access to ethnic resources seems to play a role (Drori et al., 2009). All the mentioned aspects are related to cultural issues of the entrepreneurs' home or host country.

This cultural facet of transnational entrepreneurship, however, is still not well understood. While international business research differentiates between interna-

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tional management and intercultural management, a similar distinction in entrepreneurship research does not exist. Particularly transnational entrepreneurship followed the path of considering the cultural dimension within transnational entrepreneurship studies. It is not the purpose of this paper to claim a similar research line of transcultural entrepreneurship in entrepreneurship research. However, this research project tries to deepen the cultural sphere of transnational entrepreneurship research by condensing prior research and confronting it with first evidence from the field. Particularly, this research project considers the construct of cultural distance that is well known in international business research, but not playing an adequate role in transnational entrepreneurship research to date (Hofstede, 1991; Trompenaars, 1993). The cross-cultural dimension and the debate on cultural distance, however, is of pivotal interest when it comes to understanding obstacles to business development and diversity potentials to be tapped. The according research question of this research project is: *how do the (cross-)cultural peculiarities of transnational entrepreneurship – in the light of cultural distance – influence the business development of transnational entrepreneurs?*

Against this background, this research project builds on an empirical background with a high cultural distance between the home and host country society with a typical transnational constellation, i.e., standing business and private relationships to both the home and host country with respective exchange processes of resources being relevant to the business development of transnational entrepreneurs. The empirical context refers to African entrepreneurship in Central Europe and addresses the context of digital entrepreneurship so that the venturing activities also have an impact on digital transformation processes.

In terms of the research design and the related methods, the paper adopts a social constructivist viewpoint and seeks to identify structure and meaning in data. For this sake, data stems from personal interviews, field observations, and secondary data and allows developing a single case study (Yin, 2018). A single case study allows deeper dives than multi-case studies and can, thus, open the field for following studies to recognize patterns beyond the chosen case. While the procedure is inductive in nature, data analysis is accompanied by insights from prior research following the systematic analytical approach of Gioia et al. (2013). The whole research process rests on an interactive research design according to Maxwell (2013) that provides researchers with flexibility in the process of defining research goal, research design, research question and methods, based on increasing insights during the study.

The research project contributes to transnational entrepreneurship research by specifying the cultural dimension and stressing the specific situation when cultural distance between home and host country of the transnational entrepreneurs comes into play. By illuminating the upside and downside risks of transnational entrepreneurship in case of high cultural distances, the paper specifies cultural facets of transnational entrepreneurs to deal with upside risks and to develop higher levels

of resilience and hope that help them continuing venturing effectively also when it comes to severe adversities and disaffirmations.

After this introduction in this section 1, section 2 provides conceptual foundations and clarifies terminology as well as state of the art in research on transnational entrepreneurship, transculturality in transnational entrepreneurship research, cultural distance in transnational entrepreneurship, and the context of digital transformation by transnational entrepreneurs. Section 3 portrays the method employed and specifies the research design. While section 4 presents the results, section 5 discusses them in the light of prior research. Section 6 concludes and provides policy implications.

2 Conceptual Foundations

Transnational Entrepreneurship. The research stream on transnationalism in entrepreneurship rests on migration sociology rather than international business and governance research. At its core, transnational entrepreneurship focuses on a new development in migration entrepreneurship that departs from former views of immigrant entrepreneurship as a unidirectional move from one country to another where venturing activities unfold (Glick Schiller et al., 1997; Portes et al., 2002; Light, 2010; Henn, 2014). Transnational entrepreneurship marks a new step insofar, as modern IT solutions and increased mobility enabled by most recent logistics solutions allow people to move to a new country where venturing takes place with the decisive difference that new relationships in the host country arise while embeddedness in the home country continues (Drori et al., 2009; Harima et al., 2016). Resources from at least the two involved countries are addressable and newly built relations between available resources allow reaching new levels for the sake of business development that did not exist in a similar fashion before. To tap the available potentials, transnational entrepreneurs tend to move between these different country contexts (and very often they also commute between different cultures) and build bridges between them (Portes et al., 1999; Levitt & Jaworsky, 2007; Yeung, 2009; Drori et al., 2009). Based on specific and educated skills of opportunity recognition (Drori et al., 2009), these processes may fuel processes of ideation and business development and provide at least the host country with innovative business concepts. However, whether these processes unfold, depends to a large extent on the intercultural competency of the transnational entrepreneurs (Harima et al., 2016) and their visionary power to connect resources from different countries for business development purposes (Yeung, 2002). Sometimes and particularly after going international, also home countries may benefit from this kind of diversity of the transnational entrepreneurs that not only commute physically

between the countries, but also mentally. The home country benefits rest on business transactions of the transnational entrepreneurs, as well as transfer of knowledge and experience.

At the centrepiece of this diversity-based business development and renewal stands the access of the transnational entrepreneurs to three different networks (Portes et al., 2002), mirrored in the concept of mixed embeddedness (Kloosterman et al., 1999), and, related to that, the development of social capital (Henn, 2014). As for the embeddedness in different country contexts, transnational entrepreneurs stay in touch with the home country society by nurturing contacts to family members and (business) acquaintances. Notably, these relationships may get weaker over time, but do not diminish even in later generations of transnational entrepreneurship. Insofar, these home country networks are an important pillar of business development and help building social capital.

Besides this kind of embeddedness, transnational entrepreneurs try to build networks in their host country. Due to integration issues into the host country society, typically two kinds of networks develop: ethnic networks and host country networks. The former relates to those people of the same country or country region, sometimes also people who share the same culture or cultural roots. Besides religious beliefs, it is often the ethnicity that brings these people together. As values are similar and communication within this network works, access to these ethnic networks is of pivotal relevance when entering the country. Those ethnic networks provide a basic orientation in the host country and bring people together who are in similar constellations, all of them requiring support. Sometimes these networks help accessing the other parts of the civil society in the host country, but sometimes the opposite holds: the networks are part of ethnic enclaves (Portes & Bach, 1985). In the first case, the in-coming transnational entrepreneurs get access to the mainstream society, in the latter case their business focuses on the ethnic community without significant integration and often ending in an isolation of this group. In all cases, these networks help developing a transnational business by resources from this community, but not by the mainstream society (Ram, 1994; Zhou, 2013; Henn, 2014).

The third kind of networks are those to local people of the host country society. Access to these people is often difficult due to language barriers, cultural distance, limited interactions, or already existing relationship structures. After being more familiar with the host country society and first successful steps of socialization the situation may turn and host country network structures develop on a business or private basis. This helps to explain why the first network structures in the host country belong to the ethnic ones.

When it comes to understanding the nature of network peculiarities of transnational entrepreneurs, the role of their cultural imprint is visible. In a recent study, Mitra and Basit (2021: 121) note: “(...) personal networks of second-generation

female entrepreneurs of Pakistani origin are a product of gender, culture, and religion, where choices in kinship, friendship and business or professional ties in those networks, are underpinned by the complex mix of gender, culture, and religion”. This finding reminds us to be aware of the cultural sphere of transnational entrepreneurship.

Transculturality in Transnational Entrepreneurship

While research on international business carefully differentiates between international and intercultural management issues, research on transnational entrepreneurship does not adopt this separation. Insofar, transnational entrepreneurship research seems to stress the question of crossing national borderlines (Portes et al., 2002; Drori et al., 2009). However, issues of moving beyond cultural spheres play an important role as well (Drori et al., 2009). Nevertheless, there is virtually no explicit stream of ‘transcultural entrepreneurship’.

To unveil these transcultural issues of transnational entrepreneurship (TE) research, we can refer to Yeung (2002: 30), pointing to the “(...) the social and business networks, in which these TEs are embedded, political-economic structures, and dominant organizational and cultural practices in the home and host countries”. Drori et al. (2009: 1007) add: “The transnational entrepreneur appears to be a person who can operate in two worlds”. Moreover, Aldrich et al. (1989) stress that entrepreneurs transcend essential cultural dichotomies, and Sewell (1992: 20) identifies “(...) the capacity to appropriate, reproduce, and, potentially, to innovate upon received cultural categories and [socioeconomic] conditions of action in accordance with their (actors), personal and collective ideas, interests, and commitments”.

Against this background, there is a strong transcultural dimension deeply embedded in transnational entrepreneurship that can be carved out and further illuminated, focused on the following topics: (i) mixed embeddedness and social capital, (ii) access and use of ethnic resources, and (iii) intercultural competencies of transnational entrepreneurs.

Mixed embeddedness of the social and institutional kind rests, as portrayed above, on access to home country, host country and ethnic networks, as well as to related parts of markets and societies (Kloosterman et al., 1999). These network structures deviate from local entrepreneurs considerably, thanks to the cultural background of transnational entrepreneurs. Kloosterman et al. (1999) point to the opportunity to form social capital this way – and to replace other capital gaps which transnational entrepreneurs might face. This social capital is embedded in the social relations which transnational entrepreneurs employ for business development. Through social capital they transfer knowledge and experience between different locations and provide resources being relevant to venturing processes (Henn, 2011; Westlund & Bolton, 2003).

Ethnic resources overlap with the social capital which they can access by their transnational status; they can go beyond it by comprising other kinds of capital being relevant to venture development that are open only for transnational entrepreneurs. Drori et al. (2009: 1007) claim in this context: "(...) transnational entrepreneurial behaviour and motivation (...) depend on the resources available to the entrepreneurs (...). These resources include, e.g., symbolic and material resources, professional knowledge and skills, cultural capital, and a social position within an organization (...)". It is obvious that these ethnic resources are rooted in culture and add to the debate on transculturality in transnational entrepreneurship. However, ethnic resources like the ones mentioned above can only be viewed as enablers and they form a certain structure which transnational entrepreneurs can build on. What makes them valuable for venture development depends on an ethnic resource category at the meta-level. In this vein, Harima & Baron (2020: 31) add to the discussion: "What determines the characteristics of transnational entrepreneurs is not simultaneous entrepreneurial engagement in home and host countries, but the way they compose resources from different nations to create transnational entrepreneurial value." Putz (2003: 557) claims that transnational entrepreneurs employ certain schemes within symbolic orders "(...) leading action in social practice, namely as a 'repertoire' which offers various options of how to act and to which agents can have reflexive access". Drori, Honig & Wright (2009) support the view to go beyond structure and to consider the capacity of transnational entrepreneurs to use their 'cultural toolkit' and to employ these cultural resources for the reconstruction of action. Thereby, they point to the action-oriented role of culture and the interesting fact that cultural boundaries are different from national borders in that they are fluid and implicit (Drori et al., 2009). In this sense, there are two facets of ethnic resources that drive the business development of transnational entrepreneurs: access to ethnic resources and making use of them by understanding their complex nature for taking deliberate decisions.

The intercultural competencies of transnational entrepreneurs depend on experiences gathered in different national and cultural settings. In connection with an individual absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002) they recognize, assimilate, and apply knowledge being relevant to venture development from different sources that allow bridging between different contexts. Based on accumulated knowledge on business practices in the different regions where they are familiar with, transnational entrepreneurs learn more and more what kind of elements of a business concept are useful to provide solutions that go beyond established standards (Portes et al., 2002). Drori et al. (2009: 1007) add: "TEs equipped with broad cultural tools benefit from their social presence in both origin and host countries, increasing their latitude in negotiation and their ability to recognize and manipulate and act upon opportunities for business creation, maintenance, and outcomes". Insofar, they build on their idiosyncratic experiences, skills, and cognitive scripts that relate to an educated understanding of

values and cultural aspects in different locations (Drori et al., 2009; Lundberg & Rehnfors, 2018).

Cultural Distance in Transnational Entrepreneurship

While the preceding sub-section should show that the (cross-)cultural sphere is of pivotal relevance to an understanding of the very nature of transnational entrepreneurship, the question arises whether (high) cultural distance between home and host country cultures impacts the business development activities of the respective entrepreneurs. As transnational entrepreneurship research differs from research on international and intercultural management, the role of cultural distance between home and host societies did not play a crucial role so far, although – on another level – scholars like Vertovec (2007) identified the phenomenon of ‘super-diversity’. This super-diversity refers to the “(...) dynamic interplay of variables among an increased number of new, small, and scattered, multiple-origin, transnationally connected, socio-economically differentiated and legally stratified immigrants” (Vertovec, 2007: 1024) and rests on the individual level, not on the societal one. The somewhat neglected role of cultural distance is one reason why this research project considers this issue that traces back to the seminal work of Hofstede (1991) and Trompenaars (1993). While Hofstede (1991) focuses on national cultures as starting point for dealing with cultural dimensions that differ around the globe, Krueger et al. (2013: 703) state: “(...) ‘culture’ cannot be equated to nation anymore. Multiculturalism and immigration are widespread characteristics of present-day societies, and different sub-cultures do exist within any given country”. Trompenaars (1993) is more interested in analysing cultural differences to understand culture as a dynamic process of dealing with challenges and problems. As this view is closer to the ambition of this research project, it makes sense to consider cross-cultural differences along this understanding. In this vein, Schwartz (2004) seeks to map and to interpret cultural differences around the globe and applies a seven-factor framework, made of the following dimensions: egalitarianism, harmony, embeddedness, hierarchy, mastery, affective autonomy, and intellectual autonomy.

When Schwartz (2004) compares different cultural regions around the globe, the contrasts between the Western culture, particularly as practiced and lived in Western European countries, and the cultures in Sub-Saharan Africa are sharp and mark a high cultural distance. Moreover, when mapping the cultural regions by positioning 67 countries, the cultural distance between Germany and Ghana in the respective co-plot map belongs to the highest ones. This led to favouring transnational entrepreneurship of Ghanaian entrepreneurship in Germany.

Schwartz (2004) argues that the culture of Germany is embedded in the country as follows: low levels in hierarchy, mastery, and embeddedness, while it reaches very high levels in terms of egalitarianism and intellectual autonomy. In the case of Ghana, the cultural profile rests on very high levels in mastery and

embeddedness, while harmony, egalitarianism, and intellectual autonomy range on very low levels.

Transnational Entrepreneurship and Digital Transformation

While one of the main consequences of one-way immigrant entrepreneurship is about 'brain drain' because of potential, nascent or young entrepreneurs leaving the country – oftentimes for good –, transnational entrepreneurship in recent times is about the transfer of ideas, business concepts, and (digital) technologies. The – somewhat strangely sounding – metaphor 'brain circulation' seems to replace the 'brain drain' notion and points to potential 'brain gains' from both an entrepreneurs' and regions' viewpoint (Saxenian, 2002; Saxenian, 2005; Liu et al., 2009; Kerr et al., 2016). Saxenian (1999) belongs to the first scholars pointing to this fact, also in technology-driven start-ups of the emerging digital age in the context of Silicon Valley. While these effects seem to hold for transnational entrepreneurs in general, we can expect a more intense imprint when it comes to serial entrepreneurs. In those cases, entrepreneurs founded more than one venture and did transfer knowledge and experience from one business to another – sometimes at the same time, sometimes in inter-temporal regards, depending on the context.

Knowledge and experiences belong to the category of the so-called 'generative resources' (Moldaschl & Fischer, 2004; Freiling, 2004). The distinction of finite, regenerative and generative resources according to Moldaschl and Fischer (2004) rests on the immanent logic of reproduction with finite resources being consumed in use, regenerative resources regeneratable by human effort, and generative resources being created and augmented in use. This implies that the transfer of those resources from one business case to another allows resource emergence and augmentation. This process can be supported and accelerated by means of digitalization. Insofar, there is a certain economic logic behind transferring resources of transnational entrepreneurs and to capitalize on ethnic resources.

One can expect that these upgrades may at least hold, maybe increase when resource transfers relate to diverse, yet related settings. Among such settings are knowledge and experience transfers of serial entrepreneurs between their own ventures in the host and home country. This kind of transfer between different locations works particularly well in case of digital businesses and allows accessing high-growth markets. Other reasons for addressing digital business development of African entrepreneurs relate to the facts (i) that the transnational character of the venturing requires digital equipment, (ii) that African entrepreneurs go more and more for developing digital businesses, and (iii) that tendencies in international affairs like the overfishing of West African fishing ground pushed particularly West African countries to reorientate their economic structures and to go for digital solutions in all economic sectors (Davis, 2007). This made African entrepreneurs employ modern digital solutions to improve farming – e. g. by drones

and robotic solutions, supported by artificial intelligence solutions, as in the researched case. Against this background, the research question is: *how do the (cross-) cultural peculiarities of transnational entrepreneurship – in the light of cultural distance – influence the digital business development of transnational entrepreneurs?*

3 Method and Research Design

The choice of an adequate research design and related methods should clarify the ontology and the epistemology. Moreover, the choice should take the ‘anatomy’ of the research phenomenon and the state of research into account.

Epistemology. While culture with all its complex internal structures and temporal connections belongs to the complex phenomena in terms of the philosophy of science (Hayek, 1964), the complexity challenges the minds of the researchers and leads them to subjective constructions of the reality which is, therefore, dependent on the perception of the researcher (Kukla, 2000). A response to this constellation is the adoption of a constructivist viewpoint which is also the epistemological frame of this research project. With the rather stable but not static character of culture, it deems useful to build on the interpretive paradigm of organization and management theory according to Burrell and Morgan (1979) and to establish an analytical procedure that seeks interpretations when studying reality. Following Morgan (2007), the interpretive procedure rests on induction.

Ontology. In ontological regards, this research focuses on the transnational entrepreneur as unit of analysis. It considers explicitly the transnational ventures founded by the entrepreneur as core manifestations of the entrepreneurial activities, but always under this organizational umbrella.

State of Research. As mentioned above, transnational entrepreneurship is already aware of its transcultural dimension, although certain findings are still fragmented. What is lacking, instead, is a sound understanding of the role of cultural distance and how far distant cultural elements may be beneficial or detrimental for business development. Regarding the early state of research, it deems necessary to conduct explorative research of the early stages. This implies preference for qualitative research methods to allow a deeper dive into the complexity of the research phenomenon.

Method. Qualitative research can rest on different methods. When researching cultural phenomena, particularly ethnographies and research case studies stand at the fore (Denzin & Lincoln, 2011). While ethnographies allow deep dives into cultural facets, they often consume very much time and have a specific profile regarding validity and reliability. Case study research is easier to handle and to conduct while a sound choice of data sources allows reaching an attractive position

as for quality assurance of data sourcing and handling. Moreover, Yin (2018) clarifies that case study research is an appropriate choice depending on the kind of research questions. When raising questions on the how and the why, case studies are adequate responses. Against this background, this research project rests on case study research and favours the single-case study mode according to Yin (2018). The single case design does not offer claims for generalizing the findings. Instead, intended outcome of the research process is a better understanding of a particular case that animates researching follow-up cases to move to theory building from the case study approach as proposed by Eisenhardt and Graebner (2007).

Case Selection. Criteria for case selection are based on the above considerations: (i) a digital business background, (ii) an evident socialization in both the home and the host country, and (iii) a case of high cultural distance. The developed case study is about a Ghanaian entrepreneur who founded a business in Ghana. Afterwards, he went to Europe, arranged partnerships in Estonia and launched a new business in Germany. In both cases, the Ghanaian entrepreneur developed digital solutions, namely a drone project for rural regions in Africa and a robotic solution for wind turbines in Germany. However, both the applications and the industries differ. Nevertheless, the digital business concepts as well as the digital competencies raise the question of ‘cross-fertilizations’ among the different start-up foundations.

Data Sourcing. Primary source of empirical data are three interviews. The interviews should provide different angles to understand the business activities more comprehensively and to allow data triangulation. Interviewees were the entrepreneur (E), a business advisor focused on cross-cultural management (A) who accompanied the business development in Germany of E-Drones as well as E-Robotics for a long time, and a supporting business partner (P). The interviews were conducted between March and July 2021 and lasted about 65 minutes on average. They were all held in English as favoured language of the interviewees. Due to the pandemic, the interviews were conducted as video conferences via zoom software. All the interviews were recorded and transcribed. To avoid influencing the answers of the interviewees by the interviewer, the type of semi-structured interviews was chosen. Accordingly, the first major step after a brief introduction and a small section on socio-demographics was a narration of the interviewee to tell the run of events chronologically. The second step was about questions developed from the research question and the research objective of the project. A prior test of comprehensibility was conducted. Accompanying sources were field observations and a review of published materials and internal documents. Those additional data sources should allow higher levels of data triangulation.

Data Analysis. According to the above considerations, the analysis follows the systematic inductive approach according to Gioia et al. (2013). This procedure allows analysing data at first and to move from raw data to open codes without any theoretical pattern in mind to give meaning to data. In this vein, the first step

was an initial line-by-line coding to identify the most important thematic content out of data. The next step was about structuring and giving meaning to data which implies a consolidation of the open codes and a move to selection codes, followed by a theoretical coding that employs theoretical frames from prior research (Charmaz, 2014). The entire coding was an iterative process that involved moving back and forth to develop a structure with 25 first-order concepts, eight second-order categories, and three aggregate dimensions – as visualized below in Figure 1. MAXQDA software supported the data analysis process².

Quality Assurance. To enhance the trustworthiness of the qualitative empirical research, the following measures were taken according to Flint et al. (2002) and Gersch et al. (2009). First, credibility as the extent to which results are acceptable representations of reality was achieved through gathering feedback from the informants prior and during the interpretation process. Second, the theoretical guidance with the interpretation process allowed transferability as the extent to which findings from one study on one context apply to other contexts. Third, integrity as extent to which interpretations are influenced by misinformation or evasions by participants could be achieved by four measures: built trust with interviewees prior and during the interviews, triangulation (through three angles and other data sources), anonymous handling of the data, and a bias check of the interview guideline. Fourth, a pervasive orientation of every step along the research question and objective and the theoretically guided analysis helped arranging fit as the extent to which findings fit with the substantive area under investigation.

4 Findings

The single case study focusses on a Ghanaian entrepreneur (E - for reasons of anonymity) with digital business foundations both in Ghana (drones in rural regions – E-Drones henceforth) and in Germany (robotic solutions for wind turbine maintenance – E-Robotics henceforth). E (entrepreneur) has left Ghana in 2010 and came to Germany in 2016 for private reasons. In the time between he stayed in Spain for two years, in the United Arab Emirates for one and a half years, and then he went back to Ghana for half a year. Afterwards, he spent some time in Turkey and about a year in Lithuania, with some interruptions when he moved to Latvia and Belgium and later to Germany. During this course, he was permanently in touch with Ghana. Insofar, he disposes of a truly transnational profile with imprints from many countries. This findings section starts with the two case descriptions to provide a brief overview of the businesses. The next sub-section presents

² See on the method: https://www.maxqda.com/download/researchnetwork/MAXQDA_2018_Introduction_EN.pdf

the inductively developed findings in a structured way by employing the theory according to the Gioia et al. (2013) procedure. To advance the process of theorizing, the section concludes with a model that seeks to synthesize the structured factors in a simplified way.

Case Description E-Drones

The Entrepreneur (E) founded this company in 2016 with its headquarters in Accra, Ghana. Initially, E (Entrepreneur) wanted to start an aviation company with a focus on aircraft leasing, sales, pilot training, cabin crew training, and similar services. Facing the limited market volume and market potential, E realized that a business redefinition towards digital transformation could bring him not a more favourable position. He described the shift as follows: “And then came the drone, the commercial drones coming out! So, I thought of jumping on this earlier stage. So that, you know, before it will become a very success or more commercialized. I added the drone bit to the company, and so we started commissioning drones, in operation for the mining companies, for, you know, the real-estate companies, and all of this in Ghana” (E-37 [paraphrase from the interview with E, section 37]). The redefined business went along with renaming the company to the current registered company name. From then on, E focused on the drone-tech company E-Drones, on the provision of drone-based total crop pest and nutrition management services in Ghana and beyond. The main aim of the company is to provide a comprehensive drone-based approach to crop pest and plant nutrition management in Ghana and neighbouring African countries to make farming easier, more effective, and more efficient. Today, the company E-Drones is a small business with some 30 employees that already reached the break-even years before and works profitably at a monthly revenue of about 1 million USD.

Case Description E-Robotics

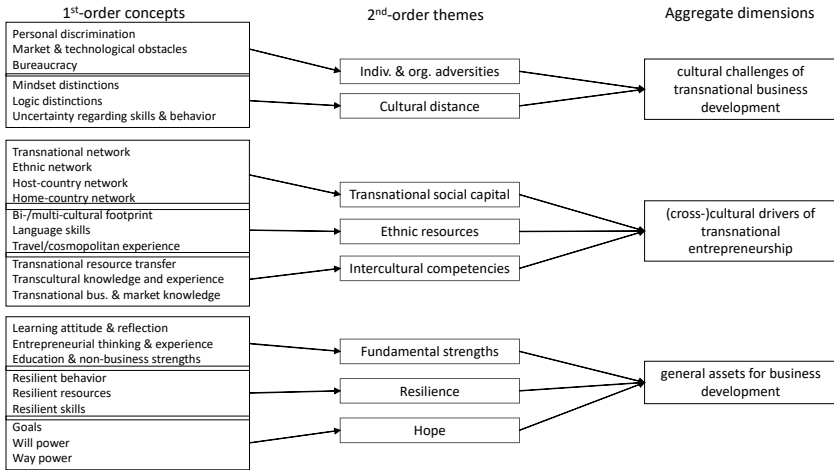
The foundation of E-Robotics took place in 2018 and was influenced by the situation that E spent most of the time working for E-Drones in Ghana, while his wife lived in Germany. With the original plan to provide similar drone-based services, E realized, based on his accumulated knowledge of the host country: “I wanted to do this service, but in Germany it’s not possible to use the drones the same way we do in Ghana, but in Germany, there are also wind farms – a lot of wind farms – where we can offer our robotic services” (E-37). Accordingly, E-Robotics became a (heavy lift) drone and robotic wind park maintenance, inspection, and repair service provider in Germany. E-Robotics offers wind turbine blade cleaning services, inspections, drainage hole cleaning, conductivity tests, coating, de-icing, and leading-edge repair services. It uses autonomous drone systems, coupled with AI (artificial intelligence)-strained software to perform maintenance and inspections in a way what manpower and even existing technology cannot perform. The digital solutions rest on end-to-end automated systems by using drones, sensors,

customised payload, artificial intelligently trained software, and data processing. E-Robotics rests on access to a technology of a Latvian company. The business is well suited to the German wind energy market which is of vital importance for the implementation of the so-called ‘German Energiewende’ (German energy transition from nuclear and fossil fuels to sustainable energy sources; see: Beveridge & Kern, 2013; Brandtner & Freiling, 2021). On the global scale, the installed base of wind turbine rotor blades is more than 1 million and expected to double until 2025, where each blade has a value of about 250,000 EUR. Wind turbine owners and/or drivers operate in a harsh environment with a strong need for monitoring and maintenance which can be easily supplied by ‘flying robots’ that replace the working of very scarce high-skilled technicians under dangerous conditions (HSA, 2021). The market receives a strong push, as changes in the regulatory framework will stop the use of manual labour. Insofar, the pressure to employ new technical solutions is very high. Already in 2020, the global wind turbine operation and maintenance market reached 11.29 billion USD, and predictions expect a volume of 52.74 billion by 2028 (Fortune Business Insights, 2021).

In this vein, the idea of connecting robotic wind turbine maintenance robotics with drones can be regarded as an outcome of the E’s transnational business experience in connection with the standing transnational network structures, here particularly in the Baltic region (predominantly Latvia).

Structured Findings. The Gioia et al. (2013) method implies starting data analysis inductively with the raw data and then to theorize by referring to prior research. This involves moving back and forth between research and data with a very prominent role of the second-order themes as transmitter between raw data and aggregate dimensions, with the latter loaded by the second-order themes. Analysing the raw data inductively allowed the development of 321 codes from interview transcripts and observation memos. The mentioned interactive procedure between raw data and prior research brought about a structure of first-order concepts, second-order themes, and aggregate dimensions exhibited in figure 1. Wherever possible, established conceptualizations of terms have been used to provide data with a framing grounded in theory. In many cases, prior research provided useful frames to structure the data. In some instances, however, data went beyond existing conceptualizations and extended available frames, and, in some cases, an established concept was simply not available to provide a frame. In these constellations, the structures emerged directly out of primary data. To structure the presentation of the findings below, the eight second-order themes provide a useful frame and an umbrella for introducing the 25 first-order concepts. This presentation equips the reader with paraphrases from field data in interaction with the concepts taken from prior research. For an overview, figure 1 highlights all the first-order concepts, second-order themes (SOT), and aggregate dimensions.

Figure 1: Data Structure



Source: Own illustration.

SOT1 – Individual and organizational adversities: Data suggests that in case of transnational entrepreneurship bridging high levels of cultural distance, individual adversities in terms of (i) personal discrimination stand at the fore and (ii) dominate market and technological obstacles, as well as (iii) bureaucracy.

(i) Personal discrimination. In this regard, the case of high cultural distance seems to go along with the most striking differences from prior research. E as an African entrepreneur, as well as advisor A and business partner P reported unanimously how hard it is for people from Africa to get accepted as person or businessman. Particularly other businesspeople from other firms have prejudices and related reservations when getting in touch with African CEOs like E. Among the factors driving this kind of rejection, ethnic origin and language factors stand at the fore which paraphrases and memos excerpts show:

Last year we had a project with Siemens, a very large project, but this project was cancelled, because the major company, which was in this project, who was connecting us to Siemens, does not want Siemens to know that the company, that was going to perform the job, is headed by a black person. (...) First, they asked me not coming for a meeting but to look for a white person to represent me in the meeting, you know, which was very upsetting and so, in the end, you know, this whole thing had to be cancelled, because I disagreed with, you know, how things were proceeded. (E-47)

E's German is a broken German plus he has the wrong skin colour! (A-45)

Deutsche Bank wouldn't even talk with them [African entrepreneurs]. (A-49)

A meeting with local business solution provider revealed that he does not see that African people have a sound background for launching a B2B-based business in Germany. (OM [Observation Memo]-5)

All the impressions collected in this regard left no doubt that such discriminations had a serious detrimental impact on the transnational business development and raised follow-up questions how transnational entrepreneurs, like E, found measures to cope with that.

(ii) Market and technological obstacles. For the businesses of E, it was a big advantage to be aware of developments in digital technologies and to recognize market opportunities. Nevertheless, he faced typical scepticism of adopting new solutions and related organizational change in business-to-business settings when potential customers employ a workforce that could be replaced by most recent drone/robotic solutions. Moreover, disruptive digital innovations like the ones of E-Drones and E-Robotics need a certain market size and potential to scale up their business. These organizational obstacles hampered the business development through shortening the financial runway due to sales on a lower level than expected. Moreover, recruiting was more difficult than expected.

We had a lot of resistance in the market and we, we realized that this resistance was just because companies, especially German companies were, they were being companies, you know. They see the potential in the technology, but they have already invested in the manpower. (...) The challenge that I see is, you know in setting up a company like ours, is in scaling up, I would say the market acceptance. (E-47)

(...) but if you do something that is innovative, like doing something with robotics in an industry (...) that is rather conservative, like, you know, the wind turbine business, then you come in with this double, you know, what is a double novelty aspect. (P-23)

(iii) Bureaucracy. While many entrepreneurs complain about bureaucratic structures and procedures when founding a venture, cultural distance in transnational entrepreneurship is an amplifier, as the transnational experience make entrepreneurs doubt about the sense of certain rules, procedures, and related institutions. While such bureaucracy may be inconvenient, the impact on business development is often limited (e.g., registration of disruptive business in existing, non-fitting categories) and in some cases restrictive ("you will find very few Afro-Germans with a good Schufa [Germany's general credit protection agency] rating. I mean this is again one thing that Germany needs to resolve, this whole Schufathing", A-49).

Based on the three sub-concepts, we develop the following research propositions (RP):

RP1.1. Personal discrimination has a strong negative impact on business development.

RP1.2. Market and technological obstacles have a negative impact on business development.

RP1.3. Bureaucracy has a negative, yet controllable impact on business development.

SOT2 – Cultural distance: The Trompenaars (1993) and Schwartz (2004) conceptualizations of cultural distance are both fine-grained and abstract in nature. Due to the limited fit to the data, the inductive procedure suggested a conceptualization of cultural distance along the following sub-concepts: (i) mindset distinctions, (ii) logic distinctions, and (iii) uncertainty regarding skills and behaviour. They also bridge between cultural differentials on the societal and the business level.

(i) Mindset distinctions. Cultural peculiarities like religion, values, or norms penetrate the minds of people considerably. Mindset differentials in different places, however, can hamper coordination of business activities. Insofar, transnational entrepreneurs in a cultural-distant context like E consider involving people and partners with a linking function between cultures as useful.

There are so many instances that I've needed experts to help me with my business here in Germany that I've relied on experts from Ghana, but better is, you know, if I can call somebody from Belgium or in Turkey, you know, so I think that the relationship when it comes to business in Germany, I would consider more close-by. (...) I would say the partners in Europe because they have the same mindset, you know, they have the same ecosystem or environment so to say. (E-78)

(ii) Logic distinctions. A logic relates to beliefs, assumptions, experiences, and industry-specific identities with predictable models of behaviour and action consequences of decision-makers (Bettis & Prahalad, 1995). One can argue that too divergent views on how the business should be conducted may cause substantial problems between business and transaction partners. Again, the case of E, particularly regarding E-Robotics, shows that high cultural distance in this respect is counter-productive for the sake of business development in terms of misunderstanding or simply misfits. Consequently, it deems useful to look for more proximity in terms of logics which, according to E-Robotics, helps bringing partners together.

(...) so, something that works in Turkey can work in Germany, but if you take something that is working in Ghana and you bring it here to Germany, it will never work. (E-78)

(iii) Uncertainty regarding skills & behaviour. Cultural distance is a phenomenon that can often be perceived right from the scratch when people meet. In case

of high cultural distance, particularly local people in a certain country find themselves challenged with interpretation and are uncertain how an interaction takes place and evolves. Insofar, there may be behavioural uncertainties from the very beginning. It depends to a large extent on the specific situation whether this uncertainty is beneficial for the transnational entrepreneur. In the case of E, the reactions are ambiguous.

But the people who have worked with him, yes, there seems to be nobody neutral. There are the people who think: “Oh, this guy is fantastic!” Absolutely! And then there are the people who will try to find, you know, something, they deal with him in a way they would not be dealing with other Germans. (A-81)

Against this background, we propose:

RP2.1. Considerable mindset distinctions have a negative impact on business development.

RP2.2. Considerable logic distinctions have a negative impact on business development.

RP2.3. Linking people or partners bridge mindset and logic distinctions.

RP2.4. Skill- and behaviour-based uncertainties have a divergent impact on business development that tends to go to extremes.

SOT3 – Transnational Social Capital: The sub-concepts of transnational social capital can directly build on the mixed embeddedness construct and the related three types of networks, identified in the literature: ethnic, host-country, and home-country networks (Kloosterman et al., 1999; Harima et al., 2016). However, due to the transnational and transcultural dimension of the case, the findings reveal that another kind of network is of pivotal relevance when it comes to transnational business development: the transnational network. Transnational networks comprise people neither residing in the home country, nor in the host country, but in third countries in which the transnational entrepreneur is familiar with.

(i) Transnational network: Thanks to the long migration path with many steps between the start in Ghana and Germany as destination and many cross-country travels, the transnational entrepreneur E developed so many relationships all over the world that he can easily approach the right partners for upcoming issues. These network relationships developed over time in terms of quality, so that E does not only know many people from different countries but has managed to build trustful and convenient relations. Moreover, the transnational network was for E a source of ideation with the Latvian partner, that finally led to the foundation of E-Robotics.

So, whilst doing that I came into contact to Latvia to visit friends there, I came across this [Latvian] company who had developed very giant, huge drones that they were using to remove the icing on the wind turbines. So

I contacted him, then I told him what I'm already doing in the wind turbine industry, and they were also new, they didn't know anything in the market, they just built a drone and they wanted to come in the wind turbine market and I said: "Look, I can hold your hand, because I have studied something already, I can guide you through the industry and then, you know, we came together and were growing together, shared business ideas, experience, and so on. So, that was how I met this company from Latvia" (E-41).

He knows how people, you know, through his time in Turkey, he knows, he is at ease with them. (...) Same is with his contacts in Latvia or with Spanish people or with African people, he's just totally at home in that sense in Germany. (A-69)

You have the choice to select certain partners from so many different countries you're familiar with in terms of knowing them and speaking even their languages. (E-79)

So, most times, I'm always on the phone with partners or with my network friends that I've got over the years in Israel, in Turkey, in Belgium, and all of that. (...) I think that the network you build in the host country is important, but the network you build internationally is more important. (E-72)

(ii) *Ethnic network*: These networks can be beneficial for merely socializing with people in the host country with the same cultural roots or – in extreme cases – for building the business around this community. The latter often leads to life in ethnic enclaves. One can reason that those transnational entrepreneurs with high cultural distance between home and host country tend to this mode of network prioritization. Case evidence, however, reveals a different constellation. Members of the ethnic community help transnational entrepreneurs to keep important elements and values of the former life in their home countries and so they provide a certain grounding. As the high cultural distance causes a chasm between transnational entrepreneurs and host-country society, members of the ethnic community are prime candidates for friendships. Insofar, ethnic networks reinforce the social position of transnational entrepreneurs once they got victim of personal discrimination. Moreover, those people are valuable candidates for human resource recruiting, particularly in case of growing business. The forms of embeddedness are emphasized in the following comments.

The embeddedness in the Ghanaian community specially in [name of the town in Germany], yes, it's part of what gives him a strength. (...) Somebody who separates from that community, does not belong to that one anymore, and kind of stands alone in facing the racist attitude in Germany. (A-75)

I have access to them, so, we – I mean Ghana is a Christian country, you know, and most people from there are Christians, and we meet at Church,

we have a local Church, a Ghanaian Church here, we're ten, this is where we mostly meet on Sundays, and I mean, we see friends and families from Ghana who are also here in Germany. (...) but we should get to the point that we will need technicians for our robotic team, we can be able to reach out, we can also go to the African community (E-82)

80 or 90% of my friends are also from African descent. (E-86)

(iii) Host-country network: Cultural distance is a factor that makes it hard for transnational entrepreneurs in such constellations to build relationships to people from the host country. This holds particularly for private relations. Business relationships can be a chance to develop connections and to convert them to more private ones. However, also this chance is hard to take due to the cultural distance. However, the small number of addressable people can be rather beneficial in case of good relationship quality, as the relation between advisor and entrepreneur shows.

In the first step I provided the structure, right. How do you develop a business? How do you start a business and what are the different parts of a business that you need to bring together? We developed together any kind of documents, budgets (...) then I helped him to identify the people he needs to get the work done. (A-38)

I've tried for different African businesspeople to open a bank account with Deutsche Bank, and it is impossible. They refuse. So, we finally got Sparkasse, made it with them, and they were very positive about it. (A-49)

We're working in partnership with Fraunhofer. (E-45)

(iv) Home-country network: Transnational entrepreneurs have the longest and deepest relationships typically with people in the home country. This holds in case of cultural distance as well. In this specific case, the home country relations broaden the resource endowment and provide emotional stability.

If he would not be well-connected to the Ghanaian community in Ghana, he wouldn't have had the money to start a business here in Germany. (A-75)

Every year I travel to Ghana at least two times, you know, because part of my family is still living in Ghana, and for me it's about the technological transfer, transfer of the knowledge that I'm building. (E-76)

In view of the findings, we propose:

RP3.1. Availability and quality of transnational networks have a strong positive impact on transnational business development.

RP3.2. Ethnic networks foster transnational business development through providing social stability and business-relevant resources.

RP3.3. Ethnic networks partly compensate for rejection-based frustration of transnational entrepreneurs.

RP3.4. Host-country networks are very hard to develop but have a strong impact on business development in case of workability.

RP3.5. Home-country networks facilitate transnational business development through resource transfer and mental support.

SOT4 – Ethnic Resources: Based on the conceptual part and the results of prior research, the results regarding ethnic resources relate to three sub-concepts, namely: (i) the ‘transcultural footprint’ of transnational entrepreneurs, (ii) language skills, and (iii) their travel/cosmopolitan experience.

(i) Bi-/multi-cultural footprint: This transcultural imprint can be made of almost all cultural elements, be they more explicit like stories, narratives, etc., or be they implicit in terms of values, norms, beliefs, and similar things. It is to a large extent this transcultural footprint that brings about an ideation which provides business development with an innovative touch different from business concept development of locals. Over and above this, this transcultural footprint can also be a measure to open minds of and doors to host country people. In this case, all this plays a role, as the paraphrases below show.

Where other people, you know, have a problem to envision, you know, how this could play out in the one country or in the other country and what kind of people there are, and how people might react and things like that, he already has that experience. (A-69)

Being raised in sub-Saharan Africa, he has been raised in several cultures. (A-73)

readiness, the willingness, the ability to just go somewhere and arrive in a way that people talk with you (A-73)

(...) finding, again, the right tonality to engage with people. (P-23)

(ii) Language skills: As language is at the heart of culture, language skills foster business development in the host country. In case of high cultural distance, high-level language command is a challenge for transnational entrepreneurs. In this case, E (entrepreneur) has skills to speak a two-digit number of languages. However, this goes at the expense of German language command that ranges on mid-level.

I think without the language, it is going to become very, very difficult to master good business in Germany, even though you can run a business. (P-25)

(...) there’s language. And when we go into meetings together, then I’m indeed the one pushing the meetings to be in English although I know that Germans are not really comfortable with it, but only in English he can really show his strengths. (A-79)

(iii) Travel/cosmopolitan experience: Travel experiences from visits in many countries often implies to get more familiar with different people and different

societies and to socialize quickly. Moreover, this helps building and reinforcing network structures. In case of E, data confirms the considerable travel experience.

The considerations allow developing the following propositions:

RP4.1. By selectively transferring culture-specific attitudes and behaviours to the host country, a transcultural footprint fosters business development.

RP4.2. Language skills have a positive impact on business development.

RP4.3. Travel experience has a positive impact on business development.

SOT5 – Intercultural Competencies: The fostering effect of knowledge and experience on building competencies is undisputed (Zollo & Winter, 2002). To understand the specific transnational dimension, three aspects of capacity building stand at the fore: (i) transnational resource transfer, (ii) transcultural knowledge and experience, and (iii) transnational business and market knowledge.

(i) Transnational resource transfer: What makes transnational business development more disruptive, is the combination of ideas and concepts from different regional settings. In this vein, a huge cultural distance can be useful to ideation. Moreover, the more sources of ideas and concepts from different countries are available, the more powerful a transfer of resources from different locations to the transnational business can be. However, besides intellectual resources also mundane assets like financial capital may fuel transnational business development. In this case, there is a resource transfer between E-Drones and E-Robotics, as well as a transfer from other countries where E (entrepreneur) resided to the countries where he founded.

I wanted to do service, but in Germany it's not possible to use the drones the same way we do in Ghana, but in Germany, there are also wind farms – a lot of wind farms – we can offer our robotic services. (E-37)

Everything that I start to do in Germany I find a way to replicate that in Ghana. (E-76)

The financial challenge is: It just doesn't make sense to take money from Africa and invest it in Germany. (A-40)

(ii) Transcultural knowledge and experience: The resources in this regard are of the general kind and may accompany the business resources below. They provide a certain basic orientation and understanding that makes interpretation of settings easier when high cultural distance plays a role. Moreover, resources of this kind contribute to a certain mental strength that is beneficial when it comes to the typical challenges of new venture creation. Field data supports this.

(...) even trying to migrate to one country, it builds you up so strong, you know that something that will discourage a local entrepreneur, will not discourage you. (E-68)

Personal life experience will support the business experience that you have. (E-70)

(iii) Transnational business and market knowledge. This kind of transnational knowledge is business-related. The effects are like those of the general resources mentioned above. A difference is, however, that this business knowledge is a crucial driver of opportunity recognition.

Sometimes, the product or the business that you are running is not favourable in that country that you're in, you know, the host country, but it has a market in a foreign country, and this is where I see the advantage for the transnational entrepreneur. (E-66)

Against this background, we propose:

RP5.1. Capacities in transnational resource transfer positively impact business development.

RP5.2. Transcultural knowledge and experience positively impact business development.

RP5.3. Transnational business and market knowledge positively impact business development.

SOT6 – Fundamental strengths: When transnational entrepreneurs need to bridge considerable cultural distances, their challenges are manifold and require basic strengths besides psychological issues to be discussed in SOT7 and SOT8. Data suggest that these fundamental strengths relate to three sub-concepts, namely: (i) a learning attitude and reflection, (ii) entrepreneurial thinking and experience, and (iii) education and other non-business strengths.

(i) Learning attitude and reflection: There is already strong evidence in literature that entrepreneurial learning stands at the fore when it comes to business development (Politis, 2015). The same holds for (self-)reflection and a related 'fail forward' attitude. For transnational entrepreneurs challenged by high cultural distance, this seems to hold even more. The case supports this view and adds modesty as an important attribute, as the following paraphrases show.

So, he makes very strong moves and constantly learns new things. (A-61)

I think he's a great guy, but he doesn't think in these dimensions, he doesn't think he's a great guy, he thinks there's a great job to be done. (A-61)

(ii) Entrepreneurial thinking and experience: For business development it makes a difference when entrepreneurs possess an entrepreneurial predisposition, show an according behaviour, and are familiar with performing entrepreneurial functions (Lumpkin & Dess, 1996; Freiling, 2008). This helps recognizing and developing entrepreneurial opportunities and tapping their potential. The following paraphrases show the relevance in this case of high cultural distance.

I started some businesses even when I was in high school in Ghana.

(...) German Aviation Capital, and so I spoke with them, then looked at their profile. (...) I knew they had aircrafts that were difficult to be sold and knowing I have so many contacts in so many different countries in

Asia, in Africa, and so I was able to convince them, not as an employee, but as a freelancer salesperson. (E-33)

(...) building the drone business in Ghana was – I mean you can see the timeline, right – summer 2017 he found out about agriculture and in summer 2018 his drones were out in the field, I mean – tack-tack-tack – this man pushes, he goes for it! (A-40)

(...) you also need to have an electrician that can dangle up there, a hundred meters high somewhere in the ropes. I mean who can do that? Not many of them. And so, the fact that in E's system you don't climb up there, you do not dangle, it's just the robotic arm that goes up. (A-45)

(iii) Education and non-business strengths: Particularly in case of digital business development, a sound education and accompanying values allow transnational entrepreneurs to cope with business development challenges in case of high cultural distance. Field data proves this.

I believe my ability to fight, to fight on, to keep the business moving, to fight at some difficult stage is from the strength that I have as a sportsman. (E-27)

So, while waiting to get employed as a pilot I could work as an aircraft salesperson, you know, and so this is what I did. And so just when I completed the training, I never even looked for an airline to work for. (E-33) You know, when I go down a little bit, or begin to doubt a little bit, so then I find answers there. And then he has – so that's the one part – where he finds strength in his spirituality. (A-65)

Once again, we conclude:

RP6.1. Continuous learning and (self-)reflection have a strong positive impact on transnational business development.

RP6.2. Entrepreneurial thinking and experience have a positive impact on transnational business development.

RP6.3. Education and non-business strengths have a positive impact on transnational business development.

SOT7 – Resilience: Resilience is a "(...) dynamic process of effectively negotiating, adapting to, or managing significant sources of stress or trauma" (Windle, 2011: 12). It rests on resource and network access, as well as identity. Entrepreneurship research reveals that resilient entrepreneurs are more likely to perform better entrepreneurial output measures (Ayala & Manzano, 2014; Saridakis et al., 2013). Resilience can, thus, be traced back to (i) resilient behaviour, (ii) resilient resources, and (iii) resilient skills.

(i) Resilient behaviour: The high cultural distance to the host country society causes challenges of orientation and coping with offending and humiliating human behaviour. To master these constellations, resilient responses enable transnational entrepreneurs to stay on the track of business development.

(...) coming through the door as the tall black guy is a challenge, so he always tries to be very friendly, very gentle, very low-key not to trigger any of these reactions. (A-40)

I've had a lot of racial unacceptability, so it's the distraction – if I'm able with this sort of distraction, it is also possible or easier for me to deal with other distraction that comes with your business. (E-68)

(ii) Resilient resources: Different from business resources, resilient resources provide a buffer when developments get rough from the entrepreneur's viewpoint.

Mental health is very important. (P-27)

(...) drive, personality, and humbleness. (A-61)

(iii) Resilient skills: These skills comprise previously learnt patterns that allow a certain controllable behaviour when it comes to shocks impacting business development.

Just deal with it as it is. Right. And to develop the sense of equanimity towards anything that happens in business and to think this is the reality. (P-27)

I have learned to build a thick skin and whenever it happens that way I tell myself that the best way to get out of this is to be the best. (E-62)

The according propositions are:

RP7.1. Resilient behaviour indirectly supports transnational business development by avoiding deviations.

RP7.2. Resilient resources indirectly support transnational business development by buffering social shocks in the host country society.

RP7.3. Resilient skills indirectly support transnational business development by pattern-based behavioural control in case of shocks in the host country society.

SOT8 – Hope: Like resilience, hope belongs to the constructs of positive psychology. To date, the role of hope in entrepreneurship is not well understood. Anyway, hope – as a learnt thinking pattern – can inspire, motivate, and activate transnational entrepreneurs in cultural distant settings that successful business development becomes more likely even in case of unfortunate events and circumstances. It can be of a preventing and enhancing kind when it comes to business development (Snyder & Feldman, 2000). Based on insight from positive psychology, particularly three pillars contribute to building hope, namely (i) goals, (ii) will power (agency), and (iii) way power (pathways) (Snyder et al., 1991; Luthans and Jensen, 2002).

(i) Goals: While way and will power provide the back-up factors of hope, goals are the benchmarks for which the people strive for. When transnational entrepreneurs believe in goals and attainment, they have enough sense of direction where to move. This holds in the studied case as well: “my goal is to succeed, you know, no matter what, and so, my focus is on the goal, you know, and so I don't allow these distractions to slow me down” (E-58).

(ii) Will power: Will power equips transnational entrepreneurs with the motivation to move on. While it is barely possible to list all factors causing this motivation, values, and ways to interpret things, even of unfavourable kind (e.g., problems and challenges as opportunities), will power ranges at the top. This is supported by field data as well, as E reported to take a lot of strength from his religion, from his family, and from his previous achievements (E-62; E-34&35; A-65).

(iii) Way power: Way power stems from a resource-backed (mental) roadmap leading to goal attainment. Way power increases with taking first steps and successfully circumventing obstacles. Field data loads this sub-concept specifically. Important steps were getting financial capital from the EU and later from US venture capitalists which allowed advancing technology development considerably (E-41). The experience to be able to develop a new drone system within a year increased hope and made E believe in the possibility of achieving even more complex technological advancements. This achievement of E-Drones fuelled the development of E-Robotics by connecting insights from drone technology and robotics (A-40).

Different from the saying ‘where there is a will, there is a way’, the three sub-concepts are interrelated, and this interplay can impact transnational business development in two ways:

RP8.1. The interplay of attainable goals, of will power, and of way power absorbs negative events and prevents transnational business development.

RP8.2. The interplay of attainable goals, of will power, and of way power enhances the traction of transnational business development.

Table 1 provides an overview of the entire causality systems based on the developed research propositions (RPs). The entire set of causalities suggests that African entrepreneurs can build on a distinct profile that may provide advantages in competition, even though high cultural distance causes problems that do not seem to arise if this distance ranges on lower levels. This all stresses the ambiguous nature of high cultural distance in case of transnational entrepreneurship. Obstacles occur and are much more challenging in these constellations, whereas certain assets of both, ‘offensive’ and ‘defensive’ kind, enable African transnational entrepreneurs to access markets – be it niches or broader markets with considerable growth perspectives. The results suggest that the ‘defensive’ component provides a protective belt on a general level – made of resilience, hope, and selected fundamental strength – that is to some extent independent of the specific business. What distinguishes African transnational entrepreneurs in cultural distant settings are more business-related resources like social capital, intercultural competencies, and ethnic resources. What the single case as a first access to this field suggests is that for African transnational entrepreneurs not every enabler is available. The single case suggests the necessity of sufficient access to host country business partners that is to a large extent hard to achieve – to a large extent being due to cultural

distance. This reveals that African transnational entrepreneurs need host country boundary spanners to connect with businesspeople and to benefit from open doors.

Having stated this, it is important to note that the findings rest on very early explorative research. Generalizations on this basis are neither possible, nor intended, but call for follow-up research to recognize patterns. But the three aggregate dimensions reveal that challenges, drivers, and assets have a role in the assessment of transnational entrepreneurship. For African entrepreneurs and especially those with a transnational calibre, further case studies can give the basis for new theoretical foundations on entrepreneurship development. The role of transnational networks - beside of home country networks, host country networks, and ethnic networks – may offer new chances for African entrepreneurs. New forms of regional and international cooperation of African entrepreneurs may lead to more such networks in the future. This may push further entrepreneurship development in Africa.

Table 1: Causality Set (Source: Own compilation)

Aggregate Dimensions & 2nd Order Themes	Causalities (Research Propositions)
Challenges - adversities	1.1. Personal discrimination: strong negative impact on business development (BD) 1.2. Market and technological obstacles: negative impact on BD 1.3. Bureaucracy: negative, yet controllable impact on BD
Challenges – cultural distance	2.1. Considerable mindset distinctions: negative impact on BD 2.2. Considerable logic distinctions: negative impact on BD 2.3. Linking people or partners: bridge mindset and logic distinctions 2.4. Skill- and behaviour-based uncertainties: divergent, extreme impact on BD
Drivers – transnational social capital	3.1. Availability/quality of transnational networks: strong positive impact on BD 3.2. Ethnic networks foster BD via social stability and business-relevant resources 3.3. Ethnic networks partly compensate for rejection-based frustration of TE 3.4. Host-country networks: very hard to develop but strong impact on BD 3.5. Home-country networks facilitate BD via resource transfer and mental support

Drivers – ethnic resources	4.1. Transcultural footprint: fosters BD by culture-specific attitudes and behaviours 4.2. Language skills: positive impact on business development 4.3. Travel experience: positive impact on business development
Drivers – intercultural competencies	5.1. Capacities in transnational resource transfer: positive impact on BD 5.2. Transcultural knowledge and experience: positive impact on BD 5.3. Transnational business and market knowledge: positive impact on BD.
General assets – fundamental strengths	6.1. Continuous learning and (self-)reflection: strong positive impact on BD 6.2. Entrepreneurial thinking and experience: positive impact on BD 6.3. Education and non-business strengths: positive impact on BD
General assets – resilience	7.1. Resilient behaviour: indirect support of BD by avoiding deviations 7.2. Resilient resources: indirect support of BD by buffering social shocks 7.3. Resilient skills: indirect support of BD by pattern-based behavioural control
General assets - hope	8.1. Interplay of goals, will power, and way power absorbs negative events and fosters BD 8.2. Interplay of goals, will power, and way power enhances the traction of BD

5 Discussion

The findings reveal that many concepts and constructs from prior transnational entrepreneurship research play an important role when it comes to settings with high cultural distance and an important impact of culture in the venturing process. However, the findings reveal some evident peculiarities that contribute to research. Some of the findings are considered below.

The single case reveals that the phenomena of mixed embeddedness (Kloosterman et al., 1999; Kloosterman, 2010) and of transnational social capital may appear in different light when it comes to the context of transnational entrepreneurship. While embeddedness in the home country, in the host country, and

ethnic networks in the host country play a visible role, the case suggests that transnational entrepreneurs who commute between different cultures develop a fourth set of network structures that is useful to ideation and implementation of new businesses: it is the type of transnational networks that comprise of people from countries outside the home and host country context. In connection with entrepreneurial judgment and intercultural competencies, these networks help closing critical resource gaps and reinforcing the business concept. As it seems, this fourth type of network structures can complement and substitute the workability of the other three types of networks. The finding complements Solano (2016; 2020) who pointed to migrants' entrepreneurial activities involving several countries and groups of people (cf. Brzozowski et al., 2014; Bagwell, 2015; Bagwell, 2018). It is an open and follow-up question whether the emergence of these transnational networks is a consequence of cultural distance, longer migration paths, or multiple stays in different countries. In this case it seems that all these factors may play a role. However, it goes beyond the scope of this research project to clarify this and to specify explanatory factors.

High cultural distance in case of transnational entrepreneurship also displays another peculiarity: personal discrimination. Transnational entrepreneurship research is familiar with adversities which transnational entrepreneurs may face (Lee, 2002; Valdez, 2008; Portes & Martinez, 2020; Zapata-Barrero & Rezaei, 2020). However, the kind and intensity of personal discrimination and discreditation seems to range on high levels. It is one core result of this study to specify this and to point to the extraordinary challenges of culturally distant transnational entrepreneurship.

As discrimination in this setting seems to play a rather huge role among the cultural challenges of transnational business development, it is highly intuitive that transnational entrepreneurs developing their businesses need a certain equivalent. They find it in two concepts borrowed from positive psychology: resilience and hope. While the former already paved the way to transnational entrepreneurship research (Ayala & Manzano, 2014; Saridakis et al., 2013), the latter still plays a rather silent role (Heilbrunn et al., 2019; Freiling & Harima, 2019). The findings reveal that a stabilizing impact of hope on developing digital businesses of transnational entrepreneurs is visible so that this topic may deserve more attention.

What does all this mean for African entrepreneurship development? African entrepreneurship development by African transnational entrepreneurs in culturally distant settings often deviates considerably from new business development in the host countries. The differences obviously do not refer to the subject matter of the business, as the use of drones, of robots, and of similar IT and digital solutions pervade almost all markets on a global scale. It is more the 'cultural load' that relates to the business and/or to the founders. The interplay of E-Drones and E-Robotics allowed a transfer of knowledge from rural to industrial and service settings and went along with African businesspeople appearing in German business-

to-business settings that were quite unfamiliar with those constellations. In technical terms, every problem could be fixed by filling gaps through accessing the wide network of experts which the African entrepreneur developed on his migration path and thereafter. The ‘socialization’ in the German business world appeared to be a completely different issue where only a very well-established host-country network in the specific business field could be helpful – but it was very difficult to arrange. This gives rise to the impression that it is not enough to have four different kinds of network structures forming social capital. It is mandatory to develop a sufficient ‘socialization’ by the entrepreneur or by members of the entrepreneurial team. The reason for this is that in case of these cultural distant settings the openness of host country business partners is limited, and the business habits are deeply embedded in people’s minds so that immediate changes in certain business sections are often impossible.

Figure 1 illuminates that three dimensions structure the field that is rich in the number of concepts and sub-concepts. This is not unusual for early explorative work like this research project. The findings make first steps of identifying factors with a rather strong impact of developing the digital businesses, although there is not enough evidence to be able to specify this. Against this background, follow-up research could select the field of factors by focusing those factors with more explanatory power. Moreover, there is much room for specifying the relationships among the factors – and to check the conceptualization of cultural distance in this context. More exploratory work could check whether there are other factors that play a role when it comes to transnational business development in cases of high cultural distance. Moreover, the role of context could be illuminated in more detail. Before moving towards more exploitative research, construct refinement is an issue.

Future research can also target more focussed issues. While at this stage of research the wider range of factors impacting digital business development stood at the fore, the role of single concepts could be subject to research. Among them, constructs that address the transnational dimension could stand at the fore. The ‘transnational footprint’, the discrimination issue, the role of religion regarding transnational entrepreneurship in cultural distant settings, as well as hope and resilience could enlighten the debate.

Finally, this single case study explored the (cross-)cultural peculiarities of transnational entrepreneurship in cultural distant settings and the influence on digital business development of transnational entrepreneurs broadly. This kind of research can be a door-opener for comparing other cases with this one and to look for patterns that seem to connect the cases. Such insights would allow first steps of generalizing the findings later in the research process.

6 Conclusions and Policy Recommendations

This research project advances research in the following regards. First, it illuminates the cultural distance as an important factor of transnational entrepreneurship. To date, the role of cultural distance is, although relevant to business development, not well understood. Second, transnational entrepreneurship research may already be aware of the role of cross-cultural peculiarities. However, as the previous discussion showed, the picture is still incomplete and needs more structure to understand the complex set of peculiarities – and interrelations among the factors. Third, this research project brought to the fore the role of specific concepts like transnational networks, resilience, hope, and discrimination.

Limitations. This research project took first steps into the topic and chose an according research design that rests on a single case. It helps understanding this case but without being able to transfer insights to other cases at this time of researching. This holds although the informants also looked beyond this research case. The research project considered a set of criteria that should contribute to the trustworthiness. However, there are still other factors that could improve the quality of data and interpretation that could not be considered here, namely dependability, conformability, integrity, and generality (Flint et al., 2002). Another issue is that the entire case was developed by a retrospective view. Recognition biases may be at work and question the results, although the multi-person perspective tries to reduce this problem. What could be useful to move on is real evolutionary fieldwork that rests on interviews and field observations for a longer time and more continuously to understand how things evolve and what can be drivers of the direction and the pace of the run of events.

Policy recommendations. While it is hard to develop policy recommendations based on a single case study, there is an opportunity to develop first conclusions in this regard that need more substantiation by follow-up research on African entrepreneurs in similar settings. In this vein, a study like this can inspire research to consider certain phenomena and first results for more intensive reality checks following up. While only the path toward future generalizations can be opened, this kind of empirical research allows deepest dives into the peculiarities of one single case without any claim to understand more than this setting. However, once multiple cases are available, next steps towards pattern recognition can be taken. The results challenge decision-makers on different levels, namely at the micro-level, the meso-level, and the macro-level. At the micro level there is room for business advisors in host countries that support the transnational entrepreneur particularly when it comes to intimate market knowledge and access to core players in the market. While transnational networks are of vital importance for transnational entrepreneurs, host country networks are often thin and weak. This gap can be closed

by specialists or boundary spanners. At the meso-level, private and public actors could provide entrepreneurial support services in institutionalized bodies. Incubators and accelerators that consider the peculiarities of these transnational entrepreneurs could be beneficial and enrich entrepreneurial ecosystems through resource injection of this kind (Harima et al., 2020). At the macro level, comprehensive entrepreneurial support systems are an issue as well.

Perspectives. What is evident is that African transnational entrepreneurs have something meaningful to offer that provide host country societies not only with increasing diversity but with lots of cultural and business inspirations that may fuel the digital transformation. In the presented case, the considerably disruptive solution developed and refined by E-Robotics allows implementing a new technical standard based on most recent digital opportunities where AI, drone technology, robotics and big data management contribute to business renewal in more conservative European markets where prior commitments and investments hamper industrial customers to take next steps of digital evolution. It takes the viewpoint and courage of transnational suppliers to make the industrial customers turn and to change markets. Once policymakers intend to nurture digitalization, the support of these entrepreneurs could be a viable option. One step further, debates may emerge to foster new generation training and entrepreneurship development promotion programmes also in Africa.

References

- Aldrich, H.; Zimmer, C. and McEvoy, D. (1989): Continuities in the study of ecological succession: Asian business in three English cities. In: *Social Forces*, 67(4): pages 920-944.
- Ayala, J. C. and Manzano, G. (2014): The resilience of the entrepreneur. Influence on the success of the business. A longitudinal analysis. In: *Journal of Economic Psychology*, 42: pages 126-135.
- Bagwell, S. (2015): Transnational Entrepreneurship amongst Vietnamese Businesses in London. In: *Journal of Ethnic and Migration Studies*, 41(2): pages 329-349.
- Bagwell, S. (2018): From Mixed Embeddedness to Transnational Mixed Embeddedness: An Exploration of Vietnamese Businesses in London. In: *International Journal of Entrepreneurial Behaviour & Research*, 24(1): pages 104-120.
- Bettis, R. A. and Prahalad, C. K. (1995): The dominant logic: Retrospective and extension. In: *Strategic Management Journal*, 16(1): pages 5-14.
- Beveridge, R. and Kern, K. (2013): The 'Energiewende' in Germany: Background, development, and future challenges. In: *Renewable Energy Law and Policy Review*, 4(1): pages 3-12.

- Brandtner, E. and Freiling, J. (2021): Is dominant logic a value or a liability? On the explorative turn in the German power utility industry. In: *Journal of Entrepreneurship, Management, and Innovation*, 17(2): pages 125-157.
- Brzozowski, J., Cucculelli, M. and Surdej, A. (2014): Transnational Ties and Performance of Immigrant Entrepreneurs: The Role of Home-Country Conditions. In: *Entrepreneurship & Regional Development*, 26(7-8): pages 546–573.
- Burrell, G. and Morgan, G. (1979): *Sociological paradigms and organisational analysis*. London: Heinemann.
- Charmaz, K. (2014): *Constructing grounded theory*, 2nd Ed. London: Sage.
- Cohen, W. M. and Levinthal, D. A. (1990): Absorptive capacity: a new perspective on learning and innovation, In: *Administrative Science Quarterly*, 35(1): pages 128-152.
- Davis, M. (2007): *In Praise of Barbarians: Essays Against Empire*. Chicago, IL: Haymarket Books.
- Denzin, N. K. and Lincoln, Y. S. (2011): *The Sage Handbook of Qualitative Research*. Los Angeles: Sage.
- Drori, I.; Honig, B. and Wright, M. (2009): Transnational entrepreneurship – an emergent field of study. In: *Entrepreneurship Theory and Practice*, 33(5): pages 1001-1022.
- Eisenhardt, K. and Graebner, M. (2007): Theory building from cases: opportunities and challenges. In: *Academy of Management Journal*, 50(1): pages 25-32.
- Flint, D. J.; Woodruff, R. B. and Gardial, S. F. (2002): Exploring the Phenomenon of Customers' Desired Value Change in a Business-to-Business Context. In: *Journal of Marketing*, 66(4): pages 102-117.
- Fortune Business Insights (2021): Wind Turbine Operation and Maintenance Market Size, Share and Covid-19 Impact Analysis. URL: <https://www.fortunebusinessinsights.com/wind-turbine-operation-and-maintenance-market-102757> (retr. 28 Oct 2021).
- Freiling, J. (2004): A Competence-based View of the Firm. In: *Management Revue*, 15(1): pages 27-52.
- Freiling, J. (2008): SME Management: (What) Can we learn from Entrepreneurship Theory? In: *International Journal of Entrepreneurship Education*, 6(1): pages 1-19.
- Freiling, J. and Harima, A. (2019): Refugee entrepreneurship - learning from case evidence. In: Heilbrunn, S.; Freiling, J. and Harima, A. (Eds). *Refugee Entrepreneurship: A case-based topography*, (pages 255-277). Cham: Palgrave Macmillan.
- Gersch, M.; Goeke, C. and Freiling, J. (2009): Empirische Herausforderungen (co-) evolutorischer Forschungskonzeptionen-Anstöße für eine Methodenreflexion im Rahmen der empirischen Kompetenzforschung. In: *Journal of Competences, Strategy and Management* (formerly: *Jahrbuch Strategisches Kompetenz-Management*) 3(1): pages 105-134.
- Gioia, D. A.; Corley, K. G. and Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research. In: *Organizational Research Methods*, 16(1): pages 15–31.

- Glick Schiller, N., Basch, L. and Blanc-Szanton, C. (1997): Transnationalismus. Ein neuer analytischer Rahmen zum Verständnis von Migration. In: Kleger, H. (Ed.): *Transnationale Staatsbürgerschaft* (Seiten 81-97). Frankfurt/M.: Campus.
- Harima, A. and Baron, T. (2020): Is this Transnational Entrepreneurship? Five Cases in Which It Is Hard to Say 'Yes' or 'No'. In: *Journal of Entrepreneurship and Innovation in Emerging Economies*, 6(1): pages 12-40.
- Harima, A.; Elo, M. and Freiling, J. (2016): Rich-to-poor diaspora ventures: how do they survive? In: *International Journal of Entrepreneurship and Small Business*, 28(4): pages 391-413.
- Harima, A.; Harima, J. and Freiling, J. (2020): The injection of resources by transnational entrepreneurs: towards a model of the early evolution of an entrepreneurial ecosystem. In: *Entrepreneurship & Regional Development*, 33(1-2): pages 80-107.
- Hayek, F. A. v. (1964): The Theory of Complex Phenomena. In: Bunge, M. (Ed.): *The Critical Approach to Science and Philosophy. Essays in Honour of K. R. Popper* (pages 332-349), New York: Free Press.
- Heilbrunn, S., Freiling, J. and Harima, A. (2019): *Refugee entrepreneurship: A case-based topography*, Cham: Palgrave Macmillan.
- Henn, S. (2011): Transnationale Unternehmer und die Entstehung von Southern Multinationals. In: *Geographische Zeitschrift*, 99(4): Seiten 202-219.
- Henn, S. (2014): *Transnationale Unternehmer und wissensbasierte Regionalentwicklung. Eine Untersuchung am Beispiel des Diamantsektors*, Habilitation Thesis, Halle: University of Halle-Wittenberg.
- HAS/Health and Safety Authority (2021): *Health and Safety in the Renewable Sector*. URL: https://www.hsa.ie/eng/Your_Industry/Renewable_Energy/ (retr. 28 Oct 2021).
- Hofstede, G. (1991): *Cultures and organizations: software of the mind*. London: McGraw-Hill.
- Kerr, S. P.; Kerr, W.; Ozden, C. and Parsons, C. (2016): Global Talent Flows. In: *Journal of Economic Perspectives*, 30(4): pages 83-106.
- Kloosterman, R. C. (2010): Matching Opportunities with Resources: A Framework for Analysing (Migrant) Entrepreneurship from a Mixed Embeddedness Perspective. In: *Entrepreneurship & Regional Development*, 22(1): pages 25–45.
- Kloosterman, R.; van der Leun, J. P. and Rath, J. (1999): Mixed embeddedness, migrant entrepreneurship, and informal economic activities. In: *International Journal of Urban and Regional Research*, 23(2): pages 253-267.
- Krueger, N. F.; Liñán, F. and Nabi, G. (2013): Cultural values and entrepreneurship. In: *Entrepreneurship & Regional Development*, 25(9/10): pages 703-707.
- Kukla, A. (2000): *Social constructivism and the philosophy of science*. London: Routledge.
- Lee, J. (2002): *Civility in the City: Blacks, Jews, and Koreans in Urban America*. Cambridge: Harvard University Press.
- Levitt, P. and Jaworsky, B. N. (2007): Transnational Migration Studies: Past Developments and Future Trends. In: *Annual Review of Sociology*, 33(1): pages 129-156.

- Light, I. (2010): Transnational Entrepreneurs in an English-Speaking World. In: *Die Erde* 141(1-2): Seiten 87-102.
- Liu, X., Lu, J., Filatotchev, I., Buck, T. and Wright, M. (2009): International human mobility, knowledge spillovers and innovation in high-tech firms in emerging economies. In: *Journal of International Business Studies*, 41: pages 1183-1197.
- Lumpkin, G. T. and Dess, G. G. (1996): Clarifying the entrepreneurial orientation construct and linking it to performance. In: *Academy of Management Review*, 21(1): pages 135-172.
- Lundberg, H. and Rehnfors, A. (2018): Transnational entrepreneurship: opportunity identification and value creation. In: *Journal of International Entrepreneurship*, 16(2): pages 150-175.
- Luthans, F. and Jensen, S. M. (2002): Hope: A New Positive Strength for Human Resource Development. In: *Human Resource Development Review*, 1(3): pages 304-322.
- Maxwell, J. A. (2013): *Qualitative research design: an interactive approach*. 3rd Ed., Thousand Oaks: Sage.
- Mitra, J. and Basit, A. (2021): Personal networks and growth aspirations: a case study of second-generation, Muslim, female entrepreneurs. In: *Small Business Economics*, 56(5): pages 121-143.
- Moldaschl, M. and Fischer, D. (2004): Beyond the Management View: A Resource-Centered Socio-Economic Perspective. In: *Management Revue*, 15(1): pages 122-151.
- Morgan, D. L. (2007): Paradigms lost, and pragmatism regained. In: *Journal of Mixed Methods Research*, 1(1): pages 48-76.
- Politis, D. (2015): The Process of Entrepreneurial Learning: A Conceptual Framework. In: *Entrepreneurship Theory and Practice*, 29(4): pages 399-424.
- Portes, A. and Bach, R. (1985): *Latin Journey*. Berkeley: University of California Press.
- Portes, A.; Guarnizo, L. E. and Landolt, P. (1999): The Study of Transnationalism: Pitfalls and Promise of an Emergent Research Field. In: *Ethnic and Racial Studies*, 22(2): pages 217-237.
- Portes, A.; Haller, W. and Guarnizo, L. (2002): Transnational entrepreneurs: An alternative form of immigrant economic adaptation. In: *American Sociological Review*, 67(2): pages 278-298.
- Portes, A. and Martinez, B. P. (2020): They Are Not All the Same: Immigrant Enterprises, Transnationalism, and Development. In: *Journal of Ethnic and Migration Studies* 46(10): pages 1991-2007.
- Putz, R. (2003): Culture and entrepreneurship. Remarks on transculturality as practice. In: *Royal Dutch Geographical Society*, 94: pages 554-563.
- Ram, M. (1994): Unravelling social networks in ethnic minority firms. In: *International Small Business Journal*, 12(3), pages 42-53
- Saridakis, G.; Mole, K. and Hay, G. (2013): Liquidity constraints in the first year of trading and firm performance. In: *International Small Business Journal*, 31(5): pages 520-535.

- Saxenian, A. L. (1999): *Silicon Valley's New Immigrant Entrepreneurs*, San Francisco: Public Policy Institute of California.
- Saxenian, A. L. (2002): Brain Circulation: How High Skilled Immigration Makes Everyone Better Off, In: *The Brookings Review*, 20(1): pages 28-31.
- Saxenian, A. L. (2005): From Brain Drain to Brain Circulation: Transnational Communities and Regional Upgrading in India and China, In: *Comparative International Development*, 40(2): pages 35-61.
- Schwartz, S. H. (2004): Mapping and interpreting cultural differences around the world. In: Vinken, H., Soeters, J. and Ester, P. (Eds.), *Comparing cultures, Dimensions of culture in a comparative perspective* (pages 43-73). Leiden: Brill.
- Snyder, C. R.; Harris, C.; Anderson, J. R.; Holleran, S. A.; Irving, L. M. and Sigmon, S. T. (1991): The will and the ways: Development and validation of an individual-differences measure of hope. In: *Journal of Personality and Social Psychology*, 60(4): pages 570-585.
- Snyder, C. R. and Feldman, D. B. (2000): The roles of hopeful thinking in preventing problems and enhancing strengths. In: *Applied and Preventive Psychology*. 9: pages 249-270.
- Sewell, W. (1992): A theory of structure: Duality, agency, and transformation. In: *American Journal of Sociology*, 98(10): pages 1-29.
- Solano, G. (2016): Multifocal Entrepreneurial Practices: The Case of Moroccan Import/Export Businesses in Milan. In: *International Journal of Entrepreneurship and Small Business*, 29(2): pages 176-198.
- Solano, G. (2020): The mixed embeddedness of transnational migrant entrepreneurs: Moroccans in Amsterdam and Milan, In: *Journal of Ethnic and Migration Studies*, 46(10): pages 2067-2085.
- Trompenaars, F. (1993): *Riding the Waves of Culture: Understanding Cultural Diversity in Business*. New York: Random House.
- Valdez, Z. (2008): The Effect of Social Capital on White, Korean, Mexican and Black Business Owners' Earnings in the US. In: *Journal of Ethnic and Migration Studies*, 34(6): pages 955-973.
- Vertovec, S. (2007): Super-diversity and Its Implications. In: *Ethnic and Racial Studies*, 30(6): pages 1024-1054.
- Westlund, H. and Bolton, R. (2003): Local Social Capital and Entrepreneurship. In: *Small Business Economics* 21: pages 77-113.
- Windle, G. (2011): What is resilience? A review and concept analysis. In: *Reviews in Clinical Gerontology*, 21(2): pages 152-169.
- Yeung, H. (2002): Entrepreneurship in international business: An institutional perspective. In: *Asia Pacific Journal of Management*, 19(1): pages 29-61.
- Yeung, H. W. (2009): Transnationalizing Entrepreneurship: A Critical Agenda For Economic Geography. In: *Progress in Human Geography* 1(11): pages 61-85.
- Yin, R. K. (2018): *Case Study Research and Applications: Design and Methods*, 6th Ed., Thousand Oaks: Sage.

- Zahra, S. A. and George, G. (2002): Absorptive capacity: a review, reconceptualization, and extension, In: *Academy of Management Review*, 27(2): pages 185-203.
- Zapata-Barrero, R. and Rezaei, S. (2020): Diaspora governance and transnational entrepreneurship: the rise of an emerging social global pattern in migration studies. In: *Journal of Ethnic and Migration Studies*, 46(10): pages 1959-1973.
- Zhou, M. (2013): Ethnic Enclaves and Niches. In: Ness, I. (Ed.): *The Encyclopaedia of Global Human Migration*. URL: <http://onlinelibrary.wiley.com/doi/10.1002/9781444351071.wbeghm201/full> (retr. 5 August 2021).
- Zollo, M. and Winter, S. G. (2002): Deliberate Learning and the Evolution of Dynamic Capabilities. In: *Organization Science*, 13(3): pages 339-351.

Digital Transformation in Cameroon and the Growth of New Enterprises¹

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1 Introduction

The macro-economic changes in Cameroon, as analysed by Mbu Daniel Tambi, are going through three main periods of macro-economic changes: “the period of real economic growth, particularly in the years 1960 to 1986; the period of economic crisis that stems up in the period of 1986 to 1994; and the period of economic recovery that started from 1995 to date, and this is the period of globalization” (Mbu D. T., 2015, page 5). In the period of economic crisis, industrial and commercial sectors registered the collapse of many companies in the private and public sectors. This led to a sharp drop in industrial production and of productive investments, to more vulnerability and to a loss of competitiveness on the part of industries that survived the crisis. In 1995, the country started an economic revival and recovery with a restoration of growth moving from -7.93% in 1993 to 3.47 % in 1995 and 5.88 % in 2014². But afterwards we see a decline of the growth rates to 3.72% in 2019 and 0.73 in 2020.³

While the economy is experiencing a relative improvement after 1995, the country faced attacks by the Nigerian Islamist sect Boko Haram since 2014 and the Anglophone Crisis since 2016⁴. And in July 2018, Cameroon’s employers’ association (GICAM/ Groupement Inter-Patronal du Cameroun) released a report establishing that the Anglophone Crisis costs the country a revenue shortfall of

¹ The authors are thankful to the suggestions from the two anonymous referees and to the valuable comments from the Chief Editor of the African Development Perspectives Yearbook, Professor Karl Wohlmuth.

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² See Perspective Monde, 2022, for download:

<https://perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays/?codeStat=NY.GD.P.MKTP.KD.ZG&codePays=CMR&codeTheme=2>

³ Perspective Monde, 2022, for download:

<https://perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays/?codeStat=NY.GD.P.MKTP.KD.ZG&codePays=CMR&codeTheme=2>

⁴ See an analysis about the crisis: <https://www.crisisgroup.org/africa/central-africa/cameroon/250-camerouns-anglophone-crisis-crossroads>

XOF⁵ 269 billion and of 6,434 jobs (GICAM, 2018, page 11)⁶. And, considering that the two anglophone regions in crisis represented significant proportions of the country's agricultural production and a large part of the agricultural export sector, the impact of the crisis on the economy is very considerable. Moreover, the most emblematic companies of the country, such as Cameroon Development Cooperation (CDC), PAMOL Plantations Plc, Cameroon Tea Estates (CTE), and the National Refining Company LTD (SONARA), have their location in this region and they are today "on the verge of cessation of activities and accumulating significant arrears in terms of trade payables and social debts" (GICAM, 2021, page 5)⁷.

In this situation of socio-political crisis, the GDP began to regress moving from 5.88 % in 2014 to 3.72 % in 2019. And while making efforts to deal with those socio-political crises, the government faced the Covid-19 pandemic, registering the first case on the 6th of March 2020. In its policy brief of December 2020, the International Labour Organization (ILO) stated that the COVID-19 pandemic is having a disastrous impact on Cameroon as the country's real economic growth is likely to fall sharply in 2020 from expected 4.03% to -1.2 per cent (ILO, 2020, page 2)⁸. The resurgence of the pandemic in 2021 with a new variety of the virus will leave the country in further difficulties to recover from the effects of the pandemic. Nevertheless, as observed by the ITU, "*during the global pandemic, digital technologies have become a critical enabler of connectivity facilitating the continuity of our regular lives and connecting people more than ever before*" (ITU, 2020, page ix). Specifically in Cameroon, the pandemic revealed the importance of developing the digital economy and it seems that Covid-19 has led to an acceleration of Cameroon's digital transformation.

Cameroon was the first country in Africa to adopt the GSM⁹ system in 1989, and then put into operation through the CAMTEL MOBILE project, the first GSM mobile telephony network in Africa in 1993. This led the country to be regarded as a technology leader in the telecommunications sector. In the dynamic of developing the sector, specifically using mobile phones for economic

⁵ XOF: Code for CFA Franc BCEAO

⁶ See: GICAM, 2018, *Insécurité dans les régions du Sud-Ouest et du Nord-Ouest*; and for download: <https://www.legicam.cm/media/upload/2019049/noso-actualisation-impacts-crise-oct19-fr-def.pdf>

⁷ See GICAM, 2021, for download GICAM Newsletter numero-82-septembre-2021: <https://www.legicam.cm/>, and the GICAM White Paper On Cameroonian Economy, The Industrial Imperative of Cameroon, February 2020: <https://www.legicam.cm/media/upload/2020049/gicam-livre-blanc-anglais.pdf>

⁸ See ILO, 2020, for download: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_763830.pdf

⁹ GSM system: The Global System for Mobile communication is a globally accepted standard for digital cellular communication.

development, Cameroon had been connected to Internet in 1997 and since this date, usage and consumption habits have changed considerably and radically. Starting with the 2G technology (Voice and Short Message System “SMS”) in the 1990s, the country moved to the 3G technology in 2014. The arrival of 3G technology in Cameroon in September 2014 had transformed the Internet market in Cameroon, a transformation that even took the form of a real revolution in 2015, because the country reached an Internet penetration rate of 25.6% at the end December 2015. The 3G technology “crowned the rise of mobile high-speed networks and innovative services with the arrival of the very first value-added multimedia applications” (BC 51, 2017, page 3)¹⁰. The introduction of 3G and 4G mobile Internet allowed for a wider use of the Internet in such a way that Internet penetration has grown hugely in Cameroon over the last 20 years, from 0.25 per cent in 2000 up to 23.1 per cent in 2020 (Ndongmo K., 2021; 239). Bakehe, N. P. et al. (2017) realized that “Internet is used in almost all areas of life”, and therefore became part and parcel of the day-to-day life of all citizens¹¹.

In this essay the following issues will be discussed in six (6) sections. In section 1 the Introduction is presented. The promotion agency ANTIC (Agence Nationale des Technologies de l'Information et de la Communication) sets the tone and argues that “*digital transformation is a novelty which Cameroon considers as an essential catalyst to its development agenda*”¹². This view will be a focus in the section 2 of this essay on the digital transformation in Cameroon. Presented are the research methodology, including the definitions, the literature review on digital transformation, the analyses of some statements on the subject made, the theories constructed relative to digital transformation, and then the method used to collect data and to conduct the study. In section 3 the process of digital transformation in the country and its impacts on traditional business are analysed, referring mainly to the digitalisation of the financial sector. In the sections 4 and 5 there are analyses of the dynamics of the creation and the growth of new enterprises (start-ups), of the difficulties that entrepreneurship is facing in the context of insufficient or irrelevant regulations, and then of case studies on certain start-ups, which successfully moved from the start-up phase to the scale-up phase. Then finally, in section 6 there will be conclusions and policy recommendations.

¹⁰ See BC 51/Business in Cameroon, Number 51, 2017, p. 3

¹¹ See Bakehe, N. P. et al., 2017, for download:

https://www.researchgate.net/publication/322318053_Internet_Adoption_and_Use_in_Cameroon

¹² See ANTIC, 2019, Cameroon’s digital transformation, ANTIC sets stage for evaluation for download: <https://www.antic.cm/index.php/en/component/k2/item/379-cameroon-s-digital-transformation-antic-sets-stage-for-evaluation.html>

2 Studying Digital Transformation in Cameroon: Research Methodology

Globally, there is an abundant literature relative to digital transformation, but for the case of Cameroon, the literature is limited in scope and depth. In fact, literature review on digital transformation in Cameroon is not very specific. Most of the articles published are looking at the global phenomenon relative to the digitalization of economy. But Atsa Etoundi R. et al. (2016, pages 1-24), Somga Bitchoga and Liudmila A. Guzikova (2018; pages 81-86), and some few other authors analyse the digital transformation process in Cameroon by focussing on the context of the digital economy.

2.1 Defining Digital Transformation

Atsa Etoundi, R. et al. (2016), analysing the challenges and the perspectives of the digital economy in Cameroon, made first a diagnosis giving an overview of existing achievements. It is established fact that “Cameroon is resolutely committed to the development of the digital economy”, but as Global Business Consulting (GBC) noted: “digital transformation is a process that is poorly understood and applied in Cameroon”¹³. That is why Atsa Etoundi, R. et al. (2016) propose in their article a roadmap for Cameroon to develop the digital economy. According to them, from 2000 to 2013 the contribution of the digital economy to the national economy grew from 1.4% to 4.9% (Atsa Etoundi, R. et al., 2016, 12).

In 2017, the magazine “Business in Cameroon” had the title: “Cameroon is going on digital” to give emphasis on the impressive deployment of infrastructure made by the government. In 2018, the magazine “Business in Cameroon” emphasizes the fact that “Cameroon’s finance sector goes through rapid digital transformation”¹⁴. In the editorial of that magazine (page 3), Bahri-Domon, Y. (2018) underlines that, in the favour of a transformation of Cameroon’s technology level, various sectors migrate toward digitalization, and the main sector where digitalization is most effective and registers a positive evolution, is the financial sector. Mbodiam, B. R. (2018, page 8, and 2021, page 8) underlines that although a real digital ecosystem is yet to be created in the country, to truly drive digital transformation, some segments are more advanced than others, such as the

¹³ See Global Business Consulting/GBC, June 23, 2021, “What is digital transformation in Cameroon?”, 2021, for download: <https://globalbusinessconsulting.com/en/digital-transformation-in-cameroon/>

¹⁴ See “Business in Cameroon”, 2018, Cameroon’s finance sector goes through rapid digital transformation; for Download: <https://www.businessincameroon.com/pdf/BC69.pdf>

financial sector with an emphasis on electronic money (see especially Mbodiam, B. R., 2021, 8)¹⁵.

Tiona Wamba, J. and Ngono Ndjie, B. (2019) made a study on “Digital Economy and Economic Growth in Cameroon”¹⁶. They made an overview of the digital economy in the country noting that despite the opportunities given by digitalization for economic growth, Cameroon was lagging the global developments and still struggles to catch up the delay, although since 2016 some activities emerged. Since 2016, the government organised fairs, forums, and dedicated days for the digital economy in the aim to largely benefit from the advantages and opportunities which are offered by Internet and ICTs (TICs¹⁷). In this perspective, the government adopted in 2016 the Strategic Plan for a Digital Cameroon 2020 (République Du Cameroun, 2016), focussing on defining strategic areas, actions, and priorities.¹⁸

The outcomes are not always clearly researched. Ngwengeh et al. (2021), when talking about the Influence of Digital Financial Services on the Financial Performance of Commercial Banks in Cameroon, conclude that if “*digital savings, digital withdrawals and digital transfer services have a positive and significant influence on the profitability of commercial banks in Cameroon*”, digital payment services in contrary “had a negative coefficient yet significant influence” (Ngwengeh, et al.; 2021; page 465).

Despite a lack of a specialised work on digital transformation in Cameroon, all these approaches can help to understand how it is handled in the country. For the ANTIC (Agence Nationale des Technologies de l'Information et de la Communication), which is Cameroon's ICT development promoter, “*Digital transformation, entails mutation in production, service delivery and marketing with the aid of Information and Communication Technologies (ICTs) to enhance*

¹⁵ See Mbodiam, R., 2018, Business in Cameroon no. 69, page 8, for download: <https://www.businessincameroon.com/pdf/BC69.pdf>; and: Mbodiam R., 2021, Business in Cameroon no. 105, page 8, for download: <https://www.businessincameroon.com/pdf/BC105.pdf>

¹⁶ See Tiona Wamba, J. and Ngono Ndjie, B., 2019, Digital Economy and Economic Growth in Cameroon/ Économie Numérique Et Croissance Économique Au Cameroun; For download: <https://halshs.archives-ouvertes.fr/halshs-01970291>, Preprint submitted on 4 January 2019

¹⁷ TIC stands for « technologies de l'information et de la communication »

¹⁸ See: Plan Stratégique Cameroun Numérique 2020, Mai 2016, by République Du Cameroun, Ministère des Postes et Télécommunications ; download: <https://cameroundigital.com/wp-content/uploads/2017/05/Plan-strat%C3%A9gique-Cameroun-Num%C3%A9rique-2020.pdf>

productivity and efficiency in public and private institutions”¹⁹. For the future of the country, this mutation process is extremely important.

2.2 Statements and theories

Many statements are made concerning digital transformation and the most fundamental is that “digital transformation affects socioeconomic systems, bringing inevitable changes to business processes, particularly those related to resource demands, networking processes, and communication mechanisms within entrepreneurial activities”²⁰. Therefore, “digital transformation is a necessity for every company” (Kabakova; 2019; pages 14-24). Bakehe, N. P., et al. (2017) noticed that Internet will enable it to stimulate economic development, to facilitate integration into the world economy, and to increase productivity, and all that is, concisely, creating a high value-added economy in Cameroon (Bakehe et al., 2017, page 1)²¹. Feubi P. and Djofang Y. (2017) underline that the “digital revolution” has impact and influence on the consumers, producers, investors, exporters, importers, public policy makers, academics, students, consultants, administrators, lawmakers, and all the other actors directly or indirectly involved in various processes of the new economy²². Analysing the actual and potential contribution of the digital economy to accelerating job creation in Central Africa²³, the OECD underlines the fact that the economies of Central Africa are making slow progress in creating digital jobs, and that for the case of Cameroon it can be said that it is a consequence of inadequate national strategies and regulations for the digital ecosystem (OECD, 2021; pages 137-160). For the World Bank Group (2020a), “digital transformation is re-shaping our global economy, permeating every sector and aspect of daily life, changing the way we learn, work, trade, socialize, and

¹⁹ See ANTIC, 2019, for download:

<https://www.antic.cm/index.php/en/component/k2/item/379-cameroon-s-digital-transformation-antic-sets-stage-for-evaluation.html>

²⁰ See L. Satalkina and G. Steiner, 2020, 12(10), 4018; for download:

<https://doi.org/10.3390/su12104018>

²¹ See Bakehe P., et al., 2017, for download:

https://www.researchgate.net/publication/322318053_Internet_Adoption_and_Use_in_Cameroon

²² See Feubi Pamen, E. R. and Djofang Yepndo, C. G., 2017.

²³ The countries of this area of Central Africa are Cameroon, Central African Republic, Chad, Republic of the Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, and São Tomé and Príncipe

access public and private services and information”²⁴. All these statements show the great and wide scope of the digital transformation issue.

2.3 Data and research method

Cameroon officially engaged the process of digitalisation in 2016 after the adoption of the Strategic Plan for a Digital Cameroon by 2020 (République Du Cameroun, Mai 2016).²⁵ Five years after, we can observe an increase of using ICTs in the public and commercial activities although the objectives of this Strategic Plan have not effectively been realised. In fact, the mobile phone subscriptions rate per 100 inhabitants grew from 42.46% in 2010 to 73.19% in 2018; and the rate of computer use per 100 inhabitants grew from 3.94% in 2010 to 13.81% in 2018, according to OECD (2021; 142). In the process, several new start-ups and web enterprises were created, and to support them and to encourage their initiatives and activities, the Government of Cameroon has planned to create a centre for the development of the digital economy (Digital Transformation Center Cameroon/DTCC)²⁶, which was considered as a support tool mainly for rural areas. Concerning enterprises, two main business counting had been made by the National Institute of Statistics (INS), respectively in 2009 (RGE-1) and in 2016 (RGE-2).

In 2009, INS counted 93,969 enterprises and in 2016 they counted 209,482 enterprises; they were geographically placed and classified by size as followed: 79,2% of Very Small-Sized Enterprises; 19,3% of Small Size Enterprises; 1,3% of Middle Size Enterprises; and 0,2% of large firms and companies; and more than 50% of all those enterprises are concentrated in Yaoundé and in Douala (INS/Institut Nationale de la Statistique, 2018, pages 14-15)²⁷. INS was analysing the adoption and the use of Internet and ICTs in enterprises, accounting for: (i) the use of a computer, (ii) the Internet connection, (iii) the intranet network, and (iv)

²⁴ See World Bank Group, 2020a; see for download:

<https://thedocs.worldbank.org/en/doc/379941605627277587-0090022020/original/DE4ACameroonCountryDiagnosticJun26.pdf>

²⁵ See: Plan Stratégique Cameroun Numérique 2020, Mai 2016, by République Du Cameroun, Ministère des Postes et Télécommunications ; download: <https://cameroundigital.com/wp-content/uploads/2017/05/Plan-strat%C3%A9gique-Cameroun-Num%C3%A9rique-2020.pdf>

²⁶ See about the Digital Transformation Center Cameroon (DTCC): <https://toolkit-digitalisierung.de/en/digitalzentrum-kamerun/>

²⁷ See INS/Institut Nationale de la Statistique, 2018, For download:

https://www.journalducameroun.com/wp-content/uploads/2018/04/Projet_de_rapport_preliminaire_RGE2_du_29_decembre_2017_final.pdf

the use of Internet for business activities. It appears in regard of these penetration indicators of ICTs and Internet that in 2016 16,9% of enterprises had an internet connection, 28,2% used internet for business operations, and 5,5% of them had an intranet network. In comparison with 2009, it is a sharp decline of ICTs penetration. In fact, in 2009, 48,9% of the enterprises had an internet connection, 33,9% had used internet for business operations, and 17,4% had an intranet network (INS, 2018, 124). This decline may be the result of a counting of many more micro size enterprises which have much less ICT and Internet equipment. Fambeu, A. H. (2021: page 29) underlined that the quality of skills and the ability to use ICT are the main determinants of the level of ICT use in firms in Cameroon. To analyse all these processes, data had been collected from the existing literature and diverse reports relative to the performance of Cameroonian enterprises in the digital economy. The financial sector registers more than other sectors a high level of digitalization. That is the reason that the study will focus to the digitalization of the financial sector and its impacts on other sectors of the economy. The study also investigates the strategies of the business project leaders and promoters from the identification of a business idea to the implementation of the enterprise, such as for FinTech enterprises and some start-ups which grow successfully in the sector of health (like HINMORE MEDICAL), despite difficulties, challenges and sometimes obstructions and lack of financial support. Finally, an examination of the policies of the government for digital development had been made, considering that digital development has been put at the heart of Cameroon's 2020-2030 national development agenda (NDS 30/SND 30)²⁸.

3 Digital transformation and its impacts on the traditional business

The second general counting of companies in Cameroon was realised in 2016 by National Institute of Statistics of Cameroon (NIS)/Institut National de la Statistique du Cameroun (INS) reports for 209,482 economic units, divided into 203,419 companies' headquarters and 6,063 establishments; 84.2 % of them operated mostly in commerce, 15.6 % in industry, and 0.2 % in agriculture (see

²⁸ See on the presentation of Cameroon's 2020-2030 national development strategy (NDS/SND30) on November 12, 2021: 2020-2030 development strategy: Cameroon bets on private investors for successful implementation of over XAF37000 bln plan, in BC/Business In Cameroon, 16 November 2021; for download: <https://www.businessincameroon.com/economy/1611-12061-2020-2030-development-strategy-cameroon-bets-on-private-investors-for-successful-implementation-of-over-xaf37000-bln-plan>, and: <https://adi.cm/strategie-nationale-de-developpement-snd30-le-cameroun-se-met-a-jour-pdf/>

the full report: INS, 2018). Small and Medium-sized Enterprises (SMEs) constitute with 95% of the number of enterprises the foundation of the country's economy and help in job creation, especially among the youths, they contribute around 36% of the GDP (Nkafu, K.; 2017; page 4).

The Law adopted in 2010 (Government of Cameroon, Law 2010) to lay down the Promotion of Small and Medium-sized Enterprises in Cameroon, and amended in 2015 (Government of Cameroon, Law 2015), distinguishes three (3) types of small-sized and medium-sized enterprises according to the number of persons employed and the annual sales (free of duties); the predominant key of classification is the annual sale (free of duties):

1. Very Small-sized Enterprises (VSE/TPE) or micro-size enterprises employ at least 5 persons with an annual sale (free of duties) which does not exceed 15 million FCFA.

2. Small-size Enterprises (SE/PE) employ between 6 and 20 persons with an annual sale (free of duties) which is beyond 15 million FCFA and does not exceed 100 million of Francs CFA.

3. Medium-size Enterprise (ME/ME) employ between 21 and 100 persons with an annual sale (free of duties) which is beyond 100 million de Francs CFA and does not exceed 1 billion of Francs CFA.

Atsa Etoundi, R. et al. (2016) are considering that the “*digital business transformation involves the upgrading and the appropriation of new digital assets not only referring to data, new payment methods and distribution, access to networks, dematerialization, the connected objects, and 3D printing, but also to the skills and the expertise of the organization*” (Atsa Etoundi, R. et al.; 2016; pages 13-15). The use of digital technologies into all business areas led to a fundamental change in the way of doing business in all types of organizations: industries, enterprises, mobile telecommunication companies, banks, and others. The National Institute of Statistics (NIS/INS) in its report of 2018 (INS/NIS, 2018), relative to the second Cameroonian enterprises counting which was carried out in 2016, noted that in 2016 the penetration of ICT in enterprises was very weak. Just 16.9% of the enterprises had an internet connection, 28.2% used internet for their business operations, 5.5% had an Intra-net Network, and 49.4% used a computer as a tool for work (INS, 2018; pages 124-125). In a study made in 2020 by the GICAM, relative to the financing and the digitalisation of about 729 enterprises affiliated to GICAM, 58% of them argued that they are digitalized; 38% have an informatic chart; 81% have a website; 85% use social network for their communication; and 67% use mobile applications in their activities (GICAM, 2020, pages 12-19)²⁹. The performance of each enterprise varies according to the

²⁹ See GICAM/Groupement Inter-Patronal Du Cameroun, 2020, Financement et Digitalisation des Entreprises du GICAM, Etude réalisée par Commission Amélioration

variable which is considered. For example, great enterprises more than others have an IT charter. However, for the use of social network, small size enterprises are better performed than others (GICAM, 2020).

As Boojihawon, D. K. and Ngoasong, Z. M. (2018) have noted, digital business models in Cameroon face two main difficulties in the process. Firstly, a problem is that "entrepreneurs focused too much on value creation (revenue) through digital technology, with a relative neglect of the network architecture, what is a contextual factor. And this restricted their capacity to capture the revenue they could potentially create, particularly over longer term" (Boojihawon, D. K. and Ngoasong, Z. M., 2018; pages 138-139). Secondly, there is the lack of appropriate legislation to regulate the digital business as a requirement "to develop the necessary know-how, skills and networks for confident and sustained value creation and capture" (Boojihawon, D. K. and Ngoasong, Z. M., 2018, page 129). Therefore, it appears that most of the traditional and established companies and enterprises in Cameroon had several difficulties to deal with disruptions resulting from the integration of ICTs into their business models. Furthermore, digital transformation also calls for the deployment of an experimental culture, and for promoting and rewarding innovative attitudes and practices. New practices led by digital transformation are now mostly seen in Cameroon in the financial sector, involving mobile companies with the new digital services, such as money transfer, mobile payments, microfinance transactions, and transactions by banks.

Digitization takes shape as services in all sectors of activity in Cameroon, and especially for the financial sector, are based on "Made in Cameroon" apps that enable users to conduct financial transactions or operations safely, and by using mobile devices such as phones or tablets. For example, among the 16 existing banks in Cameroon, about half of them have a banking application available to users. ECOBANK developed a MOBILE APP, AFRILAND First Bank speaks of a SARA BANKING app, United Bank of Africa (UBA) has created a LEO app and has launched an online banking service in the country. The Commercial Bank of Cameroon (CBC), in cooperation with IWOMI TECHNOLOGIES³⁰, opened the very first Cash Deposit ATM. All those applications appear as exchange platforms that allow customers to interact with their financial institutions without having to travel. Beyond those innovations, users can also order payment tools (check books cards, certified checks, etc.) online. In regard of all those innovations in the financial sector, Bahri-Domon, Y. (2018) has underlined that digitalization

de l'Environnement des Affaires, Juillet 2020; for download see the list of documents: <https://www.legicam.cm/index.php/p/documents?pg=2>

³⁰ See on the activities of IWOMI Technologies: <https://www.iwomitechnologies.com/iwomitech/en/>

is now a reality in Cameroon's finance industry (Business in Cameroon/BC 69, 2018, page 3)³¹.

3.1 Digitalization of the financial sector in Cameroon

Cameroon's financial system is the largest in the CEMAC (Communauté Économique des États d'Afrique Centrale)³² region with more than 600 financial institutions out of 993, representing 61% of the financial sector institutions in the region. Financial institutions are divided into four types: (i) credit institutions, as banks; (ii) microfinance institutions (MFIs), both types being under the supervision of the Banking Commission (COBAC/Commission Bancaire de l'Afrique Centrale)³³, (iii) insurance companies, regulated by the Inter-African Conference on Insurance Markets (CIMA/CONFÉRENCE INTERAFRICAINNE DES MARCHÉS D'ASSURANCES³⁴); and (iv) social security institutions, being under the supervision of the Inter-African Social Security Conference (CIPRES/CONFÉRENCE INTERAFRICAINNE DE LA PREVOYANCE SOCIALE³⁵). Digitalisation in this sector is changing the environment of the financial institutions (for retail banking, and for life and non-life insurance companies) in terms of the skills profiles of employees and in terms of the organisation of teams "from the front to the back office" (Nghane, K. L, 2020). Considering the level of digitalisation in Cameroon's finance industry, banks are the financial institutions with the highest rate of ICTs penetration and digitalisation. Digitalisation of the banks is growing fast; the digitalisation of the financial services is growing in such a way that financial inclusion is improved in the country.

3.1.1 Digital Banking

The evolution of banks from the traditional conservative business model of banking (Bank 1.0) through the digital-oriented banking model (Bank 2.0) to the digital banking model (Bank 3.0) is the result of a process of completely redefining

³¹ Bahri-Domon, Y., 2018; and for download see:

<https://www.businessincameroon.com/pdf/BC69.pdf>

³² See also about ECCAS/Economic Community of Central African States and CEEAC/Communauté Économique des États de l'Afrique Centrale: <https://ceeac-eccas.org/en/#presentation>

³³ See about the Banking Commission of Central Africa: http://www.sgcobac.org/jcms/mbm_6439/fr/historique

³⁴ See on the functions of CIMA: <https://cima-afrique.org/presentation/?lang=en>

³⁵ See on the functions of CIPRES: <https://socialprotection.org/connect/stakeholders/conf%C3%A9rence-africaine-de-la-pr%C3%A9voyance-sociale-cipres>

financial services and payments due to the changes of the technology platforms (see Vasylyeva, T.A. et al., 2017)³⁶. Writing on Bank 3.0, Brett K. (2012) emphasized that, with the dominance of the mobile wallet³⁷, and with the operationalization of the cloud and the explosion of the social media, financial services and payments are redefined in such a way that banking will no longer be “*a place you go, but something you do*”. In Cameroon, transformation and the evolution of the E-banking began according to Ayuketang, Nso M. (2018, pages 3646-3647) in the early 2000s with the Standard Chartered Bank Cameroon³⁸ which started offering, with the help of a dedicated service fixed telephone line, premium services banking to financially important public and private entities like CAA (Caisse Autonome d’Amortissement)³⁹, and a good number of International NGOs and Embassies. And with the growth of the Internet, banks such as United Bank for Africa (UBA), ECOBANK Cameroon, SOCIÉTÉ GÉNÉRALE CAMEROUN (SGC), Standard Chartered Bank Cameroon SA, and BANQUE INTERNATIONALE DU CAMEROUN POUR L’EPARGNE ET LE CREDIT (BICEC) started offering a limited range of e-banking services between 2007 and 2010. They offered e-alerts of account transactions (withdrawals, deposits, and account balances) on mobile phones and emails. After that, they gradually introduced Automated Teller Machines (ATMs) and Debit Cards (check cards)⁴⁰. In the 2010’s, with the growth and development of mobile money services launched by MTN (Mobile Telephone Networks) Cameroon in 2007, a good number of commercial banks started to rollout ATMs and to broaden the scope of e-banking services which they offer; for example, UBA since 2015 and ECOBANK since 2017 offered credit cards.

Interactions with customers on Internet / online banking and electronic banking (or E-banking) determine the success of the digital transformation of the financial institutions. In fact, customers’ acceptance of E-banking is a determining element for the banks to reach targets that previously did not have access to information for customers. Therefore, banks develop many applications to increase the autonomy of customers by facilitating day-to-day banking operations (transfers, account statements, payment opposition⁴¹, etc.), like Bank interfaces on the Internet which are relevant illustrations. In addition, it is possible now for users to directly complain online, to benefit from instantaneous after-sales service, and to make service requests online. As underlined by Mbodiam, B. R. (2018, page 8):

³⁶ See Vasylyeva, T. A. et al., 2017; doi.org/10.18371/fcaptop.v1i22.107714; for download: <http://fkdl.ubs.edu.ua/article/view/107714>

³⁷ See on the definition: <https://www.investopedia.com/terms/m/mobile-wallet.asp>

³⁸ See on the global and regional activities of SC Bank Cameroon: <https://www.sc.com/cm/>

³⁹ See on the history and workings of CAA: <http://www.minfi.gov.cm/caa/>

⁴⁰ See on the definition: <https://www.investopedia.com/terms/d/debitcard.asp>

⁴¹ See about this instrument: <https://www.lawinsider.com/dictionary/payment-opposition>

“Banking’s digitalization allows people with a bank account to travel all over the country having access to their accounts, via their smartphones and tablets”. In this process of digitalization, banks develop new ways to interact with customers, to promote their products and services; and to develop their notoriety in the market.

To interact with customers, banks involve their presence on social networks (Facebook, Twitter...). In fact, social networks are an integral part of the marketing strategy of banks, associated with two advantages: first, strengthening its brand image, and developing the feeling of proximity to its customers. To allow consumers to be able to access banking services from anywhere, banks develop several kinds of mobile applications. United Bank of Africa (UBA) launched its mobile application LEO that helps customers to use online accounts for daily transactions. In addition, prepaid cards have been launched for non-customers to bring them closer to ATMs around their region. The ECOBANK MOBILE Application allows all financial transactions to be carried out except Commercial Paper transactions⁴². For companies, applications that are more specific have been developed, such as OMNI PLUS for large companies, BANKCOLLECT for fundraising, WEB ACQUIRING for online operations, and OMNILITE for SMEs transactions. The Société Générale Cameroun (SGC) developed SG CAMEROUN CONNECT, and in addition to this application for companies, the SGC Bank has opted for the outsourcing of some of its operations to individuals via electronic money wallets, called YUP⁴³. YUP is a payment services outsourcing company based on a money wallet. YUP is oriented in the sale of digital solutions to the whole population; YUP is a "mobile money" solution that allows access to a full range of transactional and financial services without needing a bank account. BGFIBANK Cameroon⁴⁴, CCA Bank⁴⁵, and Commercial Bank Cameroon (CBC)⁴⁶ have limited themselves for the moment to mobile applications and transaction platforms for businesses.

To promote their products and services, banks use “saturation advertising” and then flood users in Internet and Social Media networks with advertising messages (information about banking applications, money transfer advertisements, new applications from companies and agencies, and the different types of credit and other services which are available). As noted by Korobov Y.

⁴² See on the Commercial Paper transactions:

<https://www.investopedia.com/terms/c/commercialpaper.asp>

⁴³ See on the YUP wallet: <https://particuliers.societegenerale.cm/en/everyday-banking/distant-and-online-banking/yup/>

⁴⁴ See: <https://www5.bgfionline.com/cm/index.ebk>

⁴⁵ See: <https://www.cca-bank.com/en/>

⁴⁶ See: <https://www.commercialbank-cm.com/welcome/>

(2020, page 4), the advertising policy went through a certain evolution, indicated exemplary by the changing forms of banking advertising⁴⁷.

To develop their notoriety, banks use rewards against subscription (ECOBANK, UBA), offer operating credits (AFRILAND FIRST BANK, BANQUE ATLANTIQUE), or extend a remuneration for deposits (AFRILAND, CBC). They also have involved themselves in an educational strategy of communication through multiple channels to attract new consumers. Using an educational and fun learning approach is done with the goal to establish a trust and confidence relationship with the consumer. It is important to underline that the multiple closure of MFIs (Micro Finance Institutions) in Cameroon since 2008, and the following bankruptcy (Tasoh, Toh et al.; 2016), have damaged client confidence, and have led clients to be suspicious concerning financial institutions (Fangue, L. et al., 2020; pages 87-89). In fact, the financial sector generally suffers from a lack of confidence that is why banks and micro-finances institutions struggle with diverse strategies, including partnerships with FinTechs and mobile operators to gain a new confident contract with customers.

3.1.2 Digital financial services

Digital financial services refer to the strategies and means of using digital technology to access financial services, such as payment of bills, transfer of money, banking, insurance, investment management, advisory services, and access to a financial institution. Digital financial services in Cameroon are growing faster than other specific services for business networks, particularly in industry, agriculture, and energy. Most focus is on bill payments and on money transfers, as the sector records an explosive growth of FinTech.

The partnership between mobile telephony operators and bankers and the inventiveness of FinTechs that develop digital apps and platforms led to the rise of electronic money in Cameroon. In fact, digital and mobile telephony allow everyone, be they old or young, be they rich or poor, to send or receive money right from mobile phones. In addition, the adoption of electronic transactions makes possible to pay for TV subscriptions, electricity and water bills, school fees, tax duties, to order drugs from chemists, and to buy insurance premiums from the own mobile phone. Moukouri, D. and Mbanda, E. (2019) reported for the CEMAC zone that, in terms of value, electronic money transactions globally amounted to XAF 4,700 bn (US\$ 7.9 bn) in 2017 and exceeded XAF 8,296 bn (US\$ 14 bn) at the end of the year 2018. This exceptional increase of e-money transactions lead

⁴⁷ See: https://www.shs-conferences.org/articles/shsconf/abs/2020/01/shsconf_ies_2019_01013/shsconf_ies_2019_01013.html

to the adoption of Regulation No 04/18/CEMAC/UMAC/COBAC on payment services within the CEMAC by the Ministerial Committee of the Central African Monetary Union (UMAC/Union Monétaire de l'Afrique Centrale) at Yaoundé, Cameroon, on 21 December 2018⁴⁸.

Mobile money (MoMo) is a service which permits customers to obtain access to financial services employing cellular devices by dialling Unstructured Supplementary Service Data (USSD) codes. This new type of digital financial services has disrupted the financial sector and the way of handling transactions, with an important impact on the Financial Performance of the SMEs. Andersson-Manjang, S. K. and Naghavi, N. (2021, page 22) in their report on the “State of the Industry Report on Mobile Money 2021”, enlightened the fact that “during the pandemic, demand for mobile money increased among businesses, governments and new services that previously relied on cash or other payment channels”⁴⁹.

Mobile phone companies and banks are teaming up to provide mobile financial services to the Cameroonians, enabling them to use their cell phones to transfer money and to pay bills. This increases access to financial services in such a way that, without having a bank account, an old person does not have to move from the village to collect money from his child who can send him money directly from his bank account to this person’s mobile account. By this way financial institutions, especially the banks, work to restore their credibility. In fact, building trust and confidence relationships with consumers will become vital for the future of financial institutions, because in an increasingly competitive environment, convincing and retaining the consumers is crucial, not only for the prosperity of those institutions but also for the financial inclusion. Digital services are becoming an important instrument to create conditions for the financial inclusion of remote villages.

3.1.3 Digitalisation of the financial sector and financial inclusion

In “The Global Findex Database 2017” on “Measuring Financial Inclusion and the Fintech Revolution”⁵⁰ it is noticed that “Saving money, accessing credit, and managing financial risk are all key aspects of financial inclusion” (Demirgüç-Kunt A. et al. 2018, FINDEX report 2017, published by the World Bank Group, 2018,

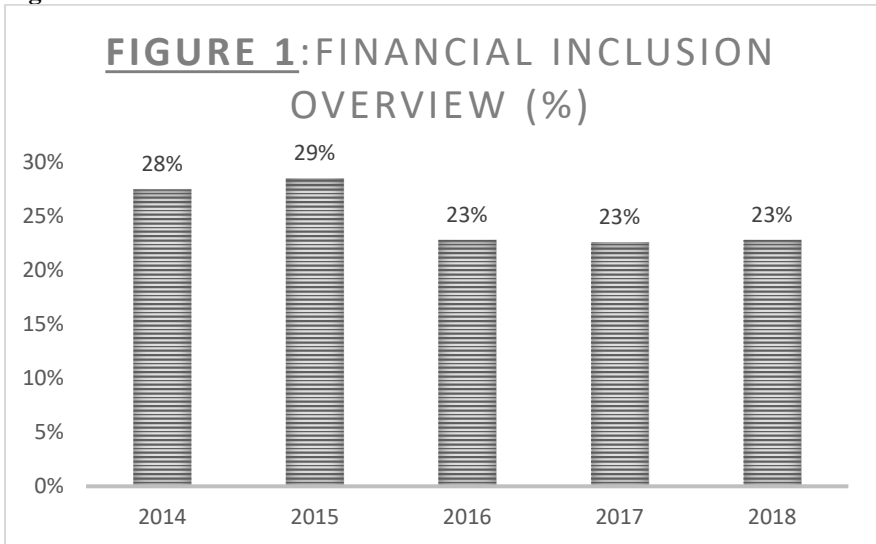
⁴⁸ See Moukouri, D. and Mbanda, E.; 2019. For download: LexAfrica, A law for Fintech companies within the CEMAC Zone; access via: <https://www.lexafrica.com/2019/12/a-law-for-fintech-companies-within-the-cemac-zone/>

⁴⁹ See on the report “State of the Industry Report on Mobile Money 2021, GSM Association” for download: https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2021/03/GSMA_State-of-the-Industry-Report-on-Mobile-Money-2021_Full-report.pdf

⁵⁰ See on the report for download: <https://openknowledge.worldbank.org/handle/10986/29510>

page 8). The “FinScope Consumer Survey Highlights Cameroon 2017” (FinScope, UNCDF, Fin Mark 2018)⁵¹ was conducted to measure the levels of access and use of financial services by adults of 15 years and older, and divided people into two categories: financially included people (they have or use financial products / services, be it formal or informal) and financially excluded people (they do not have or use financial products/services, be it formal or informal). For financially included people, the FinScope Consumer Survey (FinScope, UNCDF, Fin Mark 2018) identifies the following indicators: if they formally are served by a financial institution (bank or non-bank), and if they are informally served. Between those who are formally served, there is a distinction between bank and non-bank financial institutions. The report gives the following results (see figure 1), revealing a decline of financial inclusion:

Figure 1: Financial Inclusion Overview



Source: FinScope Consumer Survey Highlights Cameroon 2017, p. 15

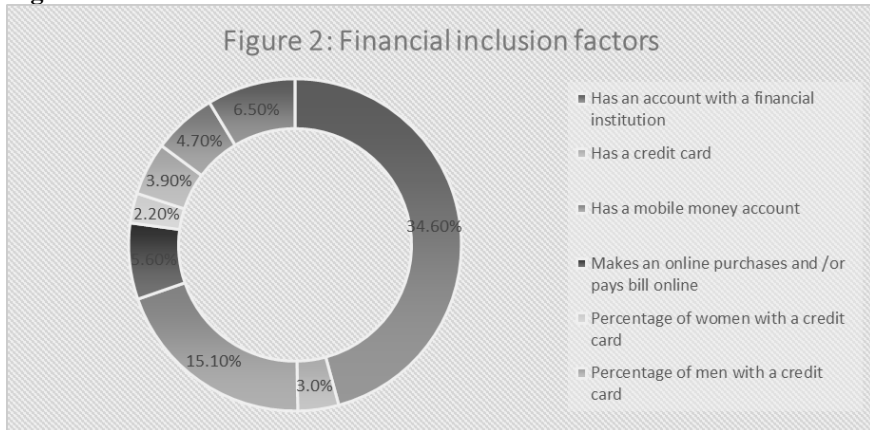
The adoption of electronic money transactions has boosted access to financial services and allows non-banking people to have an account (mobile account) to save money and to make any transactions they want from their mobile phone. In

⁵¹ See on the FinScope Consumer Survey Highlights Cameroon Pocket Guide 2017 edition, by UNCDF Making Access Possible/FinScope/FMT-Finmark Trust (2018): https://finmark.org.za/system/documents/files/000/000/220/original/Cameroon-pocket-guide_English.pdf?1601984244

fact, mobile banking has been identified as a critical means of achieving financial inclusion. But, according to the Digital 2021 Cameroon Report (11 February 2021), only 15.1% of the people have a mobile account (see: Datareportal 2021, and the changes since 2020 in: Datareportal 2020). Considering other factors of financial inclusion, such as having an account with a financial institution (34.6%), having a credit card (3%), or making purchases and pay bills online (5.6%), the level of financial inclusion remains a challenge, despite the facilities offered by mobile money and mobile banking applications.

If financial innovations offer more opportunities to achieve financial inclusion in Cameroon (Doh, E. T. S.; 2020; pages 26-39), the challenges are great relative to many aspects of the social divides and the prevalent inequalities in the country (Milana, C. and A. Ashta, 2020, pages 257–266). For Tchoffo Tameko, G. et al. (2020, pages 106-121), measuring financial inclusion in Cameroon is a challenge, and when looking at the Digital 2021 Cameroon report (Datareportal 2021), relative to the financial inclusion factors (see figure 2), it is obvious that Cameroon is far away from the aim of financial inclusion, despite the emergence of start-ups in the financial industry (FinTechs) since the early 2000s.

Figure 2: Financial inclusion factors



Source: Authors, Datareportal 2021, Digital 2021: Cameroon report, p. 44.

Comparing this information with the data of The Global Findex Database 2017 (Demirgüç-Kunt A. et al. 2018/World Bank Group, 2018: Global FINDEX Database 2017), the share of owners of an account in a financial institution has not increased; at the contrary, there is a decrease since there were 35% of the adults with an account in 2017 (Global FINDEX Database 2017; see: Demirgüç-Kunt A. et al. 2018/World Bank Group 2018, page 123) against 34.60% in January 2021. The government plans to use digitalisation as a banking strategy, but despite the

increase of the penetration rate of smartphones from 25% in 2016 to 40% in 2020, less than 20% of the population have a mobile money account and less than 36% are using a mobile banking application. Therefore, there is a need to increase and to facilitate the use of mobile financial services. In this perspective, on March 31, 2020, the Minister of Posts and Telecommunications had inaugurated the National Payment Switch (NPS), developed by CAMPOST at the Data Centre, with the objective to increase the financial inclusion from the current 40% to 98%, which is the most important mobile (smartphones) penetration rate in Cameroon.⁵² The National Payment Switch aimed at guaranteeing equitable interconnection access, reducing mobile financial transaction charges, and boosting financial inclusion (BC/Business in Cameroon 105, 2021, page 12). Up to date, ECOBANK (June 2021) and Afriland First Bank (October 2021) are the two banks which signed a trade partnership with Cameroon Postal Services (CAMPOST) for the official commercial launch of the USSD code #237#⁵³. But the measure is just for banking customers.

3.2 The digitalisation of the financial sector and its impacts to other sectors of economy

For UNCDF (2018), Cameroon has digital financial services (DFS) providers, with portfolios that span rather specific services for business networks to services for individuals, particularly in industry, agriculture, and energy⁵⁴. These services generally include bill payments and money transfers, among others. Relative to industry, it is reported by O'Neill, A. (2021) that the sector contributed with a share of 25.02% to GDP in 2020 against 26.04% in 2019⁵⁵. This decline can be

⁵² See BC/Business In Cameroon, 31 March 2020, Cameroon inaugurates the national payment Switch; for download: <https://www.businessincameroon.com/telecom/3103-10150-cameroon-inaugurates-the-national-payment-switch>

⁵³ The national payment switch USSD (Unstructured Supplementary Service Data) #237# deployed by Cameroon Postal Services (CAMPOST) is a national platform of electronic communications aggregation which enables bank customers to have access to their bank from their mobile phone wherever they are, at any time, and no cost, without a need of Internet access. The Code is accessible from all mobile networks in the country: Orange, MTN, Camtel or Nexttel.

⁵⁴ UNCDF/UN Capital Development Fund; 2018. Digital Financial Services in Cameroon, April 17, 2018; For download: <https://www.uncdf.org/article/3517/digital-financial-services-in-cameroon>; see also: Briefing Note 1, Digital Financial Services in Cameroon, 2014, 2 pages, Cameroon, Facts and figures.

⁵⁵ O'Neill A., 2021. Cameroon: Distribution of gross domestic product (GDP) across economic sectors 2020; for download: <https://www.statista.com/statistics/446567/cameroon-gdp-distribution-across-economic-sectors/>

explained by the Anglophone crises, which paralyzes emblematic companies of the country as CDC (Cameroon Development Corporation)⁵⁶, PAMOL Plantations Plc⁵⁷, CTE⁵⁸, and SONARA⁵⁹, located in those regions that account for 16.3% of the Cameroonian GDP. Therefore, the COVID-19 pandemic found a weak economy and contributed to these negative effects, thereby explaining the decline of the industrial sector (Soppo Ntouba, R., 2020, page 4).⁶⁰ However, despite of the negative impacts of the socio-political crises and the Covid-19 pandemic, the decline of the share by 1.02% of the industrial sector contribution to the GDP seems to be not alarming. In fact, facing the constraints led by COVID-19, the country registers a digital transformation acceleration with a scale and amplitude unimaginable two years ago. Considering the Network Readiness Index (NRI) score of Cameroon in these last two years, Cameroon improved his score increasing from 25.94 in 2019 to 29.86 in 2020 and reaching a score of 32.76 in 2021, although in terms of global rank the position 114 is not impressive.⁶¹ For Dutta, S. and B. Lanvin (Editors of The Network Readiness Index 2020 for the Portulans Institute), *“the acceleration impelled by COVID has not been limited to the use of digital tools. It has also induced a significant <deepening> of the ways in which governments, businesses, and individuals consider digital transformation”* (Dutta, S. and B. Lanvin, editors, 2020, page 13). The sub-pillars of the NRI (technology, people, governance, and impact) examine how individuals, businesses, and governments use ICT and how they participate in the network economy - by accessing and using technologies, by governing the ICT sector, and by reviewing the impact of ICT penetration. For Cameroon the NRI 2021 shows for the three sub-pillars “technology”, “people”, and “impact” a better position than for the overall NRI 2021, but a much worse position for the sub-pillar “governance” (with a rank 121). The NRI model takes in account how the

⁵⁶ See on this company: <https://www.cdc-cameroon.com/index.html>

⁵⁷ See: <http://www.pamol.net/aboutus.php>

⁵⁸ See: <https://cm.linkedin.com/company/cte-sa>

⁵⁹ See on the current problems of SONARA:

<https://www.businessincameroon.com/finance/0911-12040-sonara-cameroon-is-on-the-verge-of-reaching-a-10-year-repayment-deal-for-a-xaf371-bln-debt-owed-to-oil-traders>

⁶⁰ Soppo Ntouba, R., 2020. Covid-19 in Cameroon: What effect on economy? July 2020. For the download: https://mpira.ub.unimuenchen.de/102245/1/MPRA_paper_102245.pdf

⁶¹ See about the 2021 NRI data: <https://networkreadinessindex.org/country/cameroon/>; the report by the Portulans Institute is for download under the title: “Network Readiness Index 2021 Cameroon”. The full report for 2020 by the editors Soumitra Dutta and Bruno Lanvin is available under: <https://www.uneca.org/sites/default/files/COVID-19/Leveraging-Digital-Transformation-post-COVID-19-era/NRI%202020%20Final%20Report%20October2020%20%281%29.pdf>, and: https://joserobertoafonso.com.br/wp-content/uploads/2021/02/NRI-2020-V8_28-11-2020.pdf

actors in the network economy behave, how they are governed, how they are supported by technologies and regulations, and how they are impacted by the network economy.⁶²

For agriculture, there is an increase of the contribution to the GDP from 14.51% in 2019 to 15.18% in 2020. It is important to relieve that since 2010 the agriculture sector had not achieved this performance. The highest contribution of these last ten years was registered in 2015 with a share of 14.77% of the GDP (O'Neill, A., 2021). According to World Bank statistics, the agricultural sector in Cameroon accounted for 42.87% of total employment in 2020, and it represents more than half of the country's exports⁶³. Agriculture in Cameroon as in the other countries of Africa has faced diverse challenges, such as poor access to finance, to information, to extension services, and to market links and distribution networks. For Tossou, H. S. and Thoto, F. S. (2020, page 175), progress in information and communication technologies (ICTs) has offered the possibility to address many of these challenges in a new way. In Cameroon, mobile apps provide the simplest services, such as text messages, to deliver economic advice to smallholder farmers (Massoma, H., 2021). There is the rise of agri-tech companies which are providing technology-based solutions for the sector. The most important transformation in this sector which is led by digitalisation is the digitization of agribusiness payments. In the case of Nigeria, Nwagu, K. et al. (2021, page 1745) analyse the impact of digital finance technologies on Agribusiness Development between 2001 and 2019. They conclude that the point of sales payment system and the mobile money payment system have a more significant and positive impact on agribusiness than using the ATMs. In fact, for Andersson-Manjang, S. K. and Naghavi, N. (2021, pages 63-64) the digital finance services, especially mobile money, enhance the productivity of smallholder farmers through agricultural enterprise tools, such as specific agricultural digital financial services (Agri DFS). Agri DFS enable smallholders to manage cash flows, to protect themselves against external shocks, and to strengthen their resilience to climate change. Pietosi, S. et al. (2021, page 16) present Agri DFS as emerging business models to support the financial inclusion of smallholder farmers, by underlining the fact that Mobile Money Payments provide agricultural value chain payments to farmers, and - being a result of this report - it is stated that "120 agricultural organisations have digitised value chain payments via mobile money, 75 per cent of which are in Sub-Saharan Africa".

⁶² See about the NRI model and Cameroon:

<https://networkreadinessindex.org/country/cameroon/>

⁶³ See World Bank, Data retrieved on 29 January 2021 from ILOSTAT Database, Employment in agriculture, female (% of female employment) (modeled ILO estimate) – Cameroon. Access:

<https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=CM>

In the sector of energy, ENEO⁶⁴ operates since June 2014 as the dealer in the segments of production and distribution of electrical energy. ENEO, as an important actor of digitalization in the energy access sector, developed many digital services in the aim to optimize digital solutions for Customer Satisfaction. In this process, customers need to choose among diverse types of dematerialised services (ENE0, 2020, pages 29-31):

— Checking of bills, preferably, with one's telephone by sending the contract by SMS to the number 667 90 90 90, or by clicking the link: <https://my.eneo.cm/>;

— Paying bills via Mobile Money, and for this case ENEO has completed and rolled out an application that instantly take in account the electronic payments of bills. From their home, consumers can pay the electricity bill in all confidence and ease, and receipt can be made available via: *my.eneo.cm*.

— Live Chats are possible on www.eneocameroon.cm, the online agency MyEasyLight⁶⁵, the Call Centre on 8010, or dedicated WhatsApp Customers groups. ENEO strongly encourage customers to subscribe to the online agency: MyEasyLight.

— Using Eneo prepayment solutions, with prepaid meters installed. With this option, consumers can purchase energy via OM or MoMo without stepping out, and without any telephone payment charge.

ENE0 launched in the 2nd quarter of 2020 the ENEO Job Portal to inform the users about their job announcements and to facilitate interested candidates to apply directly through the platform.

4 Creation and growth of digital business and enterprises

Digital entrepreneurship is widely believed to be a key driver of the digital revolution in Africa (Friederici N. et al., 2020, page 8). In a digital economy ecosystem, digital entrepreneurship refers to the support of entrepreneurs, start-ups, and bigger companies to generate new products and services that leverage new technologies and business models, which are critical to widen and to deepen digital economic transformation. Boojihawon, D. K. and Z. M. Ngoasong (2018, pages 129-137) are analysing emerging digital business models in developing economies for the case of Cameroon, and they argue that “the diffusion and use of

⁶⁴ ENEO is a semi-public company with 51% of its capital held by Actis Group, 44% by the State of Cameroon, and 5% by its employees who are constituted as the Joint Initiative Group for the Socio-Economic Promotion of Staff (ICG-P Eneo).

⁶⁵ See on MyEasyLight: <https://my.eneocameroon.cm/login>, and: <https://www.eneocameroon.cm/index.php/en/>

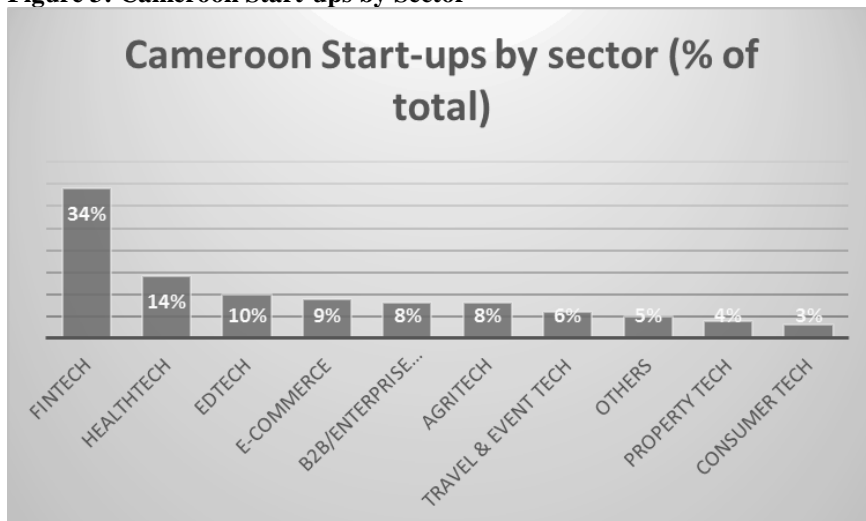
the information and communication technologies (ICTs) offer opportunities for creating digital businesses and boosting economic development”. The report of INS/NIS (INS 2018) relative to the 2nd general census of enterprises in Cameroon does not specifically highlight digital enterprises, but just analyses the determinants of the penetration of ICTs and of the technology innovations in the enterprises. So, data relative to the growth of digital enterprises are difficult to assess. Even on the website of the Ministry of Posts and Telecommunications (MINPOSTEL), the space which is reserved for start-ups does not give such data, although the website was created already in 2017. However, it is no doubt that technological innovations and the ICT penetration have reached combined performance effects on Small, Medium, and Micro-sized Enterprises (Ndokang Esone, L. and A. D. Tsambou; 2017, pages 165-186). We observe a great craving amount among the youth to create or to engage themselves in digital enterprises or a digital start-up, even in the informal sector, turning Cameroon to become a new land for digital start-ups and for digital entrepreneurship. In fact, since the 2000s there is an exponential growth of digital enterprises in Cameroon in such a way that it is difficult to count them and to compile the data relative to their activities. Such a register would be needed for policy actions.

Ajadi, S. and Acland, S. (2021) counted in July 2021 101 tech start-ups, of which 97 had been created between 2011 and 2020, and 36 of which were founded in 2019 and 2020. Making an overview of Cameroon’s tech ecosystem, they classified start-ups by sector as we can see in the figure 3 below. They noted that FinTech is the leading sector for tech innovations in Cameroon, with about 35% of the tech start-ups involved in this space. HealthTech is the second-largest sector in Cameroon’s technology and digital innovation ecosystem, accounting for around 15 % of all start-ups (Ajadi, S. and Acland, S., 2021, page 15).

Digital financial services in Cameroon are growing faster than other specific services for business networks, particularly in industry, agriculture, and energy. Most focus is on bill payments and on money transfers, as the FinTech sector records an explosive growth. FinTech (or Financial Technology) refers to a variety of financial activities, such as money transfers, depositing a check with the smartphone, bypassing a bank branch to apply for a credit, raising money for a business start-up, or self-managing of investments, generally without the assistance of a person to give advice. It is difficult to list the most important FinTech enterprises in Cameroon, as the financial technology (FinTech) space in Cameroon is flourishing. In 2016, the magazine Business in Cameroon (BC) gave a focus report on the top 20 Cameroonian start-ups (BC/Business in Cameroon, 2016, pages 8-17) being prevalent in all sectors. In 2018, the Magazine CAMEROON CEO classified IWOMI TECHNOLOGIES as the second of the top

ten of viable start-ups in Cameroon⁶⁶. In May 2021, Mbodiam, B. R. (2021, pages 8-11) in the BC/Business in Cameroon Magazine enlightened the performance of DIOOL and MAVIANCE in their expansion, after they successfully raised funds⁶⁷.

Figure 3: Cameroon Start-ups by Sector



Source: Ajadi, S. and Acland, S., 2021, page 16.

Currently, MAVIANCE⁶⁸ is the largest digital financial services platform that connects agents, businesses, billers, merchants, and financial institutions in Central Africa. In their expansion, MAVIANCE connected all major service providers, payment providers, financial institutions, and wallet operators to its digital financial services platform SMOBILPAY, a digital payment Hub.⁶⁹ The start-up registered a quick deployment through a partnership with ENEO. In fact, through SMOBILPAY, MAVIANCE acts as the collection point of ENEO, and with SmobilPay the customers can pay electricity bills just by using their mobile phone.

⁶⁶ See Cameroon CEO Magazine, 2018. For download see:

<https://cameroonceo.com/2018/08/21/top-10-des-start-ups-numeriques-camerounaises-les-plus-viables/>

⁶⁷ See BC/Business in Cameroon n° 100; 2021; pp. 8-11. For download see:

<https://www.businessincameroon.com/pdf/BC100.pdf>

⁶⁸ See the website of MAVIANCE: <https://www.maviance.com/>

⁶⁹ See the website of SMOBILPAY: <https://www.smobilpay.cm/en/home/>

Specialized in the aggregation of mobile means of payment via a single platform, DIOOL⁷⁰ helps small merchants in Africa to accept payments from customers and to pay their suppliers, using technology, data, and financial products.

IWOMI TECHNOLOGIES⁷¹ has developed several innovative solutions (Softeller, Mosa, BkWiki), and had recently benefitted from a partnership with the CBC Bank FinTech, as it had supported the bank in the deployment of ATMs for receiving cash deposits. These ATMs will reduce customer-waiting times at often-overcrowded bank counters. The purpose of those applications is to facilitate access to financial services or to help financial institutions to improve the quality of their services (see the box 1 on IWOMI Technologies Solutions).

BOX 1: IWOMI TECHNOLOGIES SOLUTIONS

IWOMI TECHNOLOGIES is a Cameroonian Fintech, which offers two types of products: B2B and B2C solutions. Its prime innovative solutions are Softeller, Mosa, and BkWiki.

MOSA, among the B2B products offered, is a POS (Point of Sales) solution, which includes a mobile commercial management application, and which integrates all means of payment in the ecosystem (GIMAC, Cards, Mobile Money, Bank accounts, etc.). GIMAC is the regional electronic money transfer platform of Central Africa. Recently GIMAC and TerraPay, the world's first mobile payments switch signed a strategic partnership agreement.

SOFTELLER, among the B2C products, is a trademark and a platform specialized in Online money transfer in Cameroon, in Online Airtime Top Up, and is offering much more other services being available into the user dashboard, such as bills payment, school fees payment, and salary payment. Inspired by the founder's experience as a Call Boxer (Telephone Communication Credit Vendor), Softeller is appearing as a relevant solution for money transfer, credit transfer, and bill payment, and is considered as one of the best applications created by IWOMI TECHNOLOGIES.

BKWIKI, also a B2C product, is a Mobile and web application that provides access to general information on banks in Africa, on general knowledge about the banking sector, its terminologies, the functioning, the structural organization, and the regulation. For each chosen bank, it gives information on General Conditions, Branches and ATM Locations, Account Types, Loan Offers, Card Offers, Mobile Banking/Payment Offers, and Other Products and Services.

⁷⁰ See the website of DIOOL: <https://www.diool.com/?lang=en>

⁷¹ See the website of IWOMI TECHNOLOGIES:
<https://www.iwomitechnologies.com/iwomitech/en/>

Sources on the apps:

<https://play.google.com/store/apps/details?id=com.iowmi.mosa&hl=de&gl=US>

<https://play.google.com/store/apps/details?id=com.iwomi.softeller&hl=de&gl=US>

<https://play.google.com/store/apps/details?id=com.app.bbwiki&hl=de&gl=US>

Supported by the rise of FinTech and e-payment solutions, e-commerce is growing and occupied the 4th place among the start-ups (see figure 3). The development of E-Commerce and the growth of this new activity led to Cameroon as being ranked (in 2021) at the top ten of the largest e-commerce countries in Africa⁷². The growth of e-commerce in Cameroon was motivated by the arrival of international operators such as JUMIA, which has been leading the market since 2013 when it settled in the country (see the box 2).⁷³ Despite the difficulties faced by JUMIA which have led to their departure from Cameroon in 2019⁷⁴, E-commerce is still flourishing in Cameroon and has recorded investments from many players who stand out nationally or internationally through their sales and purchasing offers. In fact, since the closure of JUMIA, the E-commerce registered new start-ups such as Durrell Market (an ultra-modern Cameroonian e-commerce platform)⁷⁵, which has positioned itself as the new leader in the sector. Ex-employees of JUMIA founded in 2020 the start-up BRAND SPARK⁷⁶, to boost E-commerce in Cameroon.

BOX 2: JUMIA - The Leader of E-Commerce in Africa

Jumia, the German-based Company, is a leading e-commerce platform in Africa. The company is a consumer goods e-commerce retail platform that connects sellers to consumers. It also provides logistics services, facilitating the shipment and delivery of packages from sellers to consumers, and has a payment service for transactions among participants and for JUMIA platforms in selected markets. JUMIA has started operations in Africa in 2012, in Egypt, Morocco, Ivory Coast, Kenya, and South Africa. At this first year, the company's operations were marked by rapid expansion. Two years later, offices

⁷²See BC/Business in Cameroon, 2021: "Cameroon ranked 10th largest e-commerce country in Africa (UNCTAD)"; for download:

<https://www.businessincameroon.com/ict/1101-8745-cameroon-ranked-10th-largest-e-commerce-country-in-africa-unctad>

⁷³ See on the website of JUMIA: <https://group.jumia.com/>

⁷⁴ See on the departure of JUMIA from Cameroon (Reuters, November 18, 2019):

<https://www.reuters.com/article/us-jumia-tech-cameroon-idUSKBN1XS1YK>

⁷⁵ See the website of Durrell Market: <https://durrellmarket.com/>

⁷⁶ See the website on the activities in Cameroon: <https://cm.linkedin.com/in/brand-spark-5367931a9>

in Tunisia, Tanzania, Ghana, Cameroon, Algeria, and Uganda were launched. In 2017, JUMIA launched his own payment solution: JumiaPay, which allowed the owner of an account in this platform to aggregate several local payments means, such as a bank account or mobile money. In 2018, JUMIA was present in 14 African countries, and in November 26 of this year, JUMIA signed a partnership with ADIALEA (a joint venture between CFAO and the mass-market retailer Carrefour) to ensure the online distribution of its products in Cameroon, Côte d'Ivoire, and Senegal. The agreement stated that the distribution of Carrefour products via the JUMIA platform would start in 2019. Due to allegations of fraud and concealed losses, JUMIA began to decline with their businesses in 2019, and Cameroon was the 3rd African country where JUMIA ended its online operations after Gabon and Congo. As the e-commerce frontrunner in Cameroon, JUMIA has effectively stopped operations in the country from November 18, 2019. JUMIA's departure has created a market gap with promising potential for growth. New start-ups stepped in to benefit from the market potential. JUMIA is obviously strong in other African countries, like Nigeria.

Sources on JUMIA in Cameroon and in Africa:

JUMIA Today: <https://group.jumia.com/>

JUMIA Nigeria: <https://www.jumia.com.ng/today/>

JUMIA South Africa: <https://www.jumia.co.za/>

JumiaPay: <https://pay.jumia.com.ng/>

ADIALEA, CFAO and Carrefour:

<https://www.africabusinessplus.com/en/807098/carrefour-reduces-its-stake-in-adialea-its-joint-subsidiary-with-cfao/>

CFAO (Corporation For Africa & Overseas) Group:

<https://www.cfaogroup.com/en/homepage/>

Carrefour: <https://www.carrefour.fr/>, and: <https://www.carrefour.com/en>

Despite the boom of E-commerce, Ehode, E. and Makoudem, T. (2020, pages 637-642) show that the E-commerce technology adoption by consumers (calculated in percentages of consumers) in Cameroon is not heavy, and the poor quality of the Internet can even break this dynamic (see table 1). In fact, the poor quality of the Internet and the low Internet penetration rate reduce the positive impact of the growth of E-Commerce. Average quality is obviously not enough for successful E-Commerce.

Table 1: E-commerce technology adoption by consumers (in percentage)

Level	ICT Knowledge	Internet Knowledge	Internet Quality
None	0	0	0
Average	29	26	59
Good	55	55	33

Very Good	16	19	8
Total	100	100	100

Source: Ehode and MakouDEM, 2020

Analysing those statistics, Ehode and MakouDEM (2020) underline that “the quality of Internet is very important as many e-commerce websites use a lot of images, and the user needs to have a high-speed Internet to browse them”. However, 59% of the people, who were interviewed in the field, find the quality of the Internet to be only “average”. For e-commerce sites to be successful, there is a need for a smooth and efficient system, and the commitment to make regular improvements and maintenance work.

The creation and the growth of start-ups or of digital small and medium-sized companies depends on the kinds of entrepreneurship and financing. According to the study *Doing Business 2020* (World Bank 2020b)⁷⁷, Cameroon was ranked at the position of 104 across 190 economies in 2020 in regard of the procedure relative to the starting of a business. So, Cameroon is among the worst countries, where starting up a business is not easy for entrepreneurs (Kakdeu et al., 2020, p. 11). However, relative to the access to credit, Cameroon is at the position of 80 across the 190 countries but obtaining credit from financial institutions is not that much easier for SMEs. Facing lack of capital, many owners of start-ups choose between three (3) non-exclusive strategies: self-financing, fundraising, and bank loans. The main strategies used specifically by Cameroonian FinTech start-ups is fundraising through crowdfunding platforms.

In fact, FinTechs use fundraising and partnerships with banks as financial strategies to create and to develop a business. For example, the Cameroon-based FinTech MAVIANCE PLC launched a seed investment round for its CEMAC expansion⁷⁸ and raised \$3 million from MFS Africa a Pan-African FinTech⁷⁹, operating the largest digital payments hub on the African continent. The Cameroonian start-up DIOOL raised for his part \$3.5 million (or 1.8 billion FCFA) in February 2021 to develop its digital payment services. Founded in 2015 by

⁷⁷ See World Bank Group, *Doing Business 2020* (2020b), for download: <https://documents1.worldbank.org/curated/en/688761571934946384/pdf/Doing-Business-2020-Comparing-Business-Regulation-in-190-Economies.pdf>, and: <https://www.doingbusiness.org/en/doingbusiness>

⁷⁸ See on the finance deal : <https://www.techgistafrica.com/fintech/maviance-a-fintech-company-based-in-cameroon-has-closed-a-usd-3-million-seed-round-led-by-mfs-africa/>, and:

<https://www.lunpartners.com/en/2021/05/14/maviance-raises-3m-from-mfs-africa-to-digitize-financial-services-across-central-africa/>

⁷⁹ See the website of MFS Africa: <https://mfsafrica.com/>

Serge and Philippe Boupda⁸⁰, this electronic platform claimed just 2 years after its commissioning to have reached the acquisition of 2,000 traders, with a value of approximately 120 million dollars (more than 65 billion FCFA) for the volume of transactions processed via the platform. IWOMI TECHNOLOGIES signed a partnership with the Commercial Bank of Cameroon (CBC Bank), which led the financial institution to invest in the FinTech.

The 2021 tax scheme (The General Tax Code) had been updated to promote innovative ICT start-ups as we can see in Section 124b of the General Tax Code⁸¹. Some of them succeeded to build very viable enterprises, which are growing despite financial difficulties and lack of governmental support. But the difference between all those start-ups is their scalability which allows founders of start-ups to move from start-up to scale-up, as it was the case of HIMORE MEDICAL.

5 From Start-up to Scale-up: the case of HIMORE MEDICAL

Start-ups are generally defined as companies in their first stage of operations with the ability to scale up and to grow rapidly. Analysing the growth of start-ups in Cameroon through their mechanisms of governance, Kaoutoing, S. et al. (2020, page 148) underlined that growth, clearly defined as a strategic choice, is the key for the success of a start-up. However, as the choice of “growth as a key business strategy” is not sufficient for a start-up to evolve into a viable enterprise, there is the further key point of financing the project or the business idea. As underlined by Pedchenko, N. et al. (2018, page 166) “*Access to financing is one of the key issues for small business entities in the process of their creation, existence and development*”. Therefore, they analyse the role of “business angels” as an alternative to additional financial support at the early stages of the small businesses’ life cycle (Pedchenko, N. et al., 2018, pages 166-179). But, according to the business plan and the objective of the start-up, all types of financing can be used as complementary.

Arthur Zang⁸², a young Cameroonian engineer, created HIMORE MEDICAL in 2014, after the invention of the Cardio-Pad in 2011. The Cardio-Pad is a medical tablet that takes a reading and sends it to a heart specialist. Noubiap, J. J. et al. (2014) gave more details on this local innovation for improving primary care

⁸⁰ See on the investment deal for Diool: <https://afrikanheroes.com/tag/serge-and-philippe-boupda/>

⁸¹ See The General Tax Code, Edited on the 1st of January 2021: <https://www.impots.cm/sites/default/files/documents/General%20Tax%20Code%202021.pdf>

⁸² See on the inventor of Cardio-Pad: <https://www.forbes.com/sites/mfonobongnsehe/2012/02/09/young-african-invents-touch-screen-medical-tablet/?sh=137cabd87055>

cardiology. The Cardio-Pad had been recognized by the Cameroonian government which gave to the engineer a financial aid of \$ 30,000 as a subsidy for research & development. Using a part of this money, the young man founded HIMORE MEDICAL, thinking that it was necessary to work as a company which could implement the project at a large scale. The company was in charge to design, to develop, and to bring the Cardio-Pad on the market. The first 20 Cardio-Pad devices which were built were used to promote the product, to demonstrate its capabilities, and to convince the people of its viability. This publicity helped the promoter to win the Rolex Awards for Enterprise 2014⁸³ in the category of applied technology; the invention is credited to be an African's first medical computer tablet. Arthur Zang received for his project of a Cardio-Pad from the Foundation Rolex a price of € 48,000. Arthur Zang, Founder and CEO of HIMORE MEDICAL, used the money from the Rolex Award to produce more devices and to meet the need of the market in Cameroon and in other countries of the region and the world. HIMORE MEDICAL started the commercialization of the Cardio-Pad since 2016, and each Cardio-Pad is sold for the complete unit at the price of € 3,000 (\$ 3,299; XAF 2,075,000), mainly to hospitals in Cameroon. The Cameroon Ministry of Health which ordered the first 20 tablets, starting in 2016, is the main client, and under its supervision, between 2016 and 2017 more than 20 public hospitals were fully trained and equipped with Cardio-Pad devices. Therefore, Cardio-Pad is becoming a full component of Cameroon's public health policy for the prevention of heart diseases in such a way that more than 260 health centres are equipped with the Cardio-Pad. In 2021, the Ministry of Defence ordered 30 Cardio-Pads for the various military hospitals that are counted in the country. The start-up HIMORE MEDICAL is growing, and it registered more and more orders, boosted by the pandemic Covid-19.⁸⁴

In 2015, HIMORE MEDICAL was employing 7 persons, with a non-determined annual sales volume at the time, and it is classified as a small-size enterprise according to the Law No 2010/001 of 2010 to promote Small and Medium-sized Enterprises in Cameroon (Government of Cameroon, Law No. 2015 of 16 July 2015), as amended in 2015 from the Law 2010/001⁸⁵. The start-up registered a spreading of growth since and now employs 18 persons⁸⁶, showing

⁸³ See on the Cardio-Pad invention and the inventor: <https://www.rolex.org/rolex-awards/applied-technology/arthur-zang>

⁸⁴ See on the relevance of the Cardio-Pad solution for the rural hospitals in Africa: <https://genevasolutions.news/explorations/11-african-solutions-for-the-future-world/the-day-bluetooth-brought-a-cardiologist-to-every-village-in-cameroon>

⁸⁵ The Small-size Enterprises (SE) employ between 6 and 20 persons, with an annual sale free of duties which is beyond 15 million FCFA and does not exceed 100 million of Francs CFA.

⁸⁶ See on the employment growth: <https://himore-medical.com/about/team>

the strategic choice of the young digital entrepreneurship to expand their activities despite a difficult business environment.

HIMORE MEDICAL has a team of 18 persons, comprising 5 Engineers, 4 technicians, 3 editors and project writers, 3 support team members, 1 accountant, and 2 doctors. The mission of the team is to design and to manufacture medical embedded systems (autonomous electronic and computer systems)⁸⁷. HIMORE MEDICAL also provides equipment for hospitals, and it has benefitted from local banks through loans of around € 50,000 so that the start-up could create 14 new jobs (see box 3). The local, regional, and global market prospects are very favourable as 17 million people die every year from cardiovascular diseases, and 85% of them in developing countries.⁸⁸

BOX 3: HIMORE MEDICAL

HIMORE MEDICAL is the first Medical Embedded Systems manufacturer in the Central Africa region (www.himoremedical.com). The enterprise was founded by Arthur Zang, where he still works as a Researcher, as the Chief Engineer, and as the CEO. HIMORE MEDICAL is in partnership with many hospitals in Africa; it conceived a health programme named AFRICA CARDIAC CARE for Africans with a low income. The programme offers to the subscribers the opportunity to benefit from four types of complete cardiovascular examinations (electrocardiogram, measuring blood pressure, measuring blood sugar, and oximetry) for \$ 48 per year in hospitals and for \$ 60 for home care. When a patient subscribes online or in a clinic, he receives a Smartcard, which allows him to benefit from a complete cardiac monitoring in all the centres being partners of AFRICA CARDIAC CARE for one year. A cardiologist interprets every examination, which is done remotely. The results from the Cardio-Pad are sent to a cardiologist via a mobile network and can be interpreted within 20 minutes.

Since the beginning, the programme registered 895 beneficiaries, and there are about 200 users per month. The Cardio-Pad uses a personalized operating system (OS) which was developed from the Microsoft Windows CE 5.032-bit OS. The Cardio-Pad has four main applications: (1) electrocardiograms (ECG) PAdExam to perform 3, 6 or 12-leads ECG; (2) ECG PadScope, which

⁸⁷ See on the role of medical embedded systems: <https://www.delkin.com/blog/using-embedded-systems-in-healthcare/>

⁸⁸ See on the huge market prospects for CARDIO-PADS in developing countries and in Cameroon: <https://www.itu.int/en/ITU-D/Regional-Presence/Africa/Documents/Digital%20Economy%20Development%20C.%20Africa/English%20Doc/Presentation/Technology%20For%20Healthcare.pdf>

performs real time ECG monitoring along with measuring other vital parameters, such as oximetry, respiratory rate, blood pressure, temperature, and which provides an alert in case of any anomaly; (3) ECG PadAnalyse which presents the patient's data to the cardiologist and assists him at interpreting the data and providing a computer-assigned diagnosis; and (4) Pad D-Transfer, to transfer the data from one Cardio-Pad to another one or to the National Cardiology Data Remote Centre.

Source: <https://himore-medical.com/>
<https://africacardiaccare.com/en/home/>
<https://www.odess.io/initiative-detail/africa-cardiac-care.html>

Another Cameroonian e-health start-up was founded in by Alain Nteff, named Healthlane, which offers both remote and in-person medical services. The application is functioning as a meeting point for individuals, health practitioners, health centres, and drugstores. In September 2020, Alain Nteff⁸⁹ announced that he has completed a crowdfunding operation aimed at raising FCFA 1.3 billion to develop a healthcare services platform. Healthlane⁹⁰ is the second application created by this young entrepreneur. His first application is GiftedMom⁹¹, which, via SMS, reminds pregnant women of their appointment for prenatal checks and children's vaccination dates.

The start-ups, deployed with their strategic choice to growth, are involved to transform their business idea into a business model despite various constraints. There is a great need for national initiatives and regulations to empower start-ups in Africa in general, and specifically so in Cameroon. Now, in the African continent only few countries have adopted Start-up Promotion and Development Acts, which create clear frameworks and operational support for these new enterprises. The first country was Tunisia, followed by Senegal in 2019. Cameroon is still working on this issue. Nevertheless, while waiting, the government created

⁸⁹ See on the start-ups of this young entrepreneur and his partnerships: <https://ideas4development.org/en/auteur/alain-nteff-2/>; he is one of three young Cameroonian entrepreneurs being active in the health and IT business:

<https://ideas4development.org/en/startup-cameroon-entrepreneurs-stories/>

⁹⁰ See the website and reports about Healthlane: <https://www.healthlane.co/>, and: <https://disrupt-africa.com/2020/09/08/cameroonian-e-health-startup-healthlane-raises-2-4m-funding/>, and: <https://allafrica.com/stories/202111160201.html>

⁹¹ See the website and activity reports for GiftedMom:

<http://www.giftedmom.org/index.html>, and:

<https://www.who.int/pmnch/about/members/database/giftedmom/en/>

the Cameroon Investment Portal “eRegulations Cameroon”⁹² under the auspices of the Ministry of SMEs, Social Economy, and Craft.

6 Conclusions and Policy Recommendations

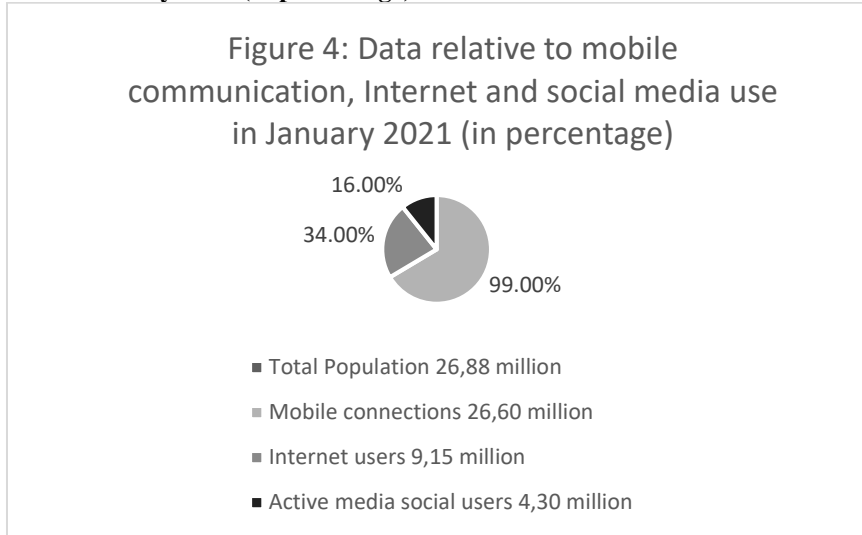
Analysing the data of the “Digital 2021 Cameroon Report” (Datareportal 2021) in the figure 4, we notice that for a population of 26.88 million there exist not less than 26.60 million (99.00%) mobile connections, but just 9.15 million people (34.0%) use the Internet, and only 4.30 million people (16.0%) are active social media users.

This limits the use of the digital media quite strongly. In regard of those statistics, Cameroon is still away from the objective of the Strategic Plan for a Digital Cameroon by 2020 (MINPOSTEL 2016) to raise the Internet penetration rate from 11% in 2016 to 50% by 2020. Nevertheless, if we consider that the Strategy has been implemented in the context of the severe political crisis (Boko Haram and the Anglophone crisis) and that the country was hit by the COVID 19 pandemic in 2020, the achievement of an Internet penetration rate of 34.00% is appreciable. The political will of the government to “turn Cameroon into a digital country” faces multiple challenges and constraints, specifically relative to the deployment of digital solutions and to secure the finances (or the sources of fundraising) for the digital business transformation.

Relative to the deployment of digital solutions, three (3) constraints should be mentioned: regulatory constraints (1), technology constraints (2), and social and structural constraints (3).

⁹² See the website eRegulations Cameroon: <https://cameroun.eregulations.org/>, and: https://cameroun.eregulations.org/communication/brochures/generic/eRegulations_Cameroun-PARTNERS-EN.pdf, and about Cameroon’s Investment Climate: <https://www.state.gov/reports/2021-investment-climate-statements/cameroun/>

Figure 4: Data relative to mobile communication, Internet and social media use in January 2021 (in percentage)



Source: Authors, and Datareportal 2021, Digital 2021 Cameroon Report, p. 17

6.1 Regulatory constraints

Legislation to promote and to facilitate digital transformation in Cameroon is rich of many laws, decrees, and other reglementary texts. Various institutions, such as Cameroon Telecommunications (CAMTEL), the Telecommunications Regulatory Board (TRB), and the National Telecommunications Agency (ANTIC) under the tutorship of the Ministry of Posts and Telecommunications (MINPOSTEL), have assumed the responsibility to regulate the development and the use of ICTs with the aim to guarantee a favourable environment for digital activities. However, despite laws and those institutions, the governmental policies remain non-efficient and ambiguous. In addition, the regulations for digital and other start-ups and for the digital transformation of established businesses matter. It is just in July 2021 that MINPOSTEL put a framework in place to elaborate an appropriate law for the deployment of start-ups in the country. Also, tax exemptions are put in place in 2021 for start-ups.⁹³

In the law n° 2010/013 of 21 December 2010 on Regulating e-Communications, amended in April 2015, it is stated in article 4 that every citizen “has the right to benefit from electronic communications services”, and articles 27

⁹³ See on the changes for taxes of start-ups: <https://afrikanheroes.com/2020/11/07/from-2021-startups-in-cameroon-will-benefit-from-tax-exemptions-for-up-to-5-years/>

to 29 establish a Universal Service Access Fund (USAF), aimed at ensuring equal, quality, and affordable access to services. However, in practice, access and affordability remain a challenge, especially among rural and poor communities. Simone Toussi (2019) noticed that the average cost of 1 GB of data is 2,000 FCFA (USD 3.4) per month, and with the proposed levy of 200 FCFAs (USD 0.34) on software and application downloads, the costs are expected to increase further⁹⁴. Therefore, Internet access in Cameroon is among the most expensive of the countries surveyed.

There are also fiscal and administrative constraints related to high taxes and long administrative procedures for the creation of business. All this combined to corruption and digital divide need public policies reforms adapted to the challenges of the digital economy.

Moreover, the digital transformations of the financial sector need new laws to regulate competition between banks, mobile operators, and other actors who are emerging in the sector. Banks and other actors in the competition arena clearly manifest their dissatisfaction with an incremental response. Ameh Akon (2012), looking at the banking sector regulations, was very early a critical observer⁹⁵.

6.2 Technology constraints

Despite the progress registered since 2020, the country remains one in which ICT's penetration and usage are relatively low. As one can observe in the figure 5 (see below), despite an annual growth of internet users of 16,3%, the percentage of the population using Internet remains low. Also, Cameroon's Internet market, which is driven by the deployment of 3G and 4G mobile broadband services, registers a fast growth, but the cost of Internet and of mobile telephony need to be related to the income per inhabitant. As observed by OECD (2021), "the cost of mobile phone communication remains a major obstacle to digital expansion". Despite a coverage rate of 78%, Cameroon failed to offer a rich service quality to those who have access to internet, as the network is being constantly disturbed.

According to Digital 2021 Cameroon report (Datareportal 2021), 9.15 million people out of 26.68 million, representing 34.00% of total population, use Internet. And if we compare 2021 and 2020 (Datareportal 2020), there were 7.87 million Internet users in Cameroon in January 2020⁹⁶, and the number of Internet users increased by 16.30% between January 2020 and January 2021 (Datareportal

⁹⁴ See Toussi, S. 2019; and for download see: <https://cipesa.org/2019/09/overview-of-camerouns-digital-landscape/>

⁹⁵ See Ameh Akon, G. 2012; and for download see: <https://www.econrsa.org/system/files/workshops/papers/2012/akon-banking-sector.pdf>

⁹⁶ See Digital 2020 Cameroon Report (Datareportal 2020); p. 22. and for download: <https://datareportal.com/reports/digital-2020-cameroon>,

2021). Despite this growth, the penetration of Internet remains low and insufficient to achieve a relevant digital transformation, considering that, with average download speeds of 13.88 Mbps for mobile tools, Cameroon ranked 115th, and with 7.85 Mbps for fixed-network broadband Internet, the country ranked 157th in October 2021, in an international comparison⁹⁷.

Also, despite the government investment into the submarine optic fibre cables, being a critical infrastructure project for the development of the telecommunication services, there are lots of problems of Internet connectivity as it is currently weak and not very affordable. Over the 9.15 million people who are connected to Internet, fixed-network broadband subscriptions in Cameroon were reported at 400,929 in 2019, according to the World Bank (World Bank Group, 2020). Fixed-network broadband Internet includes cable modems, DSL, fibre-to-the-home/building, and other fixed (wired) broadband subscriptions. This low number is explained by the fact that access to telecommunication and digital tools is more costly, and that the country suffers from poor Internet and 4G access. It appears that the government may have difficulties to control the demographic growth, and therefore it is unable to put in place adequate digital infrastructure development policies.

6.3 Social and structural constraints

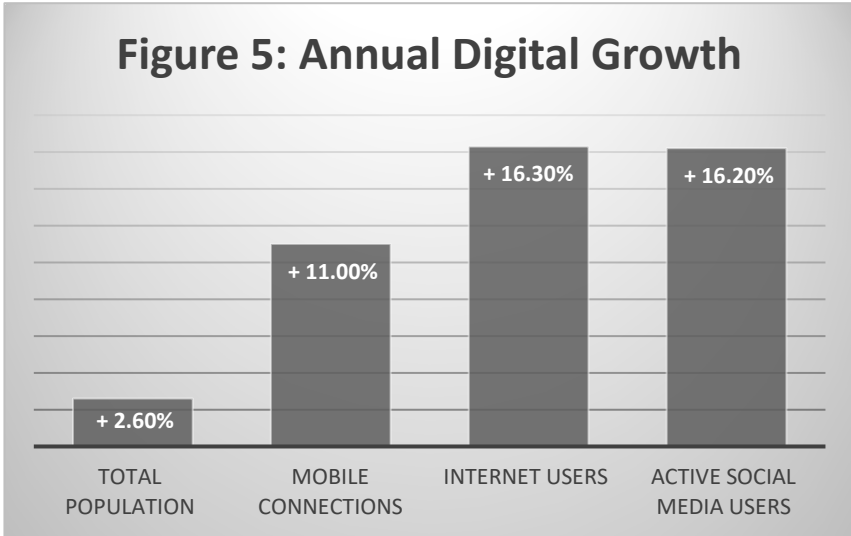
As seeing the annual digital growth in the Digital 2021 Cameroon Report (Datareportal 2021, and figure 5 below), it might be reasonable to think that digital growth impacts GDP and then will lead to digital job transformations in so far as the first impact of growth is on the workforce. In fact, for an economy to survive and to thrive in the digital era, it must empower its workforce pool with adequate digital skills. Digital skills enable enterprises and other institutions to use digital technologies and digital knowledge in an empowering and transformative way to create and to innovate in ICT professions (World Bank Group, 2020: page 20). It is supposed that there is a need for a Digital Transformation being proactive for Quality Jobs. But as noted by the OECD (2021), in Cameroon the number of direct jobs created in information and communications technology (ICT) is reported to represent 3-5% of the labour force, while each ICT job generates 4.9% of jobs in other sectors⁹⁸. But many of those jobs supported by start-ups - with little or no structure - are less sustainable. To seek solutions to the digital skills gap in Cameroon, ANTIC installed in 2019 the Cameroon Digital Skills Campaign

⁹⁷ See Speedtest Global Index (2021), "Global Median Speeds October 2021"; for download: <https://www.speedtest.net/global-index/cameroon#fixed>

⁹⁸ See OECD 2021, pp. 141-142; the report is citing Tiona Wamba and Ngonu Ndjie, 2019 for the results on Cameroon.

(CDSC), with the objective to empower youths with upper tier digital skills.⁹⁹ The 3rd edition of this annual three-day campaign took place on 21 April 2021 under the theme: “Digital Skills for Youth Employability and Entrepreneurship in the Post-COVID Technology Driven Economy”.

Figure 5: Annual Digital Growth



Source: Authors, Datareportal 2021, Digital 2021 Cameroon Report, p. 18.

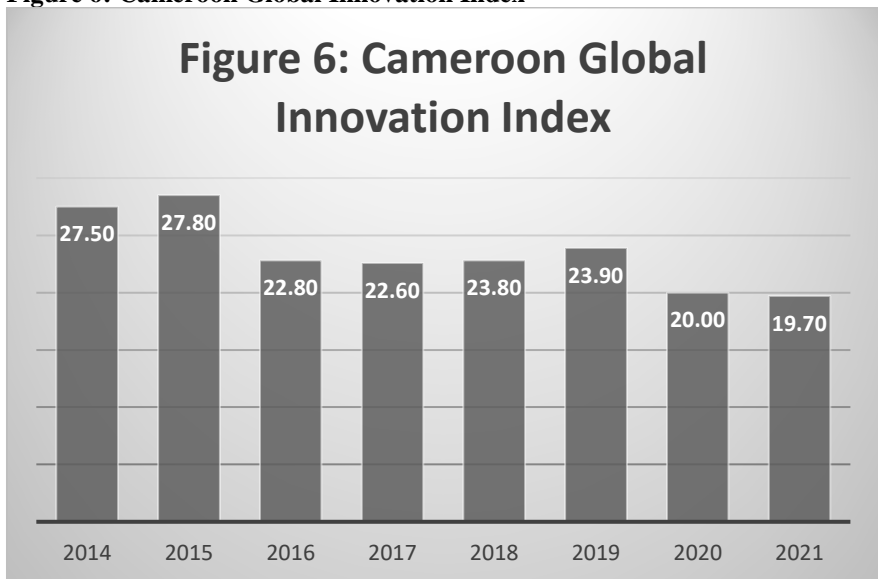
Despite the opportunities, Cameroon as well as other countries in Central Africa are making slow progress in creating digital jobs, due to significant structural constraints, such as the fact that less than 48 % of the people have access to electricity. Underemployment remains high because instead of creating new jobs, digitalisation has led to replace human resources by digital applications, cashiers by automatons, and contact centres by avatars, so that to some extent the result is job reduction or job destruction. However, considering that the digitalisation allows the development of new sectors, new products, and new services, it seems that there will also appear many new jobs. But the scores for the Global Innovation

⁹⁹ See on the scope of the campaign:

<https://www.antic.cm/index.php/en/component/k2/item/423-cameroon-digital-skills-campaign-2021-100-youths-empowered-with-microsoft-professional-certification.html>

Index (GII)¹⁰⁰ of Cameroon are constantly declining since 2015 (see figure 6 below). The latest score value from 2021 is 19.7 points. For comparison, the world score value average in 2021, which is based on 132 countries, is 34.30 points¹⁰¹. This situation can be explained by the fact that the potential of more than 60% of the population aged 15-34 years is under-exploited, as many young people are without work and do not fully contribute to wealth creation. With the pandemic of Covid-19, the situation was getting worse. Then, new policy approaches are requested as the digital transformation must account for the “human presence” to succeed in digitization; digital transformation is a process that requires “human monitoring” for its full exploitation and expansion of the talents and skills.

Figure 6: Cameroon Global Innovation Index



Source: The Global Economy.com (2021); for download: https://www.theglobaleconomy.com/Cameroon/GII_Index/

Access to the communications infrastructure and to digital tools remains disparate. The cost of a computer is equivalent to the annual per capita income,

¹⁰⁰ The Global Innovation Index (GII) captures elements of the national economy that enable innovative activities to create jobs and capabilities to capture digital opportunities to boost the digital economy.

¹⁰¹ See The Global Economy, 2021, Cameroon: Innovation index. For download: https://www.theglobaleconomy.com/Cameroon/GII_Index/

which makes the purchase of this tool inaccessible to most of the Cameroonians, and therefore constitutes a major obstacle to Internet access for the population. In addition, Cameroon has huge difficulties with electricity supplies, experiencing many blackouts, and some geographic areas are suffering from complete lack of electricity services. Cameroon experiences again, since the beginning of 2021, power outages, despite the construction of new hydroelectric dams in Mékin¹⁰², Memve'ele¹⁰³, and Lom Pangar¹⁰⁴ with hydropower installations. For the general director of ENEO, the main reason of this situation is that “*the electricity transmission network suffers from underinvestment*”¹⁰⁵. Despite a hydroelectric potential of 55.2 gigawatts (GW), Cameroon has an important energy deficit because, for about three decades, there have not been investments into energy projects because of structural adjustment and austerity programmes. With Lom Pangar, Memve'ele and Mekin hydroelectric dams under construction and becoming operational, the aim of Cameroon is it to develop its energy infrastructure in collaboration with foreign partners. However, while waiting for those dams to become effectively operational, the hydroelectric potential is underexploited.

For the solar energy, according to ARSEL (Agence de Regulation du Secteur de l'Electricite/Electricity Sector Regulatory Agency), the average irradiation in the northern part of the country is 6 kWh/m²/day, and 4 kWh/m²/day in the southern part of the country¹⁰⁶. For the regulator, there is an average irradiation of 4.9 kWh/m²/day across the country¹⁰⁷. Nevertheless, nowadays this potential remains underexploited. The country relies mainly on hydropower energy for electricity generation (73%), with persistent power outages throughout the country, especially in the dry seasons when water levels are low. Muh E. et al. (2017, page 3420) underline that the increase in electricity demand since 2014 (1,455 MW) results from strong economic growth, and they argue that the electricity demand is expected to rise over the next decade to reach 5,000 MW by 2020 and 6000 MW by 2030. Therefore, they recommend a sustainable energy policy to address energy issues (reliability, accessibility, and

¹⁰² See on the Mékin Hydroelectric Dam: <https://ejatlas.org/conflict/mekin-hydroelectric-dam>

¹⁰³ See: <https://constructionreviewonline.com/news/memveele-dam-in-cameroon-to-be-fully-operational-by-december/>

¹⁰⁴ See in BC: <https://www.businessincameroon.com/energy/2203-11398-lom-pangar-dam-the-30mw-hydropower-plant-is-45-completed-edc>

¹⁰⁵ Éric Mansuy, General Director of ENEO, interviewed by Aboudi Ottou, 2021, BC/Business Cameroon n° 99, pages 12-15.

¹⁰⁶ ARSEL, 2014; for download: <http://arsel-cm.org/electricity-sector/general-presentation/?lang=en>

¹⁰⁷ Business in Cameroon, 2012. For download: <http://www.businessincameroon.com/pdf/BC-HS01.pdf>

security). Concerning specifically accessibility, the World Bank (World Bank Group 2020a) noted that 63.45% of the population had access to electricity in 2019, with 93.24% of the people living in urban areas and 24.01% living in rural areas¹⁰⁸. As recorded by the Ministry of Water and Energy, at the end of June 2021, 63.7% of the local communities still have no access to electricity.

6.4 A New Digital Transformation Strategy and Plan is needed for Cameroon

Considering all those constraints, Cameroon needs to strategically invest in the foundational elements of their digital economy to keep pace. Several recommendations had been made by various authors, by the World Bank Group, by OECD, and by so many digital actors. The analysis of all those recommendations led us to conclude that Cameroon needs a new Digital Strategy and a specific Framework for Digital Entrepreneurship and Promotion of Start-ups in Digital Era. A new Digital Transformation Strategy for Cameroon needs to emphasize:

(1) Relative to a Digital Transformation Strategy, it is important to notice that the Strategic Plan for a Digital Cameroon by 2020, adopted in 2016 (République du Cameroun, 2016, Plan Stratégique Cameroun Numérique 2020, Mai 2016), has come to the end of its validity (2015-2020). The government faced several difficulties to achieve programmes and objectives defined in this Strategic Plan. As this Plan has shown in 2021 its limits, the National Strategy of Development SND30 underlines the importance of the “Digital Transition” in the development of the sectors of industry and services (République du Cameroun (2020), SND30, 2020, page 6). It also places ICTs among the productive infrastructure (République du Cameroun (2020), SND30, 2020, pages 8-9). The strategy of development of telecommunication infrastructure, as defined there, has the objective to guarantee to the users a secure and effective digital space with an upper middle access index with a score value of 0.4. In their projects, Cameroon plans to achieve the Central African Backbone (CAB) project¹⁰⁹. It is intended to provide the member countries with a high-speed telecommunications network. But it is necessary for the Central African countries to co-ordinate their investment in digital infrastructure to expand the coverage and the affordability.

¹⁰⁸ World Bank; 2020a; for download:

<https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=CM>

¹⁰⁹ See on the CAB project:

[https://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Cameroon_-](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Cameroon_-_)

[_Central_Africa_Backbone_CAB_Project_%E2%80%93_Phase_1_%E2%80%93_Summary_of_the_Environmental_and_Social_Management_Plan_ESMP_%E2%80%93_05_2015.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Cameroon_-_Central_Africa_Backbone_CAB_Project_%E2%80%93_Phase_1_%E2%80%93_Summary_of_the_Environmental_and_Social_Management_Plan_ESMP_%E2%80%93_05_2015.pdf)

In the implementation of the SND30 relative to the “Digital Transition” and to the development of the ICT infrastructure, it would be advisable to:

(i) elaborate and adopt a new Digital Strategic Plan for 5 years which is leaned to the SND30 as the last one was leaned to the Strategic Document of Growth and Employment (DSCE/GESP 2010-2020)¹¹⁰;

(ii) involve stakeholders in the processes of building public policies by putting in place public-private partnerships to facilitate the strategic actions of all economic actors in the process of digitalization. The top-down policies are not relevant and are not sufficient to achieve efficiently the processes led by digital transformation.

(2) For the Promotion of Digital Start-ups, despite the dispositions of the 2021 tax scheme to promote innovative ICT start-ups, there is a need of a dedicated policy to support ICT start-ups to increase employment, capital transfers, research and technology development, and structural development in less-developed areas. In this perspective, since mid-July 2021, the Ministry of Telecommunications should work hard to put in place a framework and a process for the drafting of an appropriate law to promote the development of digital start-ups as it was done in Tunisia and in Senegal. The most important expectations of the actors of ICT sectors concerning this law for the development of digital start-ups are to present:

(i) the legal definition of a digital start-up according to the Cameroonian government.

(ii) a clear framework for the creation of a digital start-up by simplifying and strengthening the procedures to encourage digital entrepreneurship. For the World Bank Group, there is a need for Cameroon to establish strong regulatory frameworks to foster competition and to promote digital entrepreneurship (World Bank Group 2020a).

(iii) a definition of their legal regime, specifically adapted to their registration and labelling.

Beside the law, there is also a need of an incentive tax policy precisising the framework of government’s financial support through: customs benefits, social and fiscal advantages, credit guarantees, public and private funding, facilities for public procurement, and facilities in training and capacities building.

In conclusion, it is relevant that Cameroon has a great potential to turn to an effective and performing digital economy and to achieve its digital transformation. However, several constraints such as corruption, inadequate policy processes, and

¹¹⁰ See on the DSCE/GESP 2010-2020 for Cameroon:

<https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Cameroon%20DSCE2009.pdf>, and:

https://www.cameroonembassyusa.org/images/documents_folder/quick_links/Cameroon_DSCE_English_Version_Growth_and_Employment_Strategy_Paper_MONITORING.pdf

internal socio-political crises slow down the development of the Cameroonian digital economy and its dynamics of digital transformation. There are many challenges; the first is being expanding Internet coverage by connecting all the cities and rural areas to fibre-optic broadband infrastructure. For the country to be able in the ten next years to have more than 70% of its population using the Internet, Bakehe, P. et al. (2017, page 32) recommended the launch of “a reverse funnel” scheme, similar to the “Reverse Funnel” system proposed by the UIT/ITU (UIT 2013). The UIT/ITU study (UIT 2013)¹¹¹ gives a very detailed explanation of the system, and how to change the education system backwards from the university level to the primary school level (RFS/Reverse Funnel System) to develop digital competences.

References

- Ajadi, S. and Acland S., (2021), “Navigating the Tech Ecosystem in Cameroon”. For download:
<https://www.gsma.com/mobilefordevelopment/wpcontent/uploads/2021/07/Navigating-the-Tech-Ecosystem-in-Cameroon.pdf>
- Ameh Akon, G., (2012), “A critical look at banking sector regulations in Cameroon”. Download:
<https://www.econrsa.org/system/files/workshops/papers/2012/akonbanking-sector.pdf>
- Andersson-Manjang, S. K. and Naghavi, N. (2021), *State of the Industry Report on Mobile Money 2021*, GSMA. For download:
https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2021/03/GSMA_State-of-the-Industry-Report-on-Mobile-Money-2021_Full-report.pdf
- Atkinson, Robert D., D. Castro, St. Ezell, A. McQuinn, and J. New (2016), “A Policymaker’s Guide to Digital Infrastructure”; In: *Information Technology & Innovation Foundation*, May 1, 2016. For download: <https://www2.itif.org/2016-policymakers-guide-digital-infrastructure.pdf>

¹¹¹ The UIT/ITU study (UIT 2013) gives a very detailed explanation of the system, and how to change the education system backwards from the university level to the primary school level (RFS/Reverse Funnel System) to develop digital competences.

- ANTIC (2019), “Cameroon’s digital transformation, ANTIC sets stage for evaluation”; for download: <https://www.antic.cm/index.php/en/component/k2/item/379-cameroon-s-digital-transformation-antic-sets-stage-for-evaluation.html>
- Asadullah, A., I. Falk, A. Kankanhalli (2018), Digital Platforms: A Review and Future Directions. PACIS 2018 Proceedings. 248. <https://aisel.aisnet.org/pacis2018/248/>
- Atsa Etoundi, R., Mani Onana, F. S., Olle Olle, G. D., Ayissi Eteme, A. (2016), “Development of the digital economy in Cameroon: Challenges and perspectives”, in: *The Electronic Journal of Information Systems in Developing Countries, EJISDC* 76, 7, pages 1-24. Download: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/j.1681-4835.2016.tb00558.x>
- Ayuketang Nso, M. (2018), “Impact of Technology on E-Banking; Cameroon Perspectives”; in: *International Journal of Advanced Networking and Applications*, Vol. 9, n° 6, May/Jun, pp. 3645-3653.
- Bahri-Domon, Yasmine (2018), "Cameroon goes through digital transformation", in *Business in Cameroon*, n° 69, p. 3
- Bakehe, Novice P., Fambeu Ariel H., and Tamokwe Piaptie George B. (2017), “Internet Adoption and Use in Cameroon”, in: AERC Research Paper 336; for download: https://www.researchgate.net/publication/322318053_Internet_Adoption_and_Use_in_Cameroon
- Belda, Pascal et al. (2006), *The premier guidebook for business globetrotters. Cameroon*, Douala, Ebizguides
- Boojihawon, Dev Kumar and Zisuh Michael Ngoasong (2018), “Emerging digital business models in developing economies: The case of Cameroon”; in: *Strategic Change* 27(2): pages 129–137. Download: <https://onlinelibrary.wiley.com/doi/10.1002/jsc.2188>, and: http://pure-oai.bham.ac.uk/ws/files/42005615/Original_Manuscript_R1v1_RB_MN_Final.pdf
- Brett, King (2012), *BANK 3.0. Why banking is no longer somewhere you go, but something you do, Singapore*, John Wiley & Sons Singapore PTE. Ltd. Access: <https://www.wiley.com/en-us/Bank+3+0%3A+Why+Banking+Is+No+Longer+Somewhere+You+Go+But+Something+You+Do+-p-9781118589649>
- BC/Business in Cameroon, HS01 (2012), *Special issue on projects. Infrastructure, Energy, Mining, Agriculture*. For download: <http://www.businessincameroon.com/pdf/BC-HS01.pdf>
- BC/Business in Cameroon, n°41/42 (2016), Digital Economy. Top 20 Cameroonian start-ups. pp. 8-17. Mbodiam B. R., Cameroon, the start-ups saga.... For download: <https://www.businessincameroon.com/pdf/BC41.pdf>
- BC/Business in Cameroon (2017), “Cameroon is going on digital”, Number 51, for download: <http://www.businessincameroon.com/pdf/BC51.pdf>
- BC/Business in Cameroon (2018), “Cameroon’s finance sector goes through rapid digitalization”, Number 69; for download: <https://www.businessincameroon.com/pdf/BC69.pdf>

- BC/Business in Cameroon (2019), “Cameroon ranked 10th largest e-commerce country in Africa (UNCTAD)”, 11/1/2019; for download: <https://www.businessincameroon.com/ict/1101-8745-cameroon-ranked-10th-largest-e-commerce-country-in-africa-unctad>
- BC/Business in Cameroon, n° 99, (2021), Outages. ENEO’s director-general explains the situation, pp. 12-15. For download: <https://www.businessincameroon.com/pdf/BC99.pdf>
- Cameroon CEO Magazine n° 002, December (2019). L’avenir du E-commerce au Cameroun. For Download: <https://cameroonceo.com/wp-content/uploads/2019/12/CAMEROON-CEO-MAGAZINE-Numero002-December2019.pdf>
- Cameroon CEO Magazine (2018), Top 10 des Start-ups numériques camerounaises les plus viables. For download: <https://cameroonceo.com/2018/08/21/top-10-des-start-ups-numeriques-camerounaises-les-plus-viables/>
- CUA/AUC/OCDE/OECD (2021), “Chapter 4. Digital transformation for youth employment and Agenda 2063 in Central Africa”, in: *Africa’s Development Dynamics 2021: Digital Transformation for Quality Jobs*, CUA/AUC, Addis Ababa/Éditions OCDE/OECD, Paris, pp. 141-160. Download: <https://doi.org/10.1787/0a5c9314-en>
- Datareportal (2020), Digital 2020 Cameroon Report; available online: <https://datareportal.com/reports/digital-2020-cameroon>
- Datareportal (2021), Digital 2021 Cameroon Report; available online: <https://datareportal.com/reports/digital-2021-cameroon>
- Demirgüç-Kunt, A., Klapper L., Singer D., Saniya Ansar, Hess J. (2018), *The Global Findex database 2017. Measuring Financial Inclusion and the Fintech Revolution*, World Bank Group, Washington. For download: https://globalindex.worldbank.org/sites/globalindex/files/2018-04/2017%20Findex%20full%20report_0.pdf, and: <https://globalindex.worldbank.org/>
- Doh, Emmanuel T. S. (2020), “The Impact of Innovation on Financial Inclusion Case of the Financial Sector of Cameroon”, in *IIARD (International Institute for Academic Research) International Journal of Economics and Business Management*, Vol 6. No. 4, pp. 26-39. For download: <http://iiardpub.org/get/IJEBM/VOL.%206%20NO.%204%202020/The%20impact%20of%20Innovation.pdf>
- Dutta, S. and Lanvin B. (2020), *The Network Readiness Index 2020. Accelerating Digital Transformation in a post-COVID Global Economy*; Portland; Portulans Institute. For download: https://archive.uneca.org/sites/default/files/uploaded-documents/COVID-19/Leveraging-Digital-Transformation-post-COVID-19-era/nri_2020_final_report_october2020_1.pdf
- Ehode Elah R., Makoudem Tene Marianne (2020), “The Development of E-Commerce in Cameroon”, in: *International Journal of Scientific and Research Publications*, Volume 10, Issue 5, pp. 637-642; download: https://www.researchgate.net/publication/341904072_The_Development_of_E-Commerce_in_Cameroon

- ENEO Cameroun (2020), Annual Report. For download: <http://www.eneocameroun.cm/pdf/Eneo2020AnnualReport.pdf>
- Fadwa Zaouia, Nissrine Souissib (2020), "Roadmap for digital transformation: A literature review", in: *Procedia Computer Science*, n° 175, pp. 621–628. For download: <https://www.sciencedirect.com/science/article/pii/S1877050920317907>
- Fambeu A. H. (2021), *Adoption of Information and Communications Technology (ICT) in Industrial Firms in Cameroon*, Nairobi, AERC Research Paper 470. For download: <http://publication.aercafricalibrary.org/bitstream/handle/123456789/2827/Research%20paper%20470.pdf?sequence=1&isAllowed=y>
- Fangue L., Douanla J., Simo C. (2020), "Internal marketing and Customer trust in second-tier micro finance institutions in Cameroon"; in: *International Journal of Business Marketing and Management (IJBMM)*, Volume 5, Issue 5, pp. 87–96; for download: <http://www.ijbmm.com/paper/May2020/8340436067.pdf>
- Feubi Pamen E. P., Djofang Yepndo C. G. (2017), "Implications of digitalization on individual's wellbeing in Cameroon", Fifth Statistical Forum under the theme "Measuring the Digital Economy", International Monetary Fund (IMF) headquarters in Washington D. C., November 16-17. Presentation Session 7.
- FinScope, UNCDF, FinMark (2018), *FinScope Consumer Survey Highlights Cameroon Pocket Guide 2017*. For download: https://finmark.org.za/system/documents/files/000/000/220/original/Cameroon-pocket-guide_English.pdf?1601984244
- Friederici N., Wahome M., Graham M., (2020), *Digital Entrepreneurship in Africa. How a Continent Is Escaping Silicon Valley's Long Shadow*, Massachusetts, MIT Press.
- GICAM (2018), *Insécurité dans les régions du Sud-Ouest et du Nord-Ouest. Conséquences économiques et impacts sur l'activité des entreprises*, Rapport juillet 2018. For download: <https://reliefweb.int/sites/reliefweb.int/files/resources/rapport-impacts-de-la-crise-nord%20ouest%20et%20sud%20ouest%20du%20Cameroun.pdf>
- GICAM (2020), Financement et Digitalisation des Entreprises du GICAM, Etude réalisée par Commission Amélioration de l'Environnement des Affaires. For download: <https://www.legicam.cm/index.php/p/documents?p=2>
- GICAM (2021), "Agir et reconstruire ensemble", Le Bulletin du Patronat, édition n°82-Juin 2021. For download: <https://financialhouse.cm/fr/nos-actualites/278-bulletin-du-gicam-n-82>
- Global Business Consulting (2021), "What is digital transformation?", June 23. For download: <https://globalbusinessconsulting.com/en/digital-transformation-in-cameroon/>
- Government of Cameroon, Law No. 2010/001 of 13 April 2010 to lay down the Promotion of Small and Medium-sized Enterprises in Cameroon
- Government of Cameroon, Law No .2015 of 16 July 2015 to amend and supplement some provisions of Law No. 2010/001 of 13 April 2010 to lay down the promotion of Small and Medium-sized Enterprises in Cameroon
- ILO (2020), Cameroon - Rapid evaluation of the impact of COVID-19 on employment and the labour market in Cameroon, Policy Brief December 2020. For download:

- https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_763830.pdf
- INS (2018), *Rapport principal du Recensement Général des Entreprises 2016 RGE-2*, INS, Yaoundé. For download: <https://ins-cameroun.cm/wp-content/uploads/2018/10/Expos%C3%A9-SPC-RAPPORT-PRINCIPAL-RGE-2-sept-2018.pdf>
- ITU (2020), Economic impact of COVID-19 on digital infrastructure. For download: https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-EF.COV_ECO_IMPACT-2020-PDF-E.pdf
- Kabakova, Elena (2019), “Digital workplaces as a necessity of the modern world” in *European Public & Social Innovation Review*, 4(2), pp. 14-24. For download: <https://pub.sinnergiak.org/esir/article/view/110>
- Kakdeu, L M., D’Pola, K. U., Egoh, M. A., & Onana, M. B. (2020). *Starting a Business in Cameroon: A Critical Analysis*. Thematic Report N.1, DBI Project, Nkafu Policy Institute. March 2020. For download: https://www.researchgate.net/publication/340886191_STARTING_A_BUSINESS_IN_CAMEROON_A_CRITICAL_ANALYSIS
- Kaoutoing, Sadjo, Mai Django Wambe Therese, Rabiadou Madina (2020), «Croissance des start-up camerounaises: une analyse par les mécanismes de gouvernance»; in: *Revue Internationale du Chercheur* Volume 1, n° 3 » pp :146 – 172.
- Korobov Y. (2020), “Impact of digitalization on consumer behaviour and marketing activity in financial markets”, SHS Web of Conferences 73, 010. IES2019. For download: https://www.shs-conferences.org/articles/shsconf/pdf/2020/01/shsconf_ies_2019_01013.pdf
- Massoma H. (2021), The state of technology in the agricultural sector in Cameroon. Online at: <https://www.theokwelians.com/the-state-of-technology-in-the-agricultural-sector-in-cameroon/>
- Mbu Daniel Tambi (2015), “Economic Growth, Crisis, and Recovery in Cameroon: A Literature Review”, in: *International Journal of Industrial Distribution & Business*, 6-1 (2015) pp. 5-15. For download: <https://www.koreascience.or.kr/article/JAKO201516863229882.pdf>
- Mbodiam, B. R., (2018), “Digitalization takes over finance industry”; in: BC/Business in Cameroon 69 (2018), “Cameroon’s finance sector goes through rapid digitalization”, p. 8. For download: <https://www.businessincameroon.com/pdf/BC69.pdf>
- Mbodiam, B. R. (2021), “The rise of electronic money”; in: BC/Business in Cameroon (2021) 105, “Forget cash, Cameroonians are in on e-money!”, pp. 8-12. For download: <https://www.businessincameroon.com/pdf/BC105.pdf>
- Mbodiam B. R. (2021); “Here come the Cameroonian unicorns”, in: Business in Cameroon, n° 100, (2021), *These Cameroonian start-ups raise billions*, pp. 8-11. For download: <https://www.businessincameroon.com/pdf/BC100.pdf>
- Mergel, Ines, Noella Edelmann, Nathalie Haug (2019), “Defining digital transformation: Results from expert interviews”; in: *Government Information Quarterly*, Volume 36,

- Issue 4; for download:
<https://www.sciencedirect.com/science/article/pii/S0740624X18304131?via%3Dihub>
- Mieszala, Jean-Christophe (2015), « La révolution technologique des systèmes financiers: L'exemple de la banque de financement et d'investissement », in : *Revue d'économie financière* vol. 2 n° 118, pp. 53-66. For download: <https://www.cairn.info/revue-d-economie-financiere-2015-2-page-53.htm>
- Milana, Carlo, Arvind Ashta (2020), "Microfinance and financial inclusion: Challenges and opportunities"; in: *Strategic Change*, n° 29, pp. 257–266. URL: <https://onlinelibrary.wiley.com/doi/abs/10.1002/jsc.2339>
- MINPOSTEL/Ministry of Posts and Telecommunications of Cameroon (2016), Strategic Plan for a Digital Cameroon by 2020, for download: http://cameroundigital.com/wp-content/uploads/2017/05/Plan-strat%C3%A9gique-Cameroun-Num%C3%A9rique-2020_ANG.pdf
- Moukouri, D. and Mbanda E. (2019), "A law for Fintech companies within the CEMAC zone". For download: <https://www.lexafrica.com/2019/12/a-law-for-fintech-companies-within-the-cemac-zone/>
- Muh, E., Amara, S. & Tabet, F. (2017). Sustainable energy policies in Cameroon: a holistic overview. In: *Renewable and Sustainable Energy Reviews*. For download: <http://dx.doi.org/10.1016/j.rser.2017.10.049>
- Ndongmo, K. (2021), "Cameroon Digital Rights Landscape Report", in: Tony Roberts (ed.), *Digital Rights in Closing Civic Space: Lessons from Ten African Countries*, Brighton: Institute of Development Studies, pp. 229-250. For download: <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/15964>, and: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/15964/Cameroon_Report.pdf?sequence=15&isAllowed=y
- Ndokang Esone, Ludwick 1^{er}, Tsambou, André Dumas (2017), "Cameroon: Innovations and ICT and Their Combined Performance Effects on Small, Medium, and Micro-sized Enterprises", in: *Management Challenges in Different Types of African Firms*, pp 165-186. Download: <https://www.springerprofessional.de/cameroon-innovations-and-ict-and-their-combined-performance-effe/12299474>
- Ngahane Konan, L. (2020), "The state of digitalisation in the banking and insurance sectors", in: Making Finance Work for Africa, Africa Finance Forum Blog, November 2, 2020, by Leticia Ngahane Konan; for download: <https://www.mfw4a.org/blog/state-digitalisation-banking-and-insurance-sectors>
- Ngwengeh, B. B., Messomo, E. S. & Mbu, S. A. (2021). "The Influence of Digital Financial Services on the Financial Performance of Commercial Banks in Cameroon". In: *European Scientific Journal*, vol. 17, Issue 15, pp. 448-468. For download: <https://eujournal.org/index.php/esj/article/view/14314>, and: <https://doi.org/10.19044/esj.2021.v17n15p448>
- Nkafu, K. (2017), *Small Businesses in Cameroon - Innovation in Action - Small Businesses in Cameroon, From economic misery to economic prosperity* 2, IFABS/ INTERNATIONAL FEDERATION OF AFRICAN BUSINESS STUDENTS, AFRICA, For download:

- https://www.academia.edu/33707669/Small_Businesses_in_Cameroon_Innovation_in_Action_Small_Businesses_in_Cameroon_From_economic_misery_to_economic_prosperity_2
- Noubiap, J. J., Jingi A. M., Kengne A. P. (2014), Local innovation for improving primary care cardiology in resource-limited African settings: an insight on the Cardio Pad@ project in Cameroon. In: *Cardiovascular Diagnosis & Therapy*; for download: <https://pubmed.ncbi.nlm.nih.gov/25414826/>, and DOI: 10.3978/j.issn.2223-3652.2014.10.01
- Nwagu, K., Okanja, O. C, Okafor M. C. (2021), “Impact of Digital Finance Technologies on Agribusiness Development in Nigeria”, in: *Revista Geintec*, Vol. 11, No. 4, pp. 1729-1750. For download: <https://www.revistageintec.net/index.php/revista/article/view/2232>
- O’Dea, S., (2021), Average global mobile and fixed broadband download & upload speed worldwide 2021, Statista; access for download: <https://www.statista.com/statistics/896779/average-mobile-fixed-broadband-download-upload-speeds/>
- O’Neill, A. (2021), Cameroon: Distribution of gross domestic product (GDP) across economic sectors from 2010 to 2020. For download: <https://www.statista.com/statistics/446567/cameroon-gdp-distribution-across-economic-sectors/>
- OECD (2021), “Digital transformation for youth employment and Agenda 2063 in Central Africa”, in: *OECD, Africa’s Development Dynamics 2021: Digital Transformation for Quality Jobs*, AUC/CUA, Addis Ababa/Éditions OCDE, Paris, pp. 137-160; Access: <https://www.oecd-ilibrary.org/docserver/0a5c9314-en.pdf?expires=1642242749&id=id&accname=guest&checksum=FCAA67AE4EE415C98A5D75730FB79102>
- Pascal Belda et al., (2006), *The premier guidebook for business globetrotters. Cameroon*, Douala, Ebizguides. Access: https://issuu.com/ebizguides/docs/cameroon_reduced
- Pedchenko, N., Strilec V., Kolisnyk G. M., Dykha M. V., Frolov S. (2018). “Business angels as an alternative to financial support at the early stages of small businesses’ life cycle”. In: *Investment Management and Financial Innovations*, 15(1), pages 166-179 ; access : <https://www.businessperspectives.org/index.php/journals/investment-management-and-financial-innovations/issue-274/business-angels-as-an-alternative-to-financial-support-at-the-early-stages-of-small-businesses-life-cycle>
- Perspective Monde (2022), Croissance annuelle du PIB (%), Cameroun. For download: <https://perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays/?codeStat=N.Y.GDP.MKTP.KD.ZG&codePays=CMR&codeTheme=2>
- Pietosi, S., Tricarico, D., Chassin, L. (2021), Agri DFS (digital financial services): Emerging business models to support the financial inclusion of smallholder farmers, GSMA Agritech Programme. For download: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2021/10/Agri-DFS-Emerging-business-models-to-support-the-financial-inclusion-of-smallholder-farmers.pdf>

- Republic of Cameroon (2020), NDS 30 (SND/Stratégie Nationale de Développement 30), National Development Strategy 2020-2030. For structural transformation and inclusive development, Ministry of Economy, Planning and Regional Development. For download: http://cdnss.minsante.cm/sites/default/files/Strat%C3%A9gie%20Nationale%20de%20D%C3%A9veloppement%20SND30_Fench.pdf ; and: https://www.minepat.gov.cm/index.php?option=com_docman&view=download&alias=262-national-development-strategy-2020-2030&category_slug=strategies-de-developpement&Itemid=380&lang=fr
- République du Cameroun (2016), Plan Stratégique Cameroun Numérique 2020, Mai 2016. For download: http://cameroundigital.com/wp-content/uploads/2017/05/Plan-strat%C3%A9gique-Cameroun-Num%C3%A9rique-2020_ANG.pdf
- Satalkina, Liliya, and Steiner, Gerald (2020), “Digital Entrepreneurship: A Theory-Based Systematization of Core Performance Indicators”; in: *Sustainability* 12, 4018; <https://www.mdpi.com/2071-1050/12/10/4018/htm>, and: <https://doi.org/10.3390/su12104018>
- Schwertner, K. (2017), “Digital transformation of business”; in: *Trakia Journal of Sciences*, Vol. 15, Suppl. 1, pp 388-393. Download: https://pdfs.semanticscholar.org/51bb/4fd609d174438fb8911f283d48d34ef1e894.pdf?_ga=2.127350477.1552864815.1642243205-1636010395.1641147710
- Shubhangi, Bhatia (2020), “Social Media Marketing for Businesses: Decoding Media Sharing Platforms”; for download: <https://razorpay.com/learn/media-sharing-platform-for-your-business-instagram-youtube/>
- Somga Bitchoga, N. F., Guzikova, L. A., (2018), “Education and digital technology as the factors of economic development in Cameroon”, in: *Innovation clusters in the digital economy: drivers of development*, Works of the IX research-to-practice conference with foreign participation, 17-21, May 2018, pp. 81-86. For download: <https://labec.spbstu.ru/userfiles/files/inprom-18/inprom-2018.pdf>
- Soppo Ntomba, R. (2020), “Covid-19 in Cameroon: What effect on economy?”, in *Munich Personal RePEc Archive (MPRA)*, Paper No. 102245. Online https://mpr.aub.uni-muenchen.de/102245/1/MPRA_paper_102245.pdf
- Speedtest Global Index (2021), “Cameroon’s Mobile and Fixed Broadband Internet Speeds”; for download: <https://www.speedtest.net/global-index/cameroon>
- Tasoh, T., Diom, G., and Mbi, E. (2016), Financial Distress and Bankruptcy: Cameroon Micro- Financial Institutions (MFIs). In: *Journal of Insurance and Financial Management*, Vol. 1, Number 5. Available at: <https://journal-of-insurance-and-financial-management.com/index.php/JIFM/article/view/41/pdf>, or: <http://dx.doi.org/10.2139/ssrn.2794551>
- Tchoffo, Tameko G., Nembot Ndeffo L., Djimoudjiel Djekonbe (2020), “Dynamic Analysis of Determinants of Financial Inclusion in Cameroon”, in: *European Scientific Journal*, Vol.16, n° 1, pp. 106-121; for download: <https://eujournal.org/index.php/esj/article/view/12635>
- Telstra Corporation Limited and Deloitte Digital (2012), *Taking Leadership in a Digital Economy*, for download:

- <http://www2.deloitte.com/content/dam/Deloitte/au/Documents/technology-mediatelecommunications/deloitte-au-tmt-taking-leadership-digital-economy-031014.pdf>
- The Global Economy.com (2021), Cameroon: Innovation index. For download: https://www.theglobaleconomy.com/Cameroon/GII_Index/
- Tiona Wamba, J. H. and B. L. Ngono Ndjie (2019), "Economie Numérique et Croissance Economique au Cameroun". For download: <https://halshs.archives-ouvertes.fr/halshs-01970291/document>
- Tossou H. S., Thoto F. S. (2020); "Digital Entrepreneurship in the Agricultural Sector in Sub-Saharan Africa: An Introductory Survey", in: *Journal of African Development* 21 (2): pages 174–188. For download: <https://doi.org/10.5325/jafrideve.21.2.0174>
- Toussi, Simone, 2019, "Overview of Cameroon's Digital Landscape", September 12, 2019, CIPESA/Collaboration on International ICT Policy in East and Southern Africa/Promoting Effective and Inclusive ICT Policy In Africa; for download: <https://cipesa.org/2019/09/overview-of-cameroons-digital-landscape/>
- UNCDF/United Nations Capital Development Fund (2018), "Digital Financial Services in Cameroon", Unlocking Private and Public Finance for the Poor, April 17, 2018. Online at: <https://www.uncdf.org/article/3517/digital-financial-services-in-cameroon>
- Union Internationale des Télécommunications (UIT/ITU). 2013. "Étude sur la connectivité internationale d'internet en Afrique subsaharienne". March 2013; for download: https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/IIC_Africa_Final-fr.pdf
- Vasylieva, T. A., Leonov, S. V., Kryvykh, Y. N. & Buriak, A. V. (2017). Bank 3.0 concept: Global Trends and Implications. In: *Financial and Credit Activity: Problems of Theory and Practice*, 1(22), pages 4–10. For download: <http://fkd1.ubs.edu.ua/article/view/107714>, and: <https://doi.org/10.18371/fcaptop.v1i22.107714>
- Verhoef, Peter C., Thijs Broekhuizen, Yakov Bart, Abhi Bhattacharya, John Qi Dong, Nicolai Fabian, Michael Haenlein (2021), "Digital transformation: A multidisciplinary reflection and research agenda", in: *Journal of Business Research*, Vol. 122, pp. 889-901. For download: <https://www.sciencedirect.com/science/article/pii/S0148296319305478#>
- Vial, Gregory (2019), "Understanding digital transformation: A review and a research agenda", in: *The Journal of Strategic Information Systems*, Volume 28, Issue 2, pp. 118-144; for download: <https://www.sciencedirect.com/science/article/abs/pii/S0963868717302196>
- Wade, Michael (2014), "Digital Business Transformation", in: IMD/International Institute for Management Development, *Research & Knowledge, insights@IMD*, n° 41; for download: <https://www.imd.org/contentassets/795162a5c0454d18948baef0efb0bcdf/41---digital-business-transformations.pdf>

- Watts, Stephen (2020), “Digital Platforms: A Brief Introduction”, July 8, 2020, The Business of IT Blog, BMC Software (<https://www.bmcsoftware.de/>); for download: <https://www.bmc.com/blogs/digital-platforms/>
- Wiesner, Stefan, Philipp Padrock, and Klaus-Dieter Thoben (2014), “Extended Product Business Model development in four manufacturing case studies”, *Procedia CIRP* (College International pour la Recherche en Productique/International Academy for Production Engineering), 16, pp. 110 – 115. For Download: <https://www.sciencedirect.com/science/article/pii/S2212827114001036>
- World Bank Group (2017), The Global Findex database 2017. Measuring Financial Inclusion and the Fintech Revolution, World Bank Group, Washington, D. C. For download: <https://globalfindex.worldbank.org/>
- World Bank Group (2020a), *Cameroon Digital Economy Assessment. Country Diagnostic*, Washington, World Bank Group; Download at: <https://thedocs.worldbank.org/en/doc/379941605627277587-0090022020/original/DE4ACameroonCountryDiagnosticJun26.pdf>
- World Bank Group (2020b), *Doing Business 2020*, Washington D. C., World Bank Group. Download at: <https://www.doingbusiness.org/en/doingbusiness>, and: <https://openknowledge.worldbank.org/bitstream/handle/10986/32436/9781464814402.pdf>
- Ziqi, Liao, and Michael Tow Cheung, (2002), “Internet-based e-banking and consumer attitudes: an empirical study”; in: *Information & Management*, Volume 39, Issue 4, pp. 283-295. For access: <https://www.sciencedirect.com/science/article/abs/pii/S0378720601000970?via%3Dihub>

Africa's Industrial and Technological Supply Response to the COVID-19 Pandemic: A Preliminary Analysis of 4IR Readiness

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1 Introduction

The COVID-19 pandemic has affected lives, livelihoods, businesses, and economies globally and in Africa in unprecedented ways. Worldwide, Real Gross Domestic Product (GDP) contracted by 3.5 percent in 2020. African countries were particularly affected. The African Development Bank (AfDB) estimates that Real GDP in Africa contracted by 2.1 percent in 2020 but is projected to grow by 3.4 percent in 2021 (AfDB, 2021). The pandemic pushed an additional 124 million into extreme poverty, while 2.4 billion people did not have access to adequate food in 2020 – an addition of 320 million in one year alone (United Nations, 2021). Human development indicators also showed a rise in poverty and unemployment.

Before the pandemic, Africa's healthcare systems were, to say the least, fragile; many of the public facilities being under-funded, lacking proper infrastructure, adequate personnel, with the middle and lower classes struggling to afford private healthcare (Mills, 2014; Aetna, 2020). Many African economies also have weak industrial capabilities and were heavily reliant on importation for needed medical supplies. A 2019 McKinsey report showed that as much as 70 to 90 percent of medicine consumed in most Sub-Saharan African countries were imported (Conway, Holt, Sabow, & Sun, 2019). This recent pandemic worsened and aggravated an already precarious situation through the disruption in the flow of goods and services, especially so of medicine and medical supplies. As demand on medical supplies for treating the virus increased in 2020, governments of over 80 countries placed export restrictions on the exportation of needed commodities, while prioritising the importation of essential medical supplies (McCarthy, 2020).

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The technological capacity of regions, countries and firms has been the bulwark against external shocks such as the pandemic, but the pandemic brought into stark reality the imperative of a resilient knowledge-based healthcare system. The pandemic has shown that investment in healthcare and the concomitant industrial capacity to produce critical drugs does more than provide employment, raise living standards, but is equally an imperative for life, health, and health security. Indeed, COVID-19 tested the readiness of countries to leverage both their industrial capabilities and their technological response to the pandemic. While it affected all sectors, industry sectors and services sectors – pharmaceuticals, health, Information & Communication Technologies (ICTs) were the leading sectors in responding to the demand for medicines, medical equipment, Personal Protective Equipment (PPE), and to the disrupted global and regional supply chains.

For the prevention and treatment of the virus, key medical supplies including pharmaceuticals (medicine) and nutraceuticals (supplements), medical equipment; medical consumables (personal protective equipment, aprons, gloves, gowns e. t. c.), and operational infrastructure (vehicles, intensive and emergency care equipment) are needed. Supply chain disruption was a major issue to address, as shortages in medical equipment and medicine exposed the fragility and weakness of Africa's health and pharmaceutical sectors and fundamentally, the region's lack of industrial capabilities.

This paper examines the industrial and technological response of firms, of industries, and of governments in Africa to COVID-19. We focus on health care and pharmaceuticals for our analysis. We hypothesize that countries, industries, and firms with relatively deep technological and innovative capacities were better able to respond faster, to mitigate, and to adapt to the negative impacts of the pandemic. We provide a preliminary and tentative analysis of both the supply response as well as the supply constraints to respond to the disease outbreak. We adopt a cross-country approach to provide observable patterns of technological and innovative capacities, and then we use the case of Nigeria to present country-specific information and recommendations.

The next section 2 (two) after the Introduction in section 1 (one) presents an overview of the literature. Section 3 (three) covers the methodology, while section 4 (four) presents the analysis and discusses our findings. The final section 5 (five) highlights the conclusions and the policy recommendations.

2 Literature Review

2.1 The Context of the Covid-19 Pandemic Challenge

When the pandemic struck, countries faced two immediate and urgent challenges – a collapse in revenues, a loss of jobs, and a predictable recession; and the need to raise spending both on emergency health measures and to counter the economic impact of economy lockdowns. At the onset of the pandemic, the World Health Organization (WHO) estimated Africa's shortage of health workers at 3.6 million; and it estimated that 50% of the population were living with no access to modern health services (African Development Institute (ADI), African Development Bank Group, 2020). In the specific cases of respiratory infections, the continent had shown abysmal capability to respond effectively, such as in the case of viral pneumonia that kills about 800,000 children each year, mainly in sub-Sahara Africa and South Asia (UNICEF, nd; WHO, 2019).

An important factor, influencing access to medicine by African countries, was the disruption to the global supply chain for medical supplies during the COVID-19 pandemic. First, there were supply shortages due to critical items being out of stock. This was in large part caused by rising demand, panic buying, hoarding, and misuse that put thousands of lives at risk. Shortages were particularly acute in the supply of surgical gloves, medical masks, respirators, goggles, face shields, gowns, and aprons (World Health Organization, 2020). For example, demand for surgical masks increased six-fold, while demand for N95 respirators trebled and for gowns doubled. Second, operational shutdowns by manufacturers caused severe shortages. The main manufacturers of Personal Protective Equipment (PPE) are based in countries (China and India) with relatively high outbreaks of the virus and quarantines, resulting in factory shutdowns that further limited supply and increased lead times. Third, inflated costs during the pandemic induced price surges, with some countries introducing price regulation. This action potentially distorted supply chains, with the suppliers opting to quickly supply those customers who are willing and able to pay inflated prices. Fourth, the outbreak of the pandemic resulted in a major global disruption to transportation, including international shipping and transportation, especially from China, where most of Africa's drugs and medical supplies originate.

The Ebola pandemic severely tested the responsiveness of African countries to health emergencies; it directed attention to its capacity to reduce morbidity, mortality, and to break the chain of transmission of the Ebola Virus Disease (EVD). Among the measures taken was the strengthening of regional and sub-regional public health systems. The African Development Bank (AfDB), for example, funded the process with a total budget of UA (Unit of Account) 40 million

(est. USD 55.64 million)² for three broad strategic outcomes: building human resource capacity and systems (for emergency response and preparedness); infrastructure development; and strengthening governance and regional institutions. The persistence of drug and vaccine dependence is unlikely to be reduced even long after COVID-19 has abated, given the various diseases that the region is coping with. This is so because the pandemic has shown that countries are vulnerable to attacks by diseases just as they are hit by other security threats (Abbott et al., 2021).

2.2 The Pandemic and Supply Chain Disruptions

The pandemic disrupted and continues to disrupt supply chains globally. Over the last several decades, technological change has enabled close interconnection in global supply chains undergirded by expansive networks of manufacturing production facilities, warehouses, and transportation hubs, including airports, seaports, and so on. The disruptions were triggered in large part both due to impediments to movement of goods and services between countries as much as by production supply constraints. The lockdowns imposed by various countries, halts in productive activities, logistical constraints, border closures, and a general slowdown in business and trade have affected the effectiveness of global supply chains (PwC, 2020).

While African countries are not as densely integrated in global supply chains as with Asia for example, the integrated nature of manufacturing and transportation has meant that sellers and buyers of intermediate and final goods were not exempted from these disruptions. Across Africa, there was a fall in trade volume, particularly in cross-border trades (Banga, Keane, Mendez-Parra, Pettinotti, & Sommer, 2020). Many African countries export primary goods, intermediate goods, and services such as crude oil, cocoa, and final goods and services, such as cut flowers, globally. The fall in commodity prices most of which suffer revenue contraction, posed a significant fiscal challenge as well as a challenge to the macroeconomics and to trade of many countries which are dependent on agriculture and mineral commodities.

Movement restrictions also affected the ability to export goods globally. Border controls and lockdowns further affected informal trade that occurs across borders on the continent (Banga, Keane, Mendez-Parra, Pettinotti, & Sommer, 2020). African countries are also integrated in global supply chain as buyers – importing goods for further processing on the continent – or of final goods for African whole-

² Exchange rate as of October 1, 2021

salers and retailers. This paper pays particular attention to the health and pharmaceutical sectors, given the importance of health products and services during the pandemic.

The pandemic has made technology adoption in supply chain processes increasingly important and critical to maintaining effective supply chains (Alicke, Barriball, & Trautwein, 2021; PwC, 2020). The McKinsey report (Alicke et al., 2021) which surveyed senior supply-chain executives from different geographies and industries in Q2 2020 and Q2 2021 showed that the “pandemic has been a catalyst for further digitization of end-to-end supply-chain processes.” Indeed, 93% of respondents intended to make their supply chains far more agile, flexible, and resilient. In the health sector specifically, 33% of respondents had invested in analytics between Q2 2020 and Q2 2021 and had more planned; 7% had invested in analytics before the pandemic and planned for further increase in investment; 40% had not implemented analytics but planned for increase in the future, while 20% had no further increase planned for investment. Again 87% of the respondents in the Healthcare sector had invested in digital supply-chain technologies in 2020, and 93% planned to invest in 2021 onward. However, the overall weak industrial and technological capabilities, for design and management of supply logistics, remain a significant barrier to accelerated digitization, with about 90% of companies not having sufficient in-house digital talent (Alicke, Barriball, & Trautwein, 2021).

2.3 The Imperative of Digital Technology Capability in the Health Sector in the Pandemic Era

New frameworks matter. Vial (2019, p. 118) proposes a framework based on the review of 282 works that coin digital transformation as “a process where *digital technologies* create *disruptions* triggering *strategic responses* from organizations that seek to alter their *value creation paths* while managing the *structural changes* and *organizational barriers* that affect the *positive* and *negative* outcomes of this process.” Digital transformation encompasses adopting disruptive technologies to increase productivity and to create value and social welfare. Policy makers and other social economic actors, including governments, multinational organizations, and industry associations, incorporate digital transformation goals into long term strategies to reap benefits, such as increased productivity, and income and value addition in the economy (Ebert & Duarte, ND).

The World Economic Forum (WEF) estimates that digital transformation can provide globally a value of more than \$100 trillion to society and industry over the next 10 years. They based this estimate by looking at over 65 digital initiatives in sectors such as health, automotive, electricity, consumer, media, and logistics. WEF identified three areas through which this value can be generated. The first is growth through digitalization which are customer-facing, e. g. revenue generating,

initiatives, whereby digital transformation enables businesses to engage patients at a large scale. The second is efficiency through digitalization which are internally facing, e. g. institutional, initiatives that increase profit generating. These initiatives include precision medicine, robotics, medical printing, and intelligent devices. The third area is called digital experience and combines the dual benefits of growth and efficiency. Examples of such initiatives include virtual care and connected home (WEF & Accenture, 2016). Virtual care includes telemedicine and telehealth and connects health professionals, clinicians, patients, and family members in real time to coordinate care, provide health services, support self-management, and promote professional collaboration (WEF & Accenture, 2016a). “Connected home” consists of “smart appliances and devices that can communicate with one another and operate independently when instructed to do so” (WEF & Accenture, 2016a, p. 18). Traditionally used to control such things as lighting, heating, security, fire protection, audio, and video to secure the homeowner’s comfort, safety, and entertainment, “connected home” offers many benefits for health care. It is providing patients with access to personal health information, and it provides insights and supports decision making. Independa, a US based company, uses a TV-based platform to enable independent living for older people in their own homes. The software provides many health-related services, including tele-visits with doctors and doctors, photo-sharing, and setting up of medication reminders. The platform can also be connected to blood pressure monitors, glucose meters and scales, and it can act as an “emergency alert system” (WEF & Accenture, 2016a, p. 19; Independa Health Hub, 2022).

Digital transformation, well-optimized in the health care sector, enables to ensure an increased quality of life and helps in saving lives (Gopal, Suter-Crazzolaro, Toldo, & Eberhardt, 2019). Various aspects of digital transformation in healthcare, such as “new developments as self-tracking, big data and predictive analytics, e-health, mobile health, participative medical research, e-patient communities, [...] and shared decision making in diagnosis and e-therapy” (Belliger & Krieger, 2018, p. 311), are pertinent and can be lifesaving during a pandemic. Digital transformation is expected to disrupt first, the location of care, i. e. bringing it closer to home and out of hospitals, and second, the type of care, i. e. changing it from diagnosing and treating to prevent and to manage (Clay, 2008). Preventive measures for contracting the COVID-19 virus, including social distancing, societal and country level lockdowns, and self-isolation, show the imperativeness of these forms of disruptions.

Despite the many benefits which digital transformation would have for health, it would not happen automatically. Vial (2019) notes that organizations must be cognizant of and need to manage factors such as inertia, where existing resources and capabilities, and resistance from employees hinder the transformation, thus preventing it from being successful and yielding positive results. Again, to ensure

digitalization's value for industry and society, WEF & Accenture (2016) also highlight the following barriers that need to be addressed: first, currently there are more incentives for creating profit which undermines collaboration and the potential for maximizing social benefits; second, innovation is growing faster than protection and regulation of the health sector to protect consumer interests; third, there is an innovator's dilemma where the focus on short-term investor interests and a conservative corporate culture keeps organisations away from making radical innovations; and fourth, there are significant skills gaps in science, technology, engineering and mathematics (STEM).

2.4 Africa's Industrial and Technological Capacity in Pharmaceuticals

There are several capability levels within the pharmaceutical value chain. A country's technological capability level determines whether its firms are innovating and making Active Pharmaceutical Ingredients (APIs) at the most sophisticated level, or if they are at the stage of 'fill and finish' operations. The latter implies that the country remains dependent on the import of antigens, reagents, stabilizers, and other inputs; and dependent on vaccine manufacturers (with "fill and finish" and some capacity for production of vaccines) and R&D-based vaccine companies. A report by McKinsey shows that only three companies in Africa, one in Ghana and two in South Africa, were producing APIs (Conway, Holt, Sabow, & Sun, 2019).

In the vaccines sector, particularly, access to technology plays a critical role in the ability of companies to compete. We find a growing group of companies which are members of the Developing Country Vaccine Manufacturers Network (DCVMN), having varying degrees of capacity, depending on their access to markets globally and on their financial capacity. DCVMN is a voluntary public health-driven alliance, seeking to ensure a "consistent supply of high-quality vaccines that are accessible to protect people against known and emerging infectious diseases globally" (DCVMN, 2022). Various companies are working to increase their production capacity, and alongside they are investing in vaccines' R&D (Sampath & Pearman, 2021).

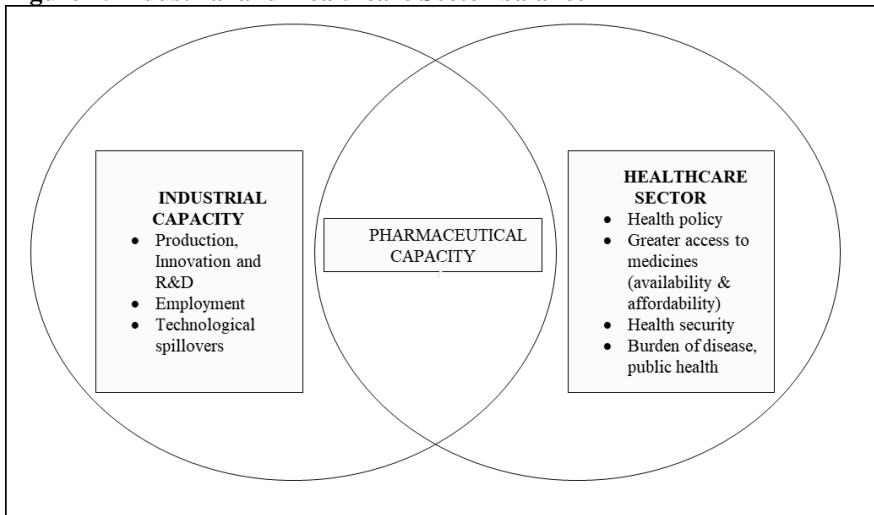
The African region currently accounts for the world's slowest COVID-19 vaccine rollouts, having vaccinated only 58.89 million out of a total 2.6 billion people fully vaccinated worldwide (Our World In Data, 2021).³ This contrasts with the situation in India with a similar population and disease burden; that country has vaccinated over 231.4 million people relying on its domestic vaccine production capacity (Our World In Data, 2021). The Africa region's weak industrial base in pharmaceuticals relates directly to its inability to produce life-saving drugs in the

³ Data reports the total number of people who received all the doses prescribed by the vaccination protocol, from 20 December 2020 to 28 September 2021.

time when the pandemic was ravaging the continent. Clearly, this has implications that go well beyond the production of vaccines. The pandemic has disrupted drug supplies across several therapeutic categories in Africa, such as for antivirals and anti-infectives, exposing people with other diseases to unforeseen vulnerabilities (UNAIDS, 2020; Uwizeyimana et al., 2021).

We examine the Covid-19 pandemic within the long-term perspectives of Africa’s readiness to meet future shocks. Our organizing principle is that the local pharmaceutical and healthcare sectors will thrive on a strong industrial sector through a series of coordinated policy incentives. We approach this analysis based on the interrelatedness of health and pharmaceuticals. We purport that the intersection of the industrial capacity of a country, as seen in its production, innovation effort, R&D (research and development) capabilities, employment within the sector, and technological spillovers, with the characteristics of its healthcare sector, for example health policies, access to medicines, health security, and the burden of disease and of public health, would determine the economy’s pharmaceutical capacity. This interrelationship is depicted in Figure 1 below.

Figure 1: Industrial and Healthcare Sector balance



Source: Author’s conceptualization

The Pharmaceutical industry is critical to a well-functioning Health System. Even though Africa’s pharmaceutical industry is the fastest growing in the world, a small number of countries currently drives it: South Africa, Nigeria, Ghana, and countries in Eastern Africa and in North Africa. Local production of medicine remains weak and limited because the industrial base of Africa is weak, evidenced

by the percentage manufacturing contribution to GDP. Imports comprise about 70% to 90% of drugs⁴, with local manufacturers producing between 10% to 30% of pharmaceuticals, and less than 10% of medical supplies that are on the African market (Conway, Holt, Sabow & Sun, 2019; Byaruhanga, 2020). Practically all the Active Pharmaceutical Ingredients (APIs) – active ingredients in any drug – are imported; yet Africa's pharmaceutical market is the only one currently achieving significantly high growth. The value of Africa's pharmaceutical industry rose from USD 5.5 billion in 2007 to USD 28.56 billion in 2017. Growth is predicted to continue at a very fast speed, reaching a net worth of USD 56 billion to USD 70 billion by 2030 (Goldstein Market Intelligence, 2021). Africa should not remain a consumer but a producer in this market, and potentials are there to go in this direction.

While the ongoing crisis due to the COVID-19 pandemic has exposed the continent's fragile health systems, which is not helped by the pharmaceutical sector's total dependence on imports, it equally presents the region with tremendous opportunity to deepen its pharmaceutical industry, its healthcare sector, and the broader industrial systems in Africa. For instance, there is the opportunity to strengthen inner-African trade of drugs and medical products leveraging the AfCFTA.

Besides the technological capacity limitations, the literature identifies the following policy and institutional challenges in dealing with access to medicines and, by extension, the region's readiness to meet current challenges: (a) Poor regulatory environment; (b) Fragmented market and supply chains; (c) Limited access to capital and financing at affordable terms; (d) Lack of technical capacity; (e) Poor enabling environment; (f) Lack of supporting industries; (g) Lack of public private partnerships aimed at the provision of high quality medical services; (h) Lack of Intellectual Property Rights; and (i) Discordance between industrial and health objectives and policies (African Union, 2007; Byaruhanga, 2020; Buckholtz, 2021).

2.5 Hypotheses

From the foregoing, we hypothesize that countries, regions, industries, and firms with relatively deep technological and innovative capacities were better able to respond faster, to mitigate, and to adapt to the negative impacts of the pandemic. This paper examines how firms, industries, and governments in Africa have responded to COVID-19. It analyses both the supply response as well as the supply constraints to respond to the disease outbreak. It adopts a cross-country approach to provide observable patterns of technological and innovative capacities, and then

⁴ China (5%) and India (20%) import comparably less than African countries (Conway, Holt, Sabow, & Sun, 2019).

uses the case study of Nigeria to present country-specific information and recommendations.

3 Methodology

We adopt three levels of analysis in this paper. The first level is a cross-country analysis to understand the response of countries globally and in Sub-Saharan Africa (SSA) to COVID-19, vis-à-vis their industrial and technological capabilities. This analysis enables us to derive a typology on the capacity to respond, whether they are strong, medium, low, or not at all responders. The second level uses desk research to drill down on select countries and sectors in SSA based on their capacity to respond. The final analysis is a case study of Nigeria that explains its response to the pandemic. Desk research and specific cases within the country are used in this analysis.

Secondary data is used for the various levels of analysis. The Network Readiness Index (NRI), the Global Innovation Index (GII), and the Competitive Industrial Performance (CIP) data sets are used for identifying countries' industrial and technological readiness at the onset of the pandemic. The data are then matched to the impact of the pandemic on countries' supply chain response, specifically with regards to the supply of vaccines. Data on vaccine development, manufacturing, and distribution are used for this analysis.

The NRI probes countries' readiness in using information technology to be ready for the future and to be competitive (Portulans Institute, 2020). The 2020 NRI, which is referenced in this paper, focuses on digital transformation and how this is happening at international, national, and local levels. It further looks at digital transformation amid Covid-19, based on the premise that the pandemic and associated lockdown strategies have indeed accelerated the digital transformation. It ranks 134 economies across 60 variables, divided across four pillars (Portulans Institute, 2020):

Technology (pillar one) – Measures the level of technology that is necessary for a country to participate in the global economy. Its three sub-pillars include Access (level of ICT in countries), Content (type of digital technology produced in countries and content deployed locally), and Future Technologies (extent to which countries are prepared for the future of the network economy and for new technology trends, such as artificial intelligence (AI) and the Internet of Things (IoT)).

People (pillar two) – This measures the application of ICT and its usage across three sub-pillars – Individuals, Businesses, and Governments.

Governance (pillar three) – It measures countries' governance of technology across three sub-pillars – Trust (safety and perceptions of safety and privacy), Reg-

ulation (government's promotion of network economy participation through regulation), and Inclusion (how governance is addressing digital divide inequalities, based on disabilities, gender, and socioeconomic status).

Impact (pillar four) – This measures the impact of participating in the network economy across three sub-pillars – Economy (economic impact), Quality of Life (social impact), and Sustainable Development Goals (SDGs) contribution (how participation in the network economy enables countries to achieve the agreed upon SDGs in areas such as health, environment, and education).

Our second index of technological and industrial capability, the GII, also measures to some extent a country's Fourth Industrial Revolution (4IR) readiness (Cornell University, INSEAD, and WIPO, 2020). The first sub-index of the GII, the Innovation Input Sub-Index, has five enabler pillars: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication. Enabler pillars define aspects of the environment conducive to innovation within an economy. The Innovation Output Sub-Index has two pillars, Knowledge and technology outputs, and Creative outputs. The pillar "Knowledge and technology outputs" includes knowledge creation, knowledge impact, and knowledge diffusion, while the pillar "Creative outputs" includes intangible assets, creative goods and services, and online creativity. For example, a country's share of high technology export to the total exports is considered as a component of technology competence because such products cannot be produced without an appropriate level of technological knowledge. Intangible assets (patents, designs, trademarks) are creative outputs. Both sub-indexes matter for industrial competence and for industrial capability.

Our third index, the Competitive Industrial Performance (CIP) index, developed by the United Nations Industrial Development Organization (UNIDO), is a composite index which drills down on Country's industrial capabilities on a range of 0 to 1 in comparison to other countries. It is made up of three dimensions and eight indicators. The three dimensions it captures include the capacity to produce and to export manufactures, the technological deepening and upgrading, and the world impact. The eight indicators include four Manufacturing Value Added indexes – Share of Manufacturing Value Added in GDP, Share of Medium and High-Tech Activities in Total Manufacturing Value Added, Industrial Intensity, and the Share of World Manufacturing Value Added; and four Manufacturing Export Indexes – Manufacturing Export per Capita, Share of Manufacturing Exports in Total Exports; Share of Medium and High-Tech Activities in Total Manufacturing Export; Industrial Export Quality, and the Share in World Manufacturing Exports (UNIDO, 2020). We also use the CIP as indicative of a country's progress towards 4IR technologies. The technological deepening and upgrading dimension, for example, measures industrial intensity and export quality which capture the technological complexity of a country's production and export bundle respectively (UNIDO, 2020a).

Data on vaccine arrangements were derived from the Global Health Centre (Global Health Centre/GHC, 2021). The Global Health Centre tracks and gathers

publicly available data on agreements to manufacture, supply, purchase and / or donate COVID-19 vaccines. The data are updated every one to two weeks. The data used for this paper were accessed on September 7, 2021. Other data are available from Reuters⁵.

4 Results of Analysis and Discussion of Findings - Impact of Industrial and Technological Readiness on Covid-19 Response

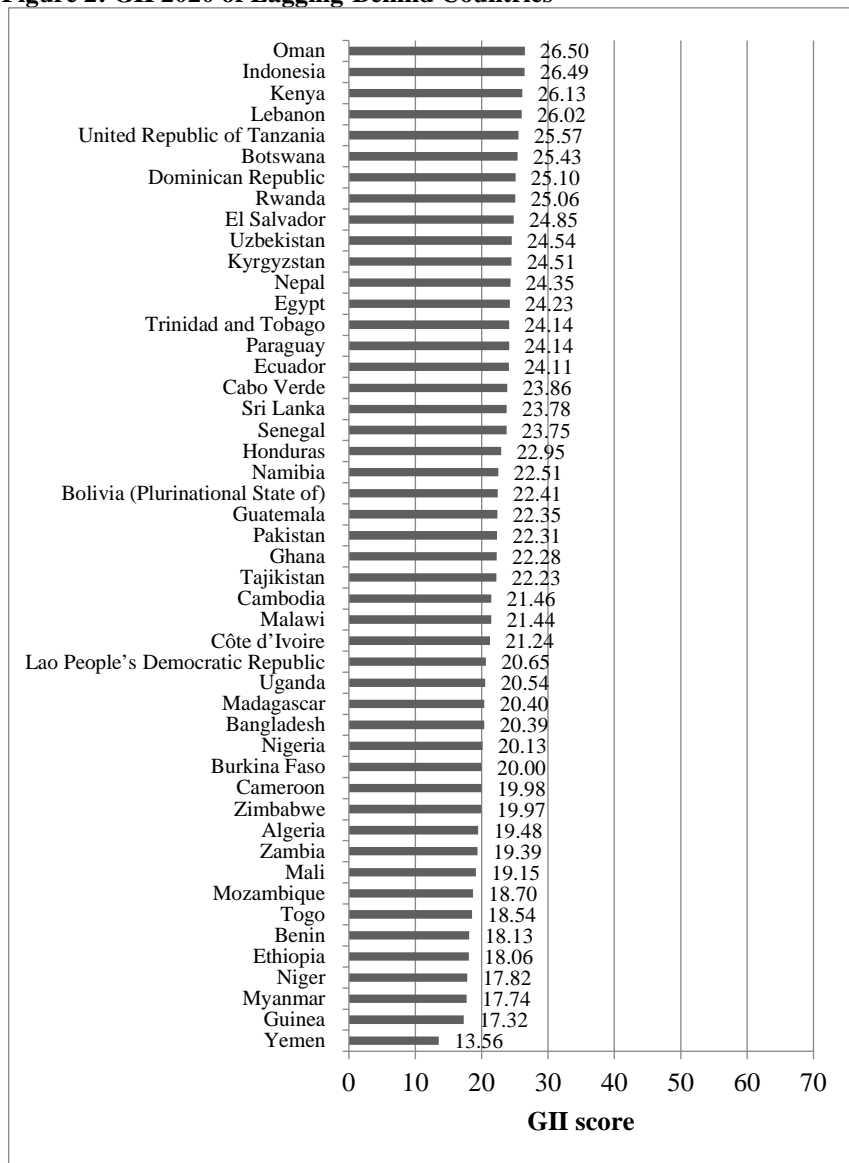
4.1 Cross-Country Analysis

Africa's industrial and technological readiness at the onset of the pandemic was weak compared to other countries globally. Specifically, no African country was in the list of initial top 60 countries in terms of the NRI nor in the list of the top 51 countries when using the GII. The top 10 countries in the NRI are Sweden, Denmark, Singapore, Netherlands, Switzerland, Finland, Norway, United States of America, Germany, and the United Kingdom. With Norway being an exception, we find that these countries were also the best performing countries using the GII, with the top 10 countries being Switzerland, Sweden, United States of America, United Kingdom, Netherlands, Denmark, Finland, Singapore, Germany, and the Republic of Korea.

Again, using the GII, we group countries into four categories – highly advanced, advanced, catching up, and lagging-behind countries depending on their score. The GII score ranges between 0 and 100. These categories are based on four equal intervals of the score in 2020 which are from 13.56 for Yemen to 66.08 for Switzerland. The lagging-behind countries are depicted in figure 2 below. Kenya, Tanzania, Botswana, Rwanda, Egypt, Cabo Verde, Senegal, Namibia, Ghana, Malawi are the countries ranked best in the fourth group, while 16 other African countries are ranked below.

⁵ See the Reuters data: <https://graphics.reuters.com/world-coronavirus-tracker-and-maps/vaccination-rollout-and-access/>

Figure 2: GII 2020 of Lagging-Behind Countries



Source: Analyzed from Cornell University, INSEAD, and WIPO, 2020

Next, we analysed the correlation between NRI and GII, and the locations where vaccines were first developed, and then manufactured or distributed (see table 1 below). Our analysis shows a positive correlation between the location of vaccine developers and the global NRI and GII indexes (0.38 for NRI and 0.44 for GII), and between the location of the manufacturers and distributors with the global indexes (0.17 for NRI and 0.18 for GII). This shows that the countries that were able to develop the Covid-19 vaccines were more technologically advanced and likely in the top tier of the most innovative countries. A weaker correlation is observed for the locations where the vaccines are manufactured or distributed. This is likely so because technological competence and innovation needed for these activities are not as high as for those countries which are developing the vaccine.

Table 1: Correlations between Covid-19 Vaccine development, production, distribution and NRI and GII - Global

Indices→ Location	Network Readiness Index (NRI)	Global Innovation Index
Developers	0.38	0.44
Manufacturers/ Distributors	0.17	0.18

Source: Authors' Analysis from NRI and GII scores

It was found that no Covid-19 vaccine developer had the location in an African country, and therefore no analysis could be done. Similarly, Egypt was the only African country that was in the manufacturing / distributor category. There was also a positive correlation between NRI (0.23) and GII (0.07) and manufacturers / distributors of vaccines (see table 2). Egypt and South Africa, but also Nigeria and Algeria have potential to advance in the group of manufacturers/distributors, and even to develop vaccines.

Table 2: Correlations between Covid-19 Vaccine development, production, distribution and NRI and GII - Africa

Indices→ Location	Network Readiness Index	Global Innovation Index
Developers	NP	NP
Manufacturers/ Distributor	0.23	0.07

Source: Authors' Analysis from NRI and GII; Note: NP → Not Possible (as there is no one developer of vaccines)

Before the COVID-19 pandemic, “the global vaccines market was expected to reach \$60 billion by 2025 from \$33 billion in 2018” (Sampath and Pearman, 2021, p. 4). However, the global market in response to the pandemic recorded compound annual growth rates of 10.3% per annum between 2018 - 2020 (Sampath and Pearman, 2021, p. 4). Africa is practically absent from this market as a supplier, as the

market is dominated by high income countries which accounted for 68% of all market sales by value. Albeit, looking at the global market for vaccines from the demand side, one finds that it is dominated by lower middle-income countries (LMICs) with high birth cohorts, e.g., India, China, Indonesia, and gradually African countries.

We find however that, as the pandemic progresses and supply chain and logistics constraints lead to low supplies of vaccines and medical equipment, African countries with existing industrial and technological capabilities will begin to look internally to meet their own needs. This trend is already becoming visible, and countries like South Africa, Senegal, Rwanda, and Kenya are examples.

4.2 A Sub-Saharan Africa Analysis

The readiness capacity of the region depends on its scientific and technological capacity. Before and during the pandemic, Africa produced less than 1% of its vaccines (Economic Commission for Africa, 2021; International Finance Corporation/IFC, 2021). The production is localized within a few countries, and even there we observe varying degrees of production sophistication and a quite limited production capacity. They include the Institut Pasteur de Dakar (the only WHO-GMP⁶ prequalified production facility), producing a relatively small share of yellow fever vaccines in comparison to competitors like Chumakov (Russia), Biomanguinhos (Brazil), and Sanofi (France) (Sampath & Pearman, 2021). In Southern Africa there is Biovac, a vaccines company based in Cape Town, South Africa. It has a filling capacity of ten million vials per annum, depending on the complexity of the vaccine in question (Abbott, Fortunak, Sampath, & Walwyn, 2021). In the rest of the region, vaccine production capacity is limited to “fill and finish”, with the import of antigens as the base (Sampath & Pearman, 2021).

But Africa is investing in the development of medicine and vaccines. A key example is seen with the investment in genomic sequencing in Africa which led to the discovery of the coronavirus Beta variant in South Africa which could circumvent the immune system (see box 1). The Africa Pathogen Genomics Initiative (Africa PGI) is an example for successful interventions in Africa's health system. While there is a saying that one should not waste a crisis, it is important not to wait for a crisis before acting.

⁶ See on the WHO-GMP (Good Manufacturing Practices) standards: <https://www.who.int/teams/health-product-and-policy-standards/standards-and-specifications/gmp>

BOX 1: The Africa Pathogen Genomics Initiative's Genomic Sequencing Success

Historically, most of the genomic sequencing in the world has taken place in the United States and in Europe. Countries with sequencing technology would send viral samples to laboratories in places like New York and London for genetic analysis – and they would get results months later.

But for the past four years, organizations have been investing in building a genomic surveillance network in Africa, and so countries on the continent could sequence viruses like Ebola and yellow fever. The Africa CDC (Africa Centres for Disease Control and Prevention) established the Africa Pathogen Genomics Initiative (Africa PGI), and when the pandemic hit, the nascent network turned its attention to SARS-Cov-2. The only reason the world knew that the more infectious and deadly beta variant had emerged in South Africa was because the country had invested heavily in R&D – in this case, pairing genomic sequencing capabilities with clinical trials and immunology studies. South Africa's own Dr Penny Moore was one of the first scientists to discover that a coronavirus variant identified in South Africa could circumvent the immune system.

Websites:

On the Africa CDC (Africa Centres for Disease Control and Prevention): <https://africacdc.org/>

Institute of Pathogen Genomics (IPG): <https://africacdc.org/institutes/ipg/>

The Africa Pathogen Genomics Initiative: <https://africacdc.org/news-item/us100-million-africa-pathogen-genomics-initiative-to-boost-disease-surveillance-and-emergency-response-capacity-in-africa/>

Source: Gates, 2021

Next, we take a closer look at countries in SSA to understand supply chain constraints and responses in the health and pharmaceutical sectors, and how their industrial and technological capabilities affected their response, if at all. We look at the top 10 ranking African countries in NRI and GII across the continent. These countries include Mauritius, South Africa, Kenya, Tunisia, Morocco etc. Tables 3 and 4 provide a comprehensive list of the top 10 and the bottom 10 ranked African countries in NRI, GII and CIP respectively.

Table 3: Top 10 African Countries: Network Readiness Index & Global Innovative Index & Competitive Industrial Performance index

	NRI			GII			CIP		
N	Country	Score	Rank	Country	Score	Rank	Country	Score	Rank
1	Mauritius	49.83	61	Mauritius	34.4	52	South Africa	0.056936	52
2	South Africa	45.26	76	South Africa	32.7	60	Morocco	0.041206	62
3	Kenya	43.22	82	Tunisia	31.2	65	Egypt	0.038669	64
4	Egypt	42.56	84	Morocco	29	75	Tunisia	0.035582	68
5	Cabo Verde	42.01	86	Kenya	26.1	86	Eswatini	0.023544	84
6	Tunisia	41.3	91	Tanzania	25.6	88	Mauritius	0.019160	90
7	Morocco	39.71	93	Botswana	25.4	89	Nigeria	0.017588	92
8	Rwanda	37.24	96	Rwanda	25.1	91	Botswana	0.017460	93
9	Ghana	36.97	98	Egypt	24.2	96	Cote d'Ivoire	0.015682	97
10	Botswana	36.94	99	Cabo Verde	23.9	100	Namibia	0.015177	98

Source: Cornell University, INSEAD, and WIPO, 2020; Portulans Institute, 2020; UNIDO, 2020

For our analysis of readiness conditions, we focus on six countries. We identify 3 countries in the top 10 list – Mauritius, South Africa, and Kenya – and 3 countries in the bottom 10 list – Mozambique, Niger, and Ethiopia – (using values of the NRI, GII and CIP indexes) to give insight into the supply chain constraints and the responses of top performers and bottom performers in Africa, with respect to their technological, innovative, and industrial capabilities. The table 5 below provides insight on these six countries.

Case 1: Mauritius

Mauritius tops the region in both NRI and GII. It is committed to having “A globally competitive and sustainable industrial sector that contributes to higher economic growth for Mauritius through continuous innovation, technology upgrading, productivity gains and high skilled employment” (Ministry of Industrial Development, SMEs and Cooperatives, Industrial Development Division, Mauritius & UNCTAD, 2020, p. 11) by 2030. Specifically, it intends to grow manufacturing at a Compound Annual Growth Rate (CAGR) of 6.79% from 2018 to 2030 and to ensure that it contributes to 25% of GDP (Ministry of Industrial

Development, SMEs and Cooperatives, Industrial Development Division, Mauritius & UNCTAD, 2020).

Table 4: Bottom 10 African Countries: Network Readiness Index & Global Innovative Index & Competitive Industrial Performance index

N	NRI			GII			CIP		
	Country	Score	Rank	Country	Score	Rank	Country	Score	Rank
1	Madagascar	25.84	124	Zimbabwe	20	120	Madagascar	0.004013	133
2	Burkina Faso	25.79	125	Algeria	19.5	121	Mozambique	0.003966	134
3	Zimbabwe	25.78	126	Zambia	19.4	122	Niger	0.003690	137
4	Malawi	25.23	127	Mali	19.2	123	Cabo Verde	0.003204	139
5	Mozambique	24.18	128	Mozambique	18.7	124	Rwanda	0.002897	140
6	Ethiopia	23.49	129	Togo	18.5	125	Malawi	0.001917	143
7	Burundi	22.62	130	Benin	18.1	126	Ethiopia	0.001725	145
8	Angola	20.96	131	Ethiopia	18.1	127	Burundi	0.001075	146
9	Congo, Dem Rep.	16.60	133	Niger	17.8	128	Eritrea	0.000476	147
10	Chad	14.80	134	Guinea	17.3	130	Gambia	0.000000	149

Source: Cornell University, INSEAD, and WIPO, 2020; Portulans Institute, 2020; UNIDO 2020

Mauritius, like every country, was hit by the pandemic. Its COVID-19 response, which amounted to fiscal injections of 32% of the GDP, was the fourth largest in the world, according to the World Bank. This investment helped to keep unemployment at 9.2% and inflation under control (Government of Mauritius, 2021).

At the onset of the pandemic, Mauritius was highly dependent on the importation of medical supplies and has faced significant challenges in procurement and promptness of delivery of essential materials during the pandemic. It was disadvantaged given its relatively small order size compared to larger countries in the heightened competitive environment for these supplies. The rise in prices for medical materials due to the increased competition for supplies and the depreciation of the Mauritian rupees is projected to have adverse consequences on the cost of

Mauritius' health system in the long run (WHO Country Office Mauritius and Government of Mauritius, 2020).

Table 5: Case Countries with Covid-10 Confirmed Cases/Deaths/Vaccine Doses Administered

No	Country	Confirmed Cases	Deaths	Vaccine Doses Administered
1	Mauritius	69,423	786	2,036,896
2	South Africa	3,534,131	92,649	27,977,830
3	Kenya	313,677	5,462	10,611,612
4	Mozambique	212,859	2,099	17,031,660
5	Niger	8,150	285	1,778,173
6	Ethiopia	448,728	7,066	10,958,395

Source: WHO data

Notes: Data on Covid confirmed cases and deaths were data as at 12th of January 2022 from the WHO. Data on vaccines administered are valid as at: Mauritius – 28th of December 2021; South Africa – 2nd of January 2022; Kenya – 10th of January 2022; Mozambique – 9th of January 2022; Niger - 10th of January 2022; and Ethiopia – 11th of January 2022.

However, several things were done well to address supply chain challenges – mapping of existing stocks and forecasting of needed medical supplies, centralized storage of and multisectoral collaboration for efficient delivery of medical materials needed to respond to the pandemic. Similarly, private manufacturing of fabric-based masks meeting international norms was encouraged and commenced. The production of hydro-alcoholic gel, using ethanol, also commenced by companies involved in local sugarcane production, and the gel was donated to meet essential services including the hospitals. Some of the demand for medical supplies and equipment, such as masks, reagents, test kits, surgical gloves, PPE, and ventilators, were sourced from mobilizing support in donations from bilateral and multilateral agencies, as well as the Jack Ma Foundation (WHO Country Office Mauritius and Government of Mauritius, 2020).

The Government has also prioritized manufacturing of vaccines, pharmaceuticals, and medical devices, has encouraged private sector investment with tax incentives, and has backed its commitment with finance allocations in the 2020/2021 budget. Specifically, it looked to “provide a seed capital of Rs 1 billion to the Mauritius Institute of Biotechnology for the setting up of a manufacturing plant for the local production of COVID-19 vaccines and other pharmaceutical products” (Government of Mauritius, 2021).⁷

⁷ R is for Mauritian Rupee (MUR)

The private sector is also taking a key role in expanding Mauritius' pharmaceutical industrial capabilities. In December 2020, a project to support the company Cape Biologix, to establish a protein manufacturing plant in Mauritius to produce reagents for 100 million vaccines a month, was agreed upon.⁸ The European Investment Bank (EIB) will provide a loan of EUR 33.3 m, and the Foundation for Innovative New Diagnostics (FIND)⁹ will fund the pilot phase production with EUR 3.2 m for the EUR 47.5 m project (European Investment Bank, 2020).

Case 2: South Africa

Prior to the pandemic, South Africa was one of the leading countries in Africa in medical and pharmaceutical manufacturing. Biovac¹⁰, a local public-private partnership was involved in late-stage vaccine production using imported APIs. Now, with South Africa having many COVID-19 confirmed cases, the country is pushing for more vaccinations, and the pandemic has seen the company at the fore of expanding its capabilities for producing COVID-19 vaccine, as well as packaging imported vaccine substances, i. e. pursue “fill-and-finish” stages of production (Kriesch, 2021).

Specifically, Aspen Pharmacare has begun producing vaccination doses, in the millions, and it is expected to “fill-and-finish” about 500 million doses of Johnson & Johnson vaccine by 2022.¹¹ Aspen is being supported by the U.S. International Development Finance Corporation, along with European partners, with a € 600 million (\$ 710 million) financing package. South Africa's Biovac Institute has also agreed to accelerate “fill-and-finish” Pfizer vaccine manufacturing in Cape Town from 2022 (Usman & Ovadia, 2021).

Case 3: Kenya

Prior to the pandemic, Kenya had very limited capability to respond to a global health risk. In the WHO's Joint External Evaluation (JEE) which measures a country's ability to prevent, detect, and respond to public health risks, Kenya had

⁸ See on the deal: <https://www.eib.org/de/press/all/2020-388-eib-and-find-back-innovative-plant-based-reagent-manufacturing-in-africa-to-fight-covid-19-and-other-endemic-diseases>

⁹ See on the Foundation for Innovative New Diagnostics (FIND): <https://www.finddx.org/>

¹⁰ See on the company Biovac: <https://www.biovac.co.za/>, and about the Biovac Institute: <https://www.biovac.co.za/about-biovac/>

¹¹ See on the Aspen Pharmacare deal: <https://www.reuters.com/business/healthcare-pharmaceuticals/safricas-aspen-signs-non-binding-agreement-with-jj-covid-vaccine-license-2021-11-30/>

scored an average of 2 out of 5 across 20 indicators.¹² With a score of 1, the assessment showed that Kenya had no capacity “for a developed and implemented national multi-hazard public health emergency preparedness and response plan, medical countermeasures, and personnel deployment...” (McDade et al., 2020; p. 2). Kenya initiated several measures in response to the pandemic. These include: constituting a National Emergency Response Committee (NERC) on the Coronavirus Disease on February 28, 2020, travel bans, curfews, and training of health care workers to support the COVID-19 response. The Government Response Stringency Index (GRSI)¹³, a composite measure depicting the strictness and numbers of government policies to control the virus shows a very strict response with a score of 93.52 out of 100 between May 4 and June 22, 2022 (McDade et al., 2020).

Kenya did not have sufficient Personal Protective Equipment (PPEs) or testing kits to meet the demand. In some cases, PPEs that were procured were costly. The cost of PPEs for health care workers contributed a significant cost to taking care of hospitalized COVID patients. Better coordination between the central government and the counties and a streamlining of the procurement and distribution of test kits was proposed to improve the availability of testing kits (McDade et al., 2020). To address supply chain challenges for medical supply, the Government encouraged local manufacturing of PPEs and expanded laboratory testing capacity. Domestic textile manufacturers, including Rift Valley Textiles, Kitui County Textile Centre, Edi Investment, and Shona EPZ Limited were among the manufacturers meeting the demand for PPEs.¹⁴ The Government also earmarked about Kenyan shilling 600 million to purchase PPEs from local manufacturers to support health workers in public hospitals (Fibre2Fashion News Desk, 2020).

¹² See on the JEE of WHO: <https://www.who.int/emergencies/operations/international-health-regulations-monitoring-evaluation-framework/joint-external-evaluations>

¹³ See on the Stringency Index, based on nine response indicators of measures taken by governments: <https://data.humdata.org/dataset/oxford-covid-19-government-response-tracker>; and: <https://ourworldindata.org/grapher/covid-stringency-index>; see also the Government Response Tracker: <https://www.bsg.ox.ac.uk/research/research-projects/covid-19-government-response-tracker>

¹⁴ On the local production of PPEs see: <https://www.fibre2fashion.com/news/company-news/domestic-kenyan-manufacturers-step-up-ppe-production-267017-newsdetails.htm?amp=true>

Particularly, “the Kenya COVID-19 Fund Board¹⁵ in partnership with the Kenya Association of Manufacturers (KAM)¹⁶ and the Equity Group Foundation (EGF)¹⁷ have taken a strategic long-term view on how to mitigate issues of supply chain disruptions through capacity building of local manufacturers to enhance the quality of and to increase the production of Personal Protective Equipment (PPEs) in the country. Over 95 local manufacturers have been trained by McKinsey & Company... in production of PPEs and the creation of efficient supply chains.” The training programmes received funding support from UK Government’s Department for International Development (UK-DfID), and they covered how to meet national and international standards in PPE development (Equity Group, 2020).

Finally, the Government is looking to kickstart local vaccine production in April 2022. This will help to mitigate issues with limited supplies of vaccines (Ro, 2022). A guiding role will have the Kenya Biovax Institute.¹⁸

Case 4: Mozambique

At the onset of the pandemic, Mozambique was recovering from major shocks including the debt crisis, an insurgency in the north displacing thousands, and a humanitarian crisis from the effect of cyclones Kenneth and Idai which left almost 2.2 million Mozambicans needing humanitarian assistance. Generally, access to healthcare had been limited with only three doctors per 100,000 people, insufficient hospital equipment and infrastructure and doctors, and only 24 ventilators at the time of 15 April 2020 (Jimenez & Daniel, 2020). In view of the already precarious situation the country was in, Mozambique received support and funding from the international community to aid its COVID-19 response. This included PPE donations from Save the Children and the U.S. Department of Defence, a World Bank grant of \$ 100 m through the International Development Association (IDA), an emergency budget support of \$ 42 m, and a grant of \$ 1.6 million from the AfDB among others (Save the Children, 2020; World Bank, 2020; AfDB, 2021; USAID, 2021). The AfDB grant was used to purchase emergency health materials, including PPEs, test kits, and oxygen masks, and to increase screening, testing, and to acquire equipment, like paediatric-and adult-intensive care unit ventilators (AfDB, 2021).

¹⁵ See on the Kenya COVID-19 Fund (Give Directly):

<https://www.givedirectly.org/covid-19/kenya/>

¹⁶ See on the KAM in Kenya: <https://www.google.com/search?client=firefox-b-d&q=Kenya+Association+of+Manufacturers+%28KAM>

¹⁷ See on EGF Kenya: <https://equitygroupfoundation.com/about-us/>

¹⁸ See on the local vaccine production: <https://www.health.go.ke/kenyas-quest-to-manufacture-own-vaccines-take-giant-leap/>

For Mozambique, low vaccine supplies as well as logistic issues in reaching people in remote areas have been challenges accompanying vaccination (Jozine & Cebola, 2021). The World Bank, through the IDA with allocations of \$ 100 m, and the Global Financing Facility (GFF)¹⁹, a Fund hosted in the World Bank, also provided a \$ 115 m grant to Mozambique to boost COVID-19 vaccinations. The funds will go towards acquiring, managing, and deploying the vaccines and for strengthening health systems' preparedness and capacities (The World Bank, 2021). It is not clear how the strengthening of the health systems will be improved. Infrastructure development and capacity building will be core areas to become supported. There has been no talk of producing PPEs or the vaccines locally.

Case 5: Niger

Niger, one of the poorest countries globally, was already facing multiple crises that were increasing humanitarian and security expenses and were putting immense pressure on its financial capacities when the pandemic hit (In Niger, a Rare Scene in the Pandemic: Covid-19 Wards Remain Empty, Agriculture and Business Benefit from Support Programs, 2021). These crises include the "Central Sahel crisis originating from Mali affecting the Tillabery and Tahoua regions in the West, the Lake Chad Basin crisis which continues to generate displacements in the Diffa region due to the insurgency of Boko Haram and other Non-State Armed Groups (NSAGs), and the influx of refugees and internally displaced persons in the border regions of Maradi and in the Tahoua due to continuing instability in northern Nigeria" (IOM, 2021).

Niger's healthcare system had been inadequate, negatively impacted by insufficient education, training, funding, the situation of the health care workers, and the health care coverage. Niger is not only low in terms of technological and industrial capabilities but has very low human development indicators which were being recorded for the past decade (Nzeribe & Lucero-Prisno, 2021). But Niger has had considerable success in continually bringing down COVID-19 infection rates. The Minister of Health attributed efforts in reducing the number of cases after a surge between November 2020 and February 2021 to strong commitment from the Government; to technical and financial partners; to the involvement of different experts, sectors, and civil society which has improved decision-making and community engagement; and to the increased communication which has helped in pandemic management (WHO, 2021; para. 7).

In March 2020, after the pandemic hit, the Government announced \$1.63 m to support the COVID-19 response (African Union, 2020). Thereafter, Niger received a budget support from international organisations like the World Bank and

¹⁹ See on the GFF, addressing especially women and children with allocations on health and nutrition: <https://www.globalfinancingfacility.org/>

the African Development Bank. The World Bank loan of \$13.95 m will help with preventing, detecting, and responding to COVID-19 threats and will contribute towards strengthening national systems for public health preparedness (Niger COVID-19 Emergency Response Project, 2021). Niger has also received support from countries like Belgium, Canada, the United Kingdom, and the United States who have donated vaccinations through COVAX, and organisations like the United Nations Children's Fund (UNICEF) who are providing accompanying vaccination management support (USAID, 2021; UNICEF, 2022).

Case 6: Ethiopia

Ethiopia scores low in technological and human development indicators. There has been unrest in the country over the past few years. However, response by the Government and the private sector contributed to ensuring the supply of critical medical supplies and to boost local manufacturing. Specifically, the Government set up a Manufacturing Task Force to aid companies who would repurpose their manufacturing. Assistance included facilitating procurement of raw materials, links to suppliers, employee training, and technical advice. Various financial initiatives, including tax incentives that made manufacturing of essential equipment more viable, and non-financial initiatives, e. g. issuing temporary licenses for local production of sanitisers and face masks, were also given. To encourage availability of technical alcohol for sanitizer manufacturers, the 60% excise tax usually levied on it was removed. PPE and sanitizer manufacturers were also prioritized in foreign exchange requests to enable the importation of necessary raw materials which were not locally available (Mamo, 2020; Mamo, 2020a). At least 36 companies repurposed their manufacturing to commence production of coveralls, surgical masks, and sanitizers. For these companies, meeting local demand helped to assuage the fall in external demand due to logistic disruptions (Mamo, 2020).

Ethiopia also received external support in its efforts to curb Covid-19. This includes about \$180 m from the U.S Government (USAID, 2021) and over \$111.1 million from the Global Fund²⁰ to strengthen its community health system, to organize for epidemiological surveillance, to strengthen infection prevention and control, and to protect vulnerable populations amongst other things (COVID-19 Response in Ethiopia, 2021). And, \$82.60 m were also committed by the World Bank for the prevention, detection, and the response to the threat posed by COVID-19, and for strengthening the national systems for public health preparedness (The World Bank, 2021). Grants from the World Bank (The World Bank, 2021) and donations of vaccine doses from the United States (US DOS, 2021) are also contributing to pushing widespread and equitable access to COVID-

²⁰ See on the role of the Global Fund since the Covid-19 crisis: <https://www.theglobalfund.org/en/covid-19/>

19 vaccines. There is however no talk of local manufacturing of vaccines, although Ethiopia is on the way to promote its pharmaceutical industry.

4.3 Nigeria's Industrial and Technological Response to Covid-19

Nigeria, Africa's most populous country and biggest economy, like every other country in Africa and around the globe, was affected by the pandemic. On a cursory reading, going by reported numbers of confirmed cases and deaths, the country seemed to fare better than many others in managing the pandemic. As accounted at the September 17th, 2020, there had been 200,957 confirmed cases and 2,647 deaths.²¹ As many as 5,712,019 vaccine doses were administered up to 12th September 2021 (World Health Organisation, 2021), what is low for this populous country. However, the impact on human welfare and well-being has been significant. A report prepared for the United Nations Inter-Agency Expert Group on the eradication of poverty (Kharas & Dooley, 2021) notes that: "Nigeria was also severely impacted. Nigeria had 84 million people living in extreme poverty in 2019; this figure rose to potentially 92 million in 2020. Due to high population growth and economic stagnation, poverty is set to rise further in 2021 to 94 million. Nigeria was home to the largest number of the extreme poor in 2019, and on current trends it will hold this title through 2030. Nigeria represents the new face of extreme poverty – middle income, fragile, and conflict-affected, and located in sub-Saharan Africa."

The Federal Government of Nigeria (FGN) and the State governments in Nigeria responded with varying measures to curb the spread of the virus and to mitigate the socio-economic impact it was having on people. Lessons learnt from Nigeria's impressive response to the Ebola crisis in 2014 were also drawn upon for dealing with Covid-19 (Adesanya, 2021; Dixit, Ogundeji & Onwujekwe, 2020; World Health Organization, 2021). An Economic Sustainability Committee (ESC), headed by the Vice President, was set up to develop a clear Economic Sustainability Plan that would enable the country to respond to the challenges posed by the pandemic (Economic Sustainability Committee, 2020).

The industrial and technological response however was varied. Prior to the pandemic, the industrial sector had generally been weak, contributing less than the recommended 25% to GDP. There was a further decline in 2020 after the pandemic, hit when compared to the year before (see table 6). Except for Q1 of 2020 when manufacturing as a contribution to GDP was 23.65% as opposed to 23.56%

²¹ Various other countries in Africa have reported significantly higher confirmed cases & death cases reported at the time, for example Kenya – with 245,337 confirmed cases & 4,961 death cases, and South Africa – with 2,873,415 confirmed cases & 85,779 reported deaths.

in Q1 2019, there had been a consistent decline in the industrial sector's contribution in every other quarter of 2020, compared to 2019. The contribution of manufacturing to GDP is much less and highly volatile since 2010.²² Specifically, manufacturing's contribution was 11.52% in 2019, rising slightly to 12.67% in 2020 (World Bank, 2022).

Table 6: Quarterly Percentage Contribution of the Industrial Sector to GDP in Nigeria

Time	Industry (₦ Million) - 2019	Contribution of Industry to GDP (%) - 2019	Industry (₦ Million) - 2020	Contribution of Industry to GDP (%) - 2020
2019-Q1	1,608,461.83	23.56	1,615,390.58	23.65
2019-Q2	1,537,522.17	23.34	1,402,571.39	21.87
2019-Q3	1,616,584.64	22.17	1,592,209.06	21.59
2019-Q4	1,707,263.24	20.27	1,681,421.10	18.77

Source: National Bureau of Statistics

Notes: *Gross Domestic Product At 2010 Constant Basic Prices (₦ Million)

Clearly, in comparison to the more advanced industrial nations, Nigeria has relatively low industrial/manufacturing capabilities in the pharmaceutical sector. The country experienced acute shortages of essential health resources and - as with most African countries - had to rely on imports and donations of vaccines. Pre-pandemic, Nigeria was importing about 70% of its medicine (Faiva, et al., 2021). Across the various market segments for Covid-19 products, there was an acute shortage. Before the pandemic, Nigeria had 350 ventilators and 350 intensive care unit beds to serve the population. Another 100 ventilators were acquired in April 2020, but this number was not at all enough (Dixit, Ogundeji, & Onwujekwe, 2020). Other factors that contributed to the shortage in drug supply and of the necessary equipment and resources, which the pandemic compounded, included the reduction of production in the manufacturing sector, the lack of buffer stocks, and the poor funding of the healthcare system (Faiva, et al., 2021).

²² See on the share of manufacturing to GDP of Nigeria: <https://tradingeconomics.com/nigeria/manufacturing-value-added-percent-of-gdp-wb-data.html>

In addition to government's initiatives and interventions, the private sector was instrumental in providing support and filling in the gaps. We see this with regards to testing centres, provision of personal protective equipment, and sanitizers. At the onset of the pandemic, the Nigeria Centre for Disease Control (NCDC) "managed a molecular RT-PCR²³ laboratory network of 6 laboratories in 3 states (out of 36) and the Federal Capital Territory." This was sufficient to run diagnostics of cholera, lassa fever, and yellow fever which the country dealt with from time to time (Dixit, Ogundeji, & Onwujekwe, 2020). It was however not enough for the recommended routine Covid-19 tests. As at the date of April 13, 2021, Nigeria had added 3 more laboratories in Federal teaching hospitals, making it to 9 laboratories in 6 states, capable of doing 2,500 tests a day. This was still not sufficient. The NCDC then launched a national strategy for expanding Covid-19 testing. The plan involved expanding the existing NCDC Laboratory Network with Molecular RT-PCR, leveraging capacity within the HIV molecular testing laboratories, and repurposing point of care tuberculosis testing GeneXpert machines for COVID-19 testing. A key element of the strategy was private sector engagement (Nigeria Center for Disease Control, 2020). Many private organisations, both for-profit and non-profit, such as 54Gene, Access Bank, Aliko Dangote Foundation, and Flying Doctors, were instrumental in the activation of mobile diagnostics laboratories in states across the country (Dixit, Ogundeji, & Onwujekwe, 2020; Williams, 2020). As recorded for September 21, 2021, there are 84 government laboratories where testing can be done and 69 Covid-19 Laboratories in the NCDC's network (Nigeria Centre for Disease Control, 2021).

At the start of the pandemic, there were about 21 hand-sanitising manufacturing companies in Nigeria. By June 2020, over 110 companies had registered with the National Agency for Food and Drug Administration Control (NAFDAC) and commenced its production (Royal, 2020). One of the top brands is 2Sure Hand and Surface Sanitizers; 2Sure is new to the market and is manufactured by Imperio International Ltd. for the 7Up Bottling Company. 2Sure has a deep market penetration as it leverages 7Up's existing facility and distribution networks (Cleanblogger, 2021).

A few companies also began producing disposable, surgical and/or N95 face masks. By June 2020, there were six companies engaged in the production (see box 2 below).²⁴ Various other companies produce cloth-based, washable face

²³ For reading the abbreviation: **R**everse **T**ranscription - **P**olymerase **C**hain **R**eaction (RT-PCR)

²⁴ A similar desktop review was carried out for the other 16 countries (Benin, Burkina Faso, Cape Verde, Côte D'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, Senegal, Sierra Leone, Togo) in the West Africa

masks. However, surgical and N95 face masks are still largely imported from China.

Box 2: Surgical and N95 Face Mask Manufacturers in Nigeria

Xirea Apparels and Buphalo Active Gear have collaborated to manufacture Buphalo BDC-13 disposable coveralls, surgical face masks, and other essential medical PPEs. According to the founder of Xirea Apparels, Obinna Eneh, the company has the capacity to produce 10,000 surgical masks daily. Located in Lagos and Rivers States, the production process of the company ranges from sourcing fabrics, designing, packaging, quality control assessments, and delivery. Raw materials used are CE (Conformité Européene) Certified and there is an on-going ISO (International Organization for Standardization) Certification for strict quality control.

Fab Que Fashion Line has its location in Aba, a popular manufacturing hub in the eastern part of the country. Headed by Mrs Queen Duruibe, this company produces waterproof, puncture-resistant and hypo-allergenic surgical face masks, made with cotton and polypropylene. Production is pegged at 10,000 masks daily. Generally, raw materials such as the PVC pellets are sourced locally and from the international market to produce facemasks in Aba.

Zubnol Investment Limited in Awka, Anambra state, produces 10,000 to 20,000 medical face masks weekly. According to the CEO, Chukwubuike Nnoli, there is on-going collaboration with a partner in Aba, to meet imminent higher targets.

Prince Interior Furniture and Furnishing Company, located in the Federal Capital Territory (FCT), Abuja, has engaged a cardiologist and an artist to help in the mass production of N95 face masks; the cardiologist is hired to assist, and an artist is hired to help in the design of the masks. The Cardiologist, Dr Kenenna Obiatuegwu, describes the features as custom-fitted, comfortable, and ventilated to enable the wearer breath, and to enable the masks to filter microbes of 0.3 microbes and above. This type of N95 face masks is made from Semi-Regis cotton and multi-layered nets which act as ventilators.

Klot Planet Global Ltd. in Aba also ventured into mass production of PPEs, including surgical and disposable face masks for hospitals and other citizens. With

United Nations Sub-region in June 2020. At the time only Ghana had companies producing disposable/surgical and N95 masks. 5 companies in Ghana were producing it, and four of them got financial support; \$10 million dollars were given as financial support to 4 companies by the Government (Ghana Talks Business, 2020; Moro, 2020; Ngenbe, 2020).

a capacity of producing up to 500,000 pieces daily, the Manager, Mr Obinna Anoruo, explained that the masks have a hydrophobic dense (water-resistant) layer and a filter layer. Also, raw materials are sourced locally.

Nigeria Air Force (NAF) Investment Limited commenced mass production of surgical face masks. These masks are certified by relevant agencies of government before deployment to NAF hospitals and other hospitals. Close to 40,000 face masks were produced within two weeks of commencing production in April 2020.

Source: Akinpelu, 2020; Ejibas, 2020; Fibre2Fashion News Desk (DS), 2020; Iheaka, 2020; NAN, 2020; Ugwu, 2020

One area in which digital technologies have significantly impacted healthcare is telemedicine and virtual care. Prior to the pandemic, there were various health tech start-ups in the healthcare space. Nigeria Health Watch (2016) had considered 20 of them as possessing sufficient capability, even before the pandemic. Some of these firms became important health service providers alongside others during the pandemic. These companies either provide Business to Business (B2B) or Business to Customer (B2C) services, and they leverage different telecommunication channels, including mobile apps, web, SMS, Android, and voice (Nigeria Health Watch, 2016). Arguably, the rise of these health tech companies can be attributed to prior investment in the telecommunication sector.

Yet, while it may be some time before digital transformation is fully entrenched within the telemedicine and the virtual care sector, the pandemic has helped the country to move it further forward. In 2019, a review of popular healthcare apps showed telemedicine had recorded just around 1,000 to 5,000 downloads, in a country of over 200 million people (Eduoh, T., 2019). Prior to the pandemic, the health tech space did not receive as much attention from the media or from the investors as financial and consumer technology did (Nigeria Health Watch, 2016). Now, there is renewed focus on the need and place of digital technologies in strengthening health services (Petracca & Ciani, n.d.; Davide, et al., 2020)

While we note some successes with these cases, we find that the products and services for which Nigeria thrived are in the category of less advanced technologies, e. g. developing hand sanitizers, setting up testing centres, and providing for telemedicine. More needs to be done for the country to gain health security and to overcome import dependence on other countries, especially in times of crisis. Moreover, while this study focused on the health sector, across all sectors investment needs to be made to improve industrial and technological capabilities.

5 Conclusions and Policy Recommendations

This paper has considered Africa's industrial and technological capabilities compared to other countries, as well as Africa's pharmaceutical and health care supply chain challenges and response during the COVID-19 pandemic to understand industrial and technological readiness for 4IR. We adopted a framework that showed that pharmaceutical capacity can be garnered in the overlay between a country's industrial capacity and its health sector characteristics including policies and access to medicine.

Using various indexes, the GII, the NRI, and the CIP index, we find that many African countries are lagging in industrial and technological capabilities and, in turn, lack the preparedness for 4IR. However, we find some indication that, prior to the pandemic, some countries have begun to advance in industrial and technological capabilities, and the pandemic has helped in pushing them even further along. For example, telemedicine in Nigeria was growing before the pandemic, and has continued to grow during it. There are prospects for advancing after the pandemic, not only in Nigeria.

Our study shows various developments with implications for policy. First, preparedness is key to responding well to a pandemic. Countries and firms which already had significant industrial and technological capabilities were in a better state to quickly proffer solutions during the pandemic. Countries like the United Kingdom, Sweden, United States, Belgium, Germany, Russia, China, and India were the top locations for vaccines development and production, while no African country was developing at the onset of the pandemic. Egypt was also the only African country that was in the manufacturer / distributor category.

However, African countries which had some industrial and technological capability, for example South Africa, Mauritius, and Kenya, have been able to begin production /to arrange for "fill-and-finish", or to make plans to do so as the pandemic progressed.

A second finding shows that investment in industrial and technological capabilities at whatever scale tends to provide the necessary technological base that firms and countries could build upon. In Nigeria, for example, a general shortage of drugs and of necessary medical equipment existed. However, it was able to leverage existing tuberculosis and HIV testing facilities for Covid-19 testing. Over 2.9 million samples have been collected and tested by 22 September 2020 (Nigeria Centre for Disease Control, 2021). In Nigeria, in Kenya, and in Ethiopia, we see many firms becoming involved in the production of PPEs and other medical supplies.

Third, private sector involvement is key, but it needs an enabling policy environment. Industrial and technological advancement occurs within an ecosystem of several actors who all are collaborating to innovate and to produce. Countries

which thrive, e. g. see the scores of NRI components of technology, people, governance, and impact, advance on all fronts. Nigeria's health tech space is an example. While entrepreneurs are pushing out the applications, they need the ecosystem that provides proper regulation, government support, investment, consumer awareness, and knowledge among other factors to thrive. In Ethiopia and Kenya, for example, we see Government playing an active role in providing incentives for the private sector to get involved in manufacturing.

Instability seriously affects a country's ability to expand its technological and innovative capabilities and increases its reliance on external partners. While all countries worked with external partners, for example COVAX, countries like Mauritius, South Africa, Kenya, and Nigeria were beginning to look inward to meet their local demand, for example of PPEs, as well as of vaccinations. However, Mozambique and Niger, who were already in the middle of a humanitarian crisis, relied heavily on external support and donor funding for strengthening their health systems.

Fourth, the COVID-19 pandemic triggered significant economic and labour market shocks, presenting considerable impacts on health and well-being (Kose, Ohnsorge, & Yu, 2022). Loss of livelihood from unemployment and underemployment for informal workers put this category of workers at greater health risks. In both rural and urban areas, wage workers and self-employed traders in the informal health sector suffered greatly. Given that most rely on self-savings and loans from informal moneylenders, the inflationary pressure brought by lockdowns and restricted supply chains would evidently impact their businesses. Predictably, specific groups of workers, largely women, youth, and children from poor households, and migrant workers, who are predominant in the informal economy, witnessed a heightened impact of negative outcomes and, as well, a further exacerbation of their vulnerability.

While we have some anecdotal evidence, the role of the informal sector and the potential contributions of informal sector participation to the manufacturing sector in the time of COVID-19 should elicit further study. Thus far, there has been a plethora of articles in the academic literature looking at the adverse effects of the pandemic on the informal economy and the lives and livelihoods of informal sector workers; some useful recommendations for their recovery were presented. Support has also been given out by various entities including governments to aid informal sector workers. However, less has been reported about how informal sector manufacturers can plug into the rapid changes taking place in the industrial and health sector. We propose a few areas of potential research contribution to highlight the issues.

Informal sector manufacturers and service producers are characterized by low skill and usually use low levels of technology. While they may have purely a marginal role in the health sector manufacturing that requires high levels of technology

and technical know-how, for example in the making of vaccines, they can potentially participate in areas of the value chain which require low levels of technology, for example the manufacturing of PPEs and hand sanitizers. Citing Kenya as an example, interventions such as training for the informal sector on how to meet national and international standards can be provided. Funding can also be made available to enable them to procure necessary resources.

Traditionally, the informal sector has played a key role in last-mile drug distribution in Africa and will continue to do so. Some informal service providers become, inadvertently, purveyors of sub-standard drugs and medical products. Skills training and capacity development is needed to empower these actors to understand the importance of distributing quality products and to better serve their clientele; where possible, access to these quality products should be provided for these actors.

In conclusion, we consider new perspectives of and new programmes for industrial policy and health sector reforms in Africa. First, we find that COVID-19 has changed our perspective on how and why Africa should manufacture drugs, vaccines, and essential medical products. The new narrative is that health care is no longer to be considered purely as a social issue but also as an investment and industrial policy. Additionally, Africa faces existential health security problems as we witness with the supply chain disruptions that the health sector problems affect the countries and people in the same manner as food insecurity which leads to widespread nutritional crises. Health security means that Africa should have sufficient health products to meet its needs without having to depend on other countries for this supply. In periods of pandemic like this, we see that some countries are placing restrictions on the exportation of drugs and equipment leading to inflated prices of health products; this is the case when countries try to guard their own health security. Africa needs health sovereignty and cannot afford to outsource its healthcare and wellbeing.

There is increased global awareness of this issue, and regional organizations like the African Union (AU) and the African Development Bank (AfDB) have been at the fore of pushing for Africa's health security. In the Joint Vision for 2030's outcome of the 6th European Union – African Union Summit that took place in February 2022, it was noted that: "Learning from the current health crisis, we are committed to supporting the full-fledged African health sovereignty, for the continent to respond to future public health emergencies. To this end, we support a common agenda for manufacturing vaccines, medicines, diagnostics, therapeutics, and health products in Africa, including investment in production capacities,

voluntary technology transfers as well as strengthening of the regulatory framework to enable equitable access to vaccines, diagnostics, and therapeutics” (Joint Vision African Union/European Union, 2022²⁵).

Now, many countries in Africa may have neither the capacity nor the capabilities to begin manufacturing their own health products in the short term. An implementable model being proposed is to have regional production hubs where each hub specializes on identified products. Even then the conversation on the technology transfer of vaccines manufacturing centres mostly around “fill and finish” activities.

Consequently, industrial policy should acknowledge the need and urgency for African countries to go beyond fill-and-finish to manufacture the needed health products. Already, we see countries like Mauritius that have prioritised the manufacturing of vaccines, pharmaceuticals, and medical devices, countries that are encouraging private sector investment with tax incentives, and which have made a finance allocation in the national budget to back this commitment. Industrial policy should also begin to explore how Fourth Industrial Revolution (4IR) and other frontier technologies can be used to meet the health needs.

Again, an important lesson of the COVID-19 pandemic is the case for strengthened intra-African regional value chains and trade through the African Continental Free Trade Area (AfCFTA) (Banga, Keane, Mendez-Parra, Pettinotti, & Sommer, 2020).

While this paper makes some contribution to the issue of advancing industrial capabilities, there is scope for further research:

First, the framework for this paper can be expanded to cover Africa’s industrial and technological preparedness in other sectors outside of healthcare and pharmaceuticals, such as education, informal sector employment, agriculture, etc. These can also be analysed using a COVID-19 supply chain response and constraint lens.

Second, we have taken a very high-aggregate level approach in using various indexes – GII, NRI, and the CIP index – to measure country-level industrial and technological preparedness for 4IR. Each of these indexes can be looked at more closely to understand factors that contribute to success or hinder progress in applying 4IR technologies.

²⁵ See about the Joint Vision: <https://au.int/en/pressreleases/20220218/6th-european-union-african-union-summit-joint-vision-2030>, and: <https://www.consilium.europa.eu/de/press/press-releases/2022/02/18/sixth-european-union-african-union-summit-a-joint-vision-for-2030/>

Third, each country has its own peculiarities and its understanding of the situation. A comparative analysis would contribute to the bigger picture of why some countries are lagging and some others are advancing with 4IR technologies.

Finally, there are other fields of development research that this paper would be applicable to. These include an understanding of Africa's 4IR preparedness vis-à-vis accomplishing SDGs, growing research on the role of international organisations and multilateral development banks in bridging inequalities between countries, and helping them to be resilient in the face of a pandemics such as COVID-19.

References

- Abbott, F. M., Abbott, R. B., Fortunak, J., Sampath, P. G., & Walwyn, D. (2021). Opportunities, Constraints and Critical Supports for Achieving Sustainable Local Pharmaceutical Manufacturing in Africa: With a Focus on the Role, Final Report of Finance. Nova Worldwide Consulting. Retrieved September 30, 2021 from: <http://dx.doi.org/10.2139/ssrn.3811733>
- Adesanya, O. A. (2021). Government preparedness and response towards COVID-19 outbreak in Nigeria: A retrospective analysis of the last 6 months. In: *Journal of Global Health*, 10(2).
- Aetna (2020, April). Health Care Quality in Africa: Uganda, Nigeria, Tanzania, Zambia, Kenya, Zimbabwe and South Africa. Retrieved from Aetna: aetnainternational.com
- AfDB/African Development Bank (2021). African Economic Outlook 2021 - From Debt Resolution to Growth Recovery: The Road Ahead for Africa. Abidjan: African Development Bank. Retrieved January 25, 2022, from: https://www.afdb.org/sites/default/files/documents/publications/afdb21-01_aeo_main_english_complete_0223.pdf
- AfDB/African Development Bank (2021, June 3). Mozambique: African Development Bank Grants \$1.6million to Support National Covid-19 Response. Retrieved from News and Events: <https://www.afdb.org/en/news-and-events/press-releases/mozambique-african-development-bank-grants-16-million-support-national-covid-19-response-44032>
- African Development Institute (ADI), African Development Bank Group. (2020, June 22 & 23). Building Resilient Health Systems: Policies for Inclusive Health in Post-COVID-19. Retrieved September 30, 2021, from: https://www.afdb.org/sites/default/files/2020/06/15/concept_note_-_g-cop_seminar_on_inclusive_health_policy_in_a_post-covid-19_africa.pdf
- African Union (2007). Pharmaceutical Manufacturing Plan for Africa. Strengthening of Health Systems for Equity and Development in Africa, Ministers' Meeting, 10-13 April 2007. Johannesburg.
- African Union (2020). Impact of the Coronavirus (COVID 19) on the African Economy. African Union. Retrieved from: https://au.int/sites/default/files/documents/38326-doc-covid-19_impact_on_african_economy.pdf

- Akinpelu, O. (2020, April 9). COVID-19: Entrepreneurs in Nigeria, Ghana, Kenya Begin Mass Surgical-Mask Production. Retrieved June 3, 2020 from Technext: <https://technext.ng/2020/04/09/covid-19-surgical-mask-production-begins-in-nigeria-and-other-african-countries/>
- Alicke, K., Barriball, E., & Trautwein, V. (2021, November 23). How COVID-19 is Reshaping Supply Chains. Retrieved December 20, 2021, from McKinsey & Company: <https://www.mckinsey.com/business-functions/operations/our-insights/how-covid-19-is-reshaping-supply-chains>
- Banga, K., Keane, J., Mendez-Parra, M., Pettinotti, L., & Sommer, L. (2020, August). Africa Trade and Covid-19: The Supply Chain Dimension. UNECA's African Trade Policy Centre and ODI. Retrieved from: https://cdn.odi.org/media/documents/Africa_trade_and_Covid19_the_supply_chain_dimension.pdf
- Belliger, A. & Krieger, D. J. (2018). The Digital Transformation of Healthcare. In: K. North, R. Maier & O. Haas (Eds.), Knowledge Management in Digital Change (pp. 311-326). Cham: Springer.
- Buckholtz, A. (2021, June). Africa's Shot at Local Pharma Production. Retrieved from IFC: https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news-and-events/news/insights/africa-local-pharma-production
- Byaruhanga, J. (2020, September 4). How Africa can Manufacture to Meet its Own Pharmaceutical Needs. Retrieved from Africa Renewal: <https://www.un.org/africarenewal/magazine/september-2020/how-africa-can-manufacture-meet-its-own-pharmaceutical-needs>
- Clay, C. (2008). *The Innovator's Prescription: A Disruptive Solution for Health Care*. McGraw-Hill.
- Cleanblogger. (2021, February 18). Top 10 Best Hand Sanitizer Brands in Nigeria. Retrieved September 21, 2021, from Cleaneat: <https://cleaneat.ng/10-best-hand-sanitizer-brands-in-nigeria/>
- Conway, M., Holt, T., Sabow, A., & Sun, I. Y. (2019, January). Should Sub-Saharan Africa Make Its Own Drugs? Retrieved from McKinsey & Company, Public Sector: <https://www.mckinsey.com/industries/public-sector/our-insights/should-sub-saharan-africa-make-its-own-drugs>
- Cornell University, INSEAD, and WIPO. (2020). *Global Innovation Index 2020: Who Will Finance Innovation?* Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, WIPO. Retrieved from: https://www.wipo.int/edocs/pub-docs/en/wipo_pub_gii_2020.pdf
- COVID-19 Response in Ethiopia. (2021, December 21). Retrieved from The Global Fund: <https://www.theglobalfund.org/en/covid-19/news/2021-12-21-covid-19-response-in-ethiopia/>
- Davide, G., Boetto, E., Carullo, G., Nuzzolese, A. G., Landini, M. P. & Fantini, M. P. (2020). Adoption of Digital Technologies in Health Care During the COVID-19 Pandemic: Systematic Review of Early Scientific Literature. *J Med Internet Res*.
- DCVMN. (2022). About. Retrieved January 25, 2022, from DCMVN: <http://www.devnm.org/-About->

- Dixit, S., Ogundeji, Y. K. & Onwujekwe, O. (2020, July 2). Future Development: How Well Has Nigeria Responded to COVID-19? Retrieved September 20, 2021 from Brookings: <https://www.brookings.edu/blog/future-development/2020/07/02/how-well-has-nigeria-responded-to-covid-19/>
- Ebert, C., & Duarte, C. H. (ND). Software Technology. Retrieved from: https://www.researchgate.net/profile/Carlos-Henrique-Duarte-2/publication/326241618_Digital_Transformation/links/5b4d14f3aca27217ff9b05e4/Digital-Transformation.pdf
- Economic Commission for Africa/ECA (2021, March 26). Africa can Take a Shot at Own COVID-19 Vaccine. Retrieved September 30, 2021, from Africa Renewal: <https://www.un.org/africarenewal/news/political-will-and-investment-africa-can-take-shot-own-covid-19-vaccine>
- Economic Sustainability Committee. (2020). Nigeria Economic Sustainability Plan. Access: <https://nipc.gov.ng/wp-content/uploads/2020/09/NG-Economic-Sustainability-Plan-2020.pdf?>
- Eduoh, Therrie. (2019, June 13). Retrieved September 22, 2021, from Top 5 Medical Apps in Nigeria: <https://eduogetherrie.medium.com/top-5-medical-apps-in-nigeria-a-review-of-the-leading-healthcare-apps-in-nigeria-dbe0bf29228c>
- Ejibas, D. (2020, April 17). COVID-19: NAF Begins Mass Production of Face Masks, Medical Kits. Retrieved June 3, 2020 from NNN: <https://nnn.com.ng/covid-19-naf-begins-mass-production-of-face-masks-medical-kits/>
- Equity Group. (2020, June 25). Kenya Association of Manufacturers in Partnership with Equity Group Foundation and the Kenya COVID-19 Fund Support Manufacturers in Kenya to Produce World Class PPEs. Retrieved from: <https://equitygroupholdings.com/ke/newsroom/24-press-release/57-kenya-association-of-manufacturers-in-partnership-with-equity-group-foundation-and-the-kenya-covid-19-fund-support-manufacturers-in-kenya-to-produce-world-class-ppes>
- European Investment Bank. (2020, December 18). Mauritius: EIB and FIND back innovative plant-based reagent manufacturing in Africa to fight COVID-19 and other endemic diseases. Retrieved January 12, 2021, from European Investment Bank: <https://www.eib.org/en/press/all/2020-388-eib-and-find-back-innovative-plant-based-reagent-manufacturing-in-africa-to-fight-covid-19-and-other-endemic-diseases>
- Faiva, E., Hashim, T. H., Ramadhan, M. A., Musa, S. K., Bchara, J., Tuama, Y. D., Adebisi, Y. A., . . . Lucero-Prisno III, D. E. (2021). Drug supply shortage in Nigeria during COVID-19: efforts and challenges. *Journal of Pharmaceutical Policy and Practice*. Jan. 22; 14(1):17 (2021). <https://doi.org/10.1186/s40545-021-00302-1>
- Fibre2Fashion News Desk. (2020, May 7). Domestic Kenyan Manufacturers Step Up PPE Protection. Retrieved from FF: <https://www.fibre2fashion.com/news/apparel-news/domestic-kenyan-manufacturers-step-up-ppe-production-267017-newsdetails.htm?amp=true>
- Gates, B. (2021, September 14). Innovation and Inequity | 2021 Goalkeepers Report. Retrieved September 22, 2021, from: [linkedin.com: https://www.linkedin.com/pulse/innovation-inequity-2021-goalkeepers-report-bill-gates](https://www.linkedin.com/pulse/innovation-inequity-2021-goalkeepers-report-bill-gates)

- Ghana Talks Business. (2020, April 4). Four local companies in Ghana to produce PPEs with \$10 million Gov't support. Retrieved June 2020 from Ghana Talks Business: <https://ghanatalksbusiness.com/2020/04/govt-gives-four-local-companies-10-million-dollars-to-produce-ppes/>
- Global Health Centre. (2021). COVID-19 Vaccine Purchases and Manufacturing Agreements. Graduate Institute of International and Development Studies. Retrieved September 7, 2021 from www.knowledgeportal.org/covid19-vaccine-arrangements
- Goldstein Market Intelligence. (2021, May 18). African Pharmaceutical Market Analysis By Therapeutic Class , By Drug Categories, By Inhalants, By Anabolic Steroids & By Region With COVID-19 Impact | Forecast Period 2019-2035. Retrieved from Goldstein Market Intelligence: <https://www.goldsteinresearch.com/report/africa-pharmaceutical-industry-market-size-forecast>
- Gopal, G., Suter-Crazzolaro, C., Toldo, L. & Eberhardt, W. (2019). Digital Transformation in Healthcare - Architectures of Present and Future Information Technologies. In: *Clinical Chemistry and Laboratory Medicine*, 57(3), pages 328-335.
- Government of Mauritius. (2021). Budget Speech 2021-2022 - Better Together. Retrieved from: https://gis.govmu.org/Lists/DocumentsLinks/Attachments/26/2021_22budgetspeech_english.pdf
- Iheaka, I. (2020, April 13). COVID-19: Protective kit maker calls for government support. Retrieved June 2, 2020 from NNN: <https://nnn.com.ng/covid-19-protective-kit-maker-calls-for-government-support/>
- In Niger, a Rare Scene in the Pandemic: Covid-19 Wards Remain Empty, Agriculture and Business Benefit from Support Programs. (2021, May 11). Retrieved from African Development Bank Group: <https://www.afdb.org/en/news-and-events/niger-rare-scene-pandemic-covid-19-wards-remain-empty-agriculture-and-business-benefit-support-programs-43576>
- Independa Health Hub (2022). Retrieved January 25, 2022 from Independa: <https://indepanda.com/>
- International Finance Corporation (IFC) (2021, July 9). IFC and Partners Support New COVID-19 Vaccine Manufacturing Facility of Institut Pasteur de Dakar in Senegal. Retrieved September 30, 2021 from IFC: <https://press-room.ifc.org/all/pages/PressDetail.aspx?ID=26493>
- IOM/International Organization for Migration. (2021, January 28). Niger Crisis Response Plan 2021. Retrieved from IOM Global Crisis Response Platform: <https://crisisresponse.iom.int/response/niger-crisis-response-plan-2021>
- Jimenez, M., & Daniel, E. (2020, May 5). Mozambique's Response to COVID-19: Challenges and Questions. Retrieved from International Growth Centre: <https://www.theigc.org/blog/mozambiques-response-to-covid-19-challenges-and-questions/>
- Jozine, E., & Cebola, T. (2021, November 21). With Omicron on the Horizon, Mozambique Delivers Covid Vaccines to the Last Mile. Retrieved from The Optimist: <https://www.standard.co.uk/optunist/vaccine-world/mozambique-covid-vaccines-omicron-variant-b969112.html>

- Kharas, H., & Dooley, M. (2021). Extreme Poverty in the Time of COVID-19. Prepared for the United Nations Virtual Inter-agency Expert Group Meeting on the Implementation of the Third United Nations Decade for the Eradication of Poverty (2018-2027), May 24-27, 2021. Retrieved September 20, 2021, from: https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2021/05/KHARAS_paper1.pdf
- Kose, A. M., Ohnsorge, F. & Yu, S. (2022, January 27). The informal sector: Compounding the damage of Covid-19. Retrieved from Vox EU: <https://voxeu.org/article/informal-sector-compounding-damage-covid-19>
- Kriesch, A. (2021, December 14). COVID-19: South Africa develops own coronavirus vaccine. Retrieved from DW (Deutsche Welle): <https://www.dw.com/en/covid-19-south-africa-develops-own-coronavirus-vaccine/a-60121009>
- Krugman, P. R. and Obstfeld, M. (2003): International Economics – Theory and Policy, 6th edition, Boston et al.: Addison-Wesley
- Mamo, L. T. (2020, December 17). Insights from Africa's Covid-19 Response: Repurposing Manufacturing. Retrieved from Tony Blair Institute for Global Change: <https://institute.global/advisory/insights-africas-covid-19-response-repurposing-manufacturing>
- Mamo, L. T. (2020a, December 16). The Covid-19 Blueprint: Tackling PPE Shortages Provides Lessons for Accelerating Africa's Industrialisation. Retrieved from Tony Blair Institute for Global Change: <https://institute.global/policy/covid-19-blueprint-tackling-ppe-shortages-provides-lessons-accelerating-africas>
- McCarthy, N. (2020, April 20). COVID-19 OUTBREAK: Global Export Restrictions In Response To Covid-19. Retrieved from statista: <https://www.google.com/amp/s/www.statista.com/chart/amp/21429/countries-that-have-imposed-temporary-export-restrictions-on-products/>
- McDade, K., Ogira, D., Onyangi, J., Ojal, J., Kowaro, G., Mao, W. & Yamey, G. (2020). Kenya's Policy Response to COVID-19. The Center for Policy Impact in Global Health.
- Mills, A. (2014). Health Care Systems in Low- and Middle-Income Countries. In: *New England Journal of Medicine*. 2014; 370 (6), pages 552-557.
- Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division) & UNCTAD. (2020). Industrial Policy and Strategic Plan for Mauritius 2020-2025. Port Louis: Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division) & UNCTAD.
- Moro, S. B. (2020, April 18). DTRT Apparel, Ghana's Solution to the Global Shortage of PPEs. Retrieved June 2020 from Ghana Talks Business: <https://ghanatalksbusiness.com/2020/04/dtrt-apparel-ghanas-solution-to-the-global-shortage-of-ppes/>
- NAN (2020, April 17). NAF Begins Mass Production of Face Masks, Medical Kits. Retrieved June 3, 2020 from The Guardian: <https://t.guardian.ng/news/naf-begins-mass-production-of-face-masks-medical-kits/>

- Ngnenbe, T. (2020, April 23). Companies Ready to Deliver PPE mid-May - Managers. Retrieved June 2020 from Graphic Online: <https://www.graphic.com.gh/news/general-news/ghana-news-companies-ready-to-deliver-ppe-mid-may-managers.html>
- Niger COVID-19 Emergency Response Project. (2021, October 26). Retrieved from The World Bank: <https://projects.worldbank.org/en/projects-operations/project-detail/P173846>
- Nigeria Center for Disease Control/NCDC. (2020). National Strategy to Scale Up Access to Coronavirus Disease Testing in Nigeria. NCDC. Accessed from: https://covid19.ncdc.gov.ng/media/files/COVID19TestingStrategy_2ZWBQwh.pdf
- Nigeria Centre for Disease Control/NCDC. (2021). Government Laboratories. Retrieved from NCDC: <https://covid19.ncdc.gov.ng/laboratory/>
- Nigeria Health Watch. (2016, August 30). 20 Startups to know in the Nigerian Health Tech Space. Retrieved from Nigeria Health Watch: <https://nigeriahealth-watch.com/20-startups-to-know-in-the-nigerian-health-tech-space/>
- Nzeribe, E.,& Lucero-Prisno, D. E. (2021). COVID-19 and its Impacts: The Situation in Niger Republic. *Clinical Epidemiology and Global Health*, July-September 2021, 11: 100797. doi: 10.1016/j.cegh.2021.100797. Access from: <https://pub-med.ncbi.nlm.nih.gov/34095612/>
- Our World In Data. (2021, September 28). Number of people fully vaccinated against COVID-19. Retrieved September 29, 2021, from Our World In Data: https://our-worldindata.org/explorers/coronavirus-data-explorer?zoomToSelection=true&facet=none&pickerSort=asc&pickerMetric=location&Metric=People+fully+vaccinated&Interval=Cumulative&Relative+to+Population=false&Align+outbreaks=false&country=OWID_WRL~Afri
- Petracca, F. & Ciani, O. (2020). Harnessing Digital Health Technologies During and After the COVID-19 Pandemic: Context Matters. In: *Journal of Medical Internet Research*, Volume 22(12), pages 1-7
- Portulans Institute. (2020, October). NRI 2020 Analysis. Retrieved September 14, 2021, from Network Readiness Index: <https://networkreadinessindex.org/nri-2020-analysis/>
- PwC/PricewaterhouseCoopers. (2020). Impact of COVID-19 on the Supply Chain Industry. PwC. Retrieved from: <https://www.pwc.com/ng/en/assets/pdf/impact-of-covid19-the-supply-chain-industry.pdf>
- Ro, C. (2022, January 2). Kenya's Covid-19 Vaccination Innovations. Retrieved from Forbes. Access from: <https://www.forbes.com/sites/christinero/2022/01/02/kenyas-covid-19-vaccination-innovations/?sh=60eb1d103a50>
- Royal, D. O. (2020, June 4). Nigeria: Over 110 Hand Sanitiser Production Companies Registered in Nigeria - NAFDAC. Retrieved September 21, 2021, from allAfrica: <https://allafrica.com/stories/202006040140.html>
- Sampath, P. G., & Pearman, J. (2021). Local Production of COVID 19 Vaccines: A Strategy for Action. *Global Policy*. 23 August 2021. For access: <https://www.globalpolicyjournal.com/articles/health-and-social-policy/local-production-covid-19-vaccines-strategy-action>

- Save the Children (2020, July 26). Niger - 1.2 Million Children and Young People Were Out of School Because of COVID-19. Retrieved from Save the Children: <https://www.savethechildren.net/news/niger-%E2%80%93-12-million-children-and-young-people-were-out-school-because-covid-19>
- Save the Children (2020, October 23). Save the Children Donates COVID-19 PPEs in Gaza. Retrieved from Mozambique: <https://mozambique.savethechildren.net/news/save-children-donates-covid-19-ppes-gaza>
- The World Bank. (2021, March 30). Accelerating Broad and Equitable Access to the COVID-19 Vaccine in Ethiopia. Retrieved from The World Bank: <https://www.worldbank.org/en/news/feature/2021/03/30/accelerating-broad-and-equitable-access-to-the-covid-19-vaccine-in-ethiopia>
- The World Bank. (2021, June 1). Ethiopia COVID-19 Emergency Response. Retrieved from The World Bank: <https://projects.worldbank.org/en/projects-operations/project-detail/P173750>
- The World Bank. (2021, June 4). World Bank Injects \$115 Million to Boost COVID-19 Vaccination in Mozambique. Retrieved from Press Release. Access from: <https://www.worldbank.org/en/news/press-release/2021/06/03/world-bank-injects-115-million-to-boost-covid-19-vaccination-in-mozambique>
- Ugwu, R. (2020, May 3). Furniture company to produce Made in Nigeria N95 face masks. Retrieved September 30, 2021 from The Sun: <https://www.sunnewsonline.com/furniture-company-to-produce-made-in-nigeria-n95-face->
- UNAIDS (2020). The Impact of the COVID-19 Response on the Supply Chain, Availability and Cost of Generic Antiretroviral Medicines for HIV in Low-and Middle-Income Countries. UNAIDS. Retrieved from: https://www.unaids.org/sites/default/files/media_asset/covid19-supply-chain-availability-cost-generic-arv_en.pdf
- UNICEF. (2022, January 8). The First Doses of Pfizer COVID-19 Vaccine have Arrived in Niger. Retrieved from Reliefweb: <https://reliefweb.int/report/niger/first-doses-pfizer-covid-19-vaccine-have-arrived-niger>
- UNICEF. (n.d.). Maternal, Newborn and Child Survival - Childhood Diseases. Retrieved October 1, 2021 from UNICEF: <https://www.unicef.org/health/childhood-diseases>
- UNIDO/United Nations Industrial Development Organization (2020). Competitive Industrial Performance Report 2020 - CIP Index, Edition 2020: Country and Economy Profiles. Vienna: UNIDO.
- UNIDO (2020a). Industrial Development Report 2020: Industrializing in the Digital Age. Vienna: UNIDO.
- United Nations (2021). Our Common Agenda - Report of the Secretary-General. New York: United Nations. Accessed from: https://www.un.org/en/content/common-agenda-report/assets/pdf/Common_Agenda_Report_English.pdf
- US DOS/United States Department of State. (2021, November 2). The United States Donates 1,552,590 Doses of the Pfizer COVID-19 Vaccine to Ethiopia. Retrieved from: <https://reliefweb.int/report/ethiopia/united-states-donates-1552590-doses-pfizer-covid-19-vaccine-ethiopia>

- USAID/United States Agency for International Development. (2021, January). Ethiopia Fact Sheet: COVID-19 Response. Retrieved from USAID: https://www.usaid.gov/sites/default/files/documents/Ethiopia-Fact-Sheet_COVID-19_January-2021.pdf
- USAID. (2021, September 7). Joining Forces: How DOD and USAID Partnered to Keep Students Safe and in School. Retrieved from USAID: <https://www.usaid.gov/mozambique/documents/joining-forces-how-dod-and-usaid-partnered-keep-students-safe-and-school>
- Usman, Z., & Oviada, J. (2021, September 13). Is There Any COVID-19 Vaccine Production in Africa? Retrieved from Carnegie Endowment for International Peace: <https://carnegieendowment.org/2021/09/13/is-there-any-covid-19-vaccine-production-in-africa-pub-85320>
- Uwizeyimana, T., Hashim, H. T., Kabakambira, J. D., Mujuyarugamba, J. C., Dushime, J., Ntacyabukura, B., . . . Lucero-Prisno III, D. E. (2021). Drug Supply Situation in Rwanda During COVID-19: Issues, Efforts and Challenges. In: *Journal of Pharmaceutical Policy and Practice*, 14(12).
- Vial, G. (2019). Understanding Digital Transformation: A Review and A Research Agenda. In: *The Journal of Strategic Information Systems*, 28(2), pages 118-144.
- WEF & Accenture. (2016). *Digital Transformation of Industries Demystifying Digital and Securing \$100 Trillion for Society and Industry by 2025*. Geneva: World Economic Forum. Accessed from: <https://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef1601-digitaltransformation-1401.pdf>
- WEF & Accenture. (2016a). *World Economic Forum White Paper - Digital Transformation of Industries: Healthcare*. Geneva: World Economic Forum. Retrieved January 25, 2022 from: <https://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-healthcarewhitepaper-final-january-2016.pdf>
- WHO (2019, August 2). *Pneumonia*. Retrieved October 1, 2021 from World Health Organization: <https://www.who.int/news-room/fact-sheets/detail/pneumonia>
- WHO (2021, February 2021). *Minister of Health of Niger on Keeping COVID-19 Cases Low*. Retrieved from WHO: <https://www.afro.who.int/news/minister-health-niger-keeping-covid-19-cases-low>
- WHO Country Office Mauritius and Government of Mauritius. (2020). *Best Practices and Experience of Mauritius' Preparedness and Response to COVID-19 Pandemic, Inter-Action Review 1 - January to August 2020*. WHO Country Office Mauritius & Government of Mauritius.
- Williams, T. (2020, March 31). *Nigeria COVID-19 Testing Support Fund Launched by 54gene*. Retrieved from Forbes: <https://www.forbes.com/sites/tommywilliams/2020/03/31/nigeria-covid-19-testing-support-fund-launched-by-54gene/?sh=6fad4cabce17>
- World Bank (2020, October 22). *World Bank Helps Mozambique Mitigate Impact of Covid-19 with a New \$100 Million Grant*. Retrieved from World Bank:

<https://www.worldbank.org/en/news/press-release/2020/10/22/world-bank-helps-mozambique-mitigate-impact-of-covid-19-with-a-new-100-million-grant>

World Bank (2022). Manufacturing, value added (% of GDP) - Nigeria. Retrieved from World Bank: <https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=NG>

World Health Organisation (WHO). (2021). Nigeria. Retrieved September 20, 2021, from World Health Organisation: <https://www.who.int/countries/nga/>

World Health Organization (WHO). (2020, March 20). Shortage of personal protective equipment endangering health workers worldwide. Retrieved September 10, 2021, from WHO: <https://www.who.int/news/item/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>

Unit 2: New Business Opportunities created by the Digital Transformation in West Africa

New Business Opportunities created by the Digital Transformation in West Africa - An Introduction

By Ulrike Schuerkens¹ and Karl Wohlmuth²

1 The Issues

This thematic unit with the title *New Business Opportunities created by the Digital Transformation in West Africa* will permit it to describe IT situations in enterprises in West Africa with case studies for Senegal, Ghana, and the Ivory Coast. The introduction demonstrates the regional tendencies for digital transformation and considers the specific role of Senegal as a regional hub of digital transformation in West Africa (see: Friederici 2020). New products, new services, and new forms of cooperation will be discussed. It will be shown that digital entrepreneurship is advancing not only in technology hubs, but in all areas where Internet access is given. Connections of the digital enterprises to local, regional, and global markets will be shown. Long-term implications of the digital transformation will also be tackled (see: Deichmann et al. 2016).

Socio-economic local and national legacies and contexts influence economic activities, even in the digital sector (Kamdem 2004). In this Unit 2 of the African Development Perspectives Yearbook, we analyse how economic actors, digital technologies, and socio-economic environments interact in the 21st century in West Africa. Academic discourses and political programmes give inaccurate visions of entrepreneurship in the digital sector of West Africa. The studies in this Unit investigate what digital enterprises are doing in the regional context beside of acting in the local context. Local socio-economic situations shape market opportunities (Hopkins 2015). Therefore, it is necessary to study the local environment of digital enterprises, and to clarify what this means for acting in the sub-regions and the neighbouring regions. We present some innovative solutions that were found in the sub-region. The digital enterprises concentrate on local markets with few contacts to foreign markets such as France, a country which is of great relevance for other (more traditional) enterprises from Senegal and the Ivory Coast, but also from Ghana. As such, the post-colonial legacies persist and

¹ Ulrike Schuerkens, Professor at the University of Rennes, is Guest Editor for this Unit. She has recruited for this Unit the authors of the case studies. The case studies which are included in this Unit are part of her EU-financed research project.

² Karl Wohlmuth, Professor at the University of Bremen in Bremen, Germany, is the Co-Editor of this Unit. He has given advice to the authors of this Unit by reviewing the various drafts. He was also active to restructure the essays.

can continue to disadvantage local enterprises (Schuerkens et al., 2019). The impact of these legacies on the digital enterprises is of interest; this helps to analyse the limits of the digital transformation in terms of speed and scope.

The essays on the entrepreneurs and the actors that we have displayed in the four studies focus on operational issues, on income opportunities, on digital applications and solutions, and on the exchanges with local actors. Digital African enterprises and entrepreneurs are limited by the economic, social, and political environments around them. They cannot invest huge funds for uncertain gains over several years. If they have international contacts, these contacts are limited and are based on former activities in France or elsewhere. These entrepreneurs are active in economic niches that larger enterprises are not interested in; in these spheres they have a competitive advantage (Manyika et al., 2013). Moreover, their activities are limited to urban regions where these actors can build on established socio-economic infrastructures. These enterprises grow according to the dynamics of local markets; these markets are limited and exploiting the market opportunities depends on the owners' learning capacities. Business ideas are combined with local patterns, goals, and interests. These markets are limited as most of the rural dwellers have not the capacity to follow, to apply and to use digital innovations (See: van der Merwe 2016).

Beliefs about the transformative potential of digitalization are widespread and are publicized by political actors, such as the DER (Délégation de l'Entrepreneuriat Rapide) in Senegal, described by Ulrike Schuerkens in essay 1 of this Unit. Such political actors use institutions like DER to benefit from the transformative potential of the digitalization process politically. However, socio-economic realities are much more limited and very diverse. These discourses are particular to the African context, but they also transform it into new realities that people discover and envisage themselves. However, it is not probable that these new and small enterprises challenge the global digital markets, as their main competitive advantage is to be near to the local socio-economic contexts that permit it to build strategies of successful market penetration (See: Friederici 2020). Africans will continue to use apps, devices, and software originating from the Global North, and from China, Korea, and Taiwan. These enterprises have the possibility to deliver solutions that would be beneficial and open to African digital enterprises, but many of these enterprises cannot reach and afford them because of their strong links to local markets. The limited range of functions may hinder the spread of African solutions.

In African countries, there are many local problems that wait for solutions to be developed by local enterprises; but the spread of digital solutions based on local business models may take time and may have limits in terms of reliability, efficiency, and scalability. Local markets are open to them and invite their engagements. The availability of skilled labour and trust-based networks decide on their opportunities to spread local digital innovations. The entrepreneurs we

present in the following case studies have learnt that growth is limited and that their progress is slow. As such, these enterprises can make valuable contributions to their economies, but public support for them is limited. These enterprises have a considerable knowledge base, but they are not strongly visible. The founders of these enterprises have all the needed technological knowledge and know how to run a business under local conditions, but they primarily try to organize the business model in such a way that it fits for realizing a sufficient income stream for livelihood purposes.

African governments in the region have contributed to the development of the infrastructure to widen the opportunities for the digital entrepreneurs. The development of rural areas as a base for digital enterprises would need the local creation of digital competences, the spread of knowledge on digital products and resources, and the establishment of digital infrastructure. But infrastructure development alone will not suffice. Services to low-income customers and measures for adequate infrastructure development are required. This will not be a quick process, but so far not much is done to involve rural areas in the process of digital transformation.

Developing African digital enterprises is a rather new endeavour and will continue in the future (Friederici, 2020). These enterprises should develop and disseminate products that are useful and can be applied in the African socio-economic context. Integrated digital infrastructure is needed to accelerate growth, productivity increase, and innovation. The global power balance in the digital sector cannot be reversed, as argued by most of the observers. To become producers of digital knowledge and not only to stay in the position of consumers of digital products, continentwide efforts are required for Africa. The probable future of digitalization in Africa is one of common efforts by reuniting larger markets and by marketing products which are produced and distributed on a greater scale. Entrepreneurs in the first phase must stick on local markets and need to adopt local digital adaptations. In later phases a national, regional, and global focus may evolve. Infrastructure, such as hub buildings, tech parks, and incubators, is necessary and will provide local competitive advantages. There is a need for a specialization that is locally relevant; this form of specialization can only be identified by local entrepreneurs. Niches for digital solutions must be found which are based on local socio-economic structures and on local networks. But cross-country partnerships can play a role when combined with local adaptations and with perspectives on international growth of demand for digital solutions. However, digital entrepreneurship is rarely considered to foster a broad socio-economic development in African settings. A more modest role can be expected in the next few years. African digital entrepreneurs are shaping lives, are transforming economies, and are changing societies all over the continent. As such, they form a key part of creating the future of the continent and of contributing to the avoidance of a much greater digital divide in the world.

Economic empowerment is one of the goals of these enterprises in the 21st century. But it cannot be expected that these entrepreneurs will quickly accelerate the digital transformation in Africa.

Recent studies (such as: Madichie, N. O., Bolat, E. and Taura, N., 2021) explore the opportunities and challenges of accelerating digital entrepreneurship development in key economic growth sectors (by digital technologies for media and agriculture) of West Africa (as analyzed for Nigeria and Ghana as research focus countries). Case illustrations from the media and agriculture sectors are highlighting some of the opportunities and challenges that are shaping some of the current business practices in the digital space of West Africa. The findings of the research are revealing and important for policymakers. Technological infrastructure is most important for the success in the media-tech sector cases, and this has to do with the low internet penetration rates in West Africa. As well, technological infrastructure is a challenge in the agri-tech sector cases. So, we can see that a sector-specific identification of challenges and opportunities is requested. And the research on digital entrepreneurship ecosystems also highlights the role of partnerships within the entrepreneurship ecosystems. Such partnerships are of critical importance for realizing positive benefits for all stakeholders within the entrepreneurial ecosystem. It is obvious that the challenges and opportunities related to digital entrepreneurship development may be different in West Africa when compared with other regions in Africa.

The technological infrastructure has a base in West Africa. There are 142 Technopoles, like the Information Technology and Biotechnology Village in Côte d'Ivoire. West Africa has incubators, such as Jokkolabs (Senegal, Côte d'Ivoire, Mali, Burkina Faso, Benin, The Gambia) which provide support to locally based start-ups. Nollywood in Nigeria is the world's second largest film industry, and nearly 90% of its \$3bn in revenue are generated through the Internet (see: *theafricareport*, 28 January 2021/updated 29 January 2021).³ But, it is reported that more than half of the college-educated young people do not have the skills required to work in the digital world. And less than 5% of the households own a computer, and only 41.5% of the population has access to a mobile network. Concerning enterprises, barely 24% of the businesses have a website, and E-commerce faces huge logistical challenges as between 30% and 40% of the products ordered over the Internet are returned because the recipient cannot be found. The recommendations for West Africa's digital transformation comprise training for digitalization measures, increasing the electricity supply, and building communication infrastructure. School-enterprise partnerships may be of

³ See: A whole new (digital) world. Three ways West Africa's digitalisation can improve, by Alain Faujas; access: <https://www.theafricareport.com/60956/three-ways-west-africas-digitalisation-can-improve/>

importance; solar electricity can bring supply to millions of people; and 4G coverage and deployment of terrestrial fibre optic infrastructure are of increasing relevance (see: *theafricareport*, 28 January 2021/updated 29 January 2021). It is on this basis that the digital entrepreneurship ecosystem will be able to expand in West Africa.

Recent data (see: AU/OECD 2021) for the West Africa region show that the digital entrepreneurship ecosystem can contribute to employment generation of the youth, as already 200,000 people work in a formal way and 800,000 in an informal way in the mobile ecosystem, mostly in distribution and sale of mobile devices. Also, indirect employment creation beside of direct employment creation is of importance. But many challenges are there. First, the strengthening of government support is requested, through technology parks and start-up incubators, and through a more systematic monitoring of progress; second, a strengthening of the regulatory frameworks is needed, as well as supportive measures to expand the adoption of fintech products; third, supporting small and medium enterprises (SMEs) and small producers to use digital technologies is recommended, to strengthen their integration into local, regional and global value chains; and fourth, key policy measures relate to investing in skills development and digital-related technical and vocational education and training (TVET) initiatives for the youth (AU/OECD, 2021, Chapter 7). The cases of enterprises in Senegal, Ghana, and Ivory Coast give evidence what the key challenges are for entrepreneurs and for their staff in terms of employment, innovation, growth, and sustainability. Although the mobile ecosystem has only a share of 3.5% of the regional GDP, the impact of this sector on all other economic and government sectors is huge and accelerates with the progress of digital transformation. As 92% of the jobs in the West Africa region are in the informal sector, the new enterprises need to adapt to this structure of the labour market.

The discussion about digital transformation and entrepreneurship in Africa is intensifying. Recent reports analyse the dynamics of digital start-ups in Africa, but evidence shows that governments can do more. Not more than 10% of the government incentives for business across 32 African countries facilitate investment in Fourth Industrial Revolution (4IR) technology. But also, other handicaps are found in research surveys.⁴ Digital transformation in Africa has to

⁴ See: Tech Start-ups Key to Africa's Digital Transformation but Urgently Need Investment, 20 January 2022; access for download: <https://www.weforum.org/press/2022/01/tech-start-ups-key-to-africa-s-digital-transformation-but-urgently-need-investment/>, and access to the full report from the World Economic Forum, Regional Action Group for Africa, Attracting Investment and Accelerating Fourth Industrial Revolution Adoption in Africa, White Paper, January 2022: https://www3.weforum.org/docs/WEF_Attracting_Investment_and_Accelerating_Fourth_Industrial_Revolution_Adoption_in_Africa_2022.pdf

start with homegrown solutions (Elo Umeh, December 15, 2021, Harvard Business Review).⁵ Enterprises in Africa need to consider that the continent with 1.2 billion people has more than 800 million mobile connections, and that 26% of the people are mobile internet users, so that the available mobile network integrations are the starting point for digital integration. So, for example, mobile numbers are unique identifiers what is important for enterprise solutions. The variety of regulatory and legal requirements, especially for data governance, is another issue for homegrown enterprise solutions. And entrepreneurship development can benefit from initiatives like “Talent for Africa”⁶, meaning that entrepreneurship education and training need to be integrated across Africa and in cooperation with global partners. The contributions to this Unit are near to such views of homegrown African digital solutions, of cooperation across Africa’s entrepreneurship development initiatives, and towards more and better inputs from the governments towards entrepreneurial culture and progress.

2 The Contributions

The *first essay* of this Unit on **New business opportunities in Senegal: Policy measures and actual entrepreneurship models** is authored by **Ulrike Schuerkens**. The essay gives an overview of the role of the Délégation de l’Entrepreneuriat Rapide (DER), an institution to support digital entrepreneurship which is linked to the Senegalese presidency. The DER has started to give credits to digital start-ups and entrepreneurs in 2018, by supporting small entrepreneurs with counselling activities and using governmental links to banks so that these small entrepreneurs begin to be accustomed to bank accounts and services. The DER has put in place a framework for ensuring the implementation of support measures, and for promoting youth and women's entrepreneurship programmes, especially through the development of value chains and the exploitation of the growth potential brought about by ICT technologies. The DER dedicates a share of its credits to economic empowerment, what gives benefits to people who ask for small loans and bank credits. The second part of its funding and counselling activity is allocated to much more structured entrepreneurs; this allows to use funds for the financing of solid business projects, for the creation of business

⁵ See: Elo Umeh, Digital Transformation in Africa Requires Homegrown Solutions, Harvard Business Review, December 15, 2021). Access for download: <https://hbr.org/2021/12/digital-transformation-in-africa-requires-homegrown-solutions>

⁶ See on such education and training initiatives the blog by N. Zefran and M. Handler, Africa Powering Digital Transformation, April 5, 2021: <https://gbsn.org/africa-powering-digital-transformation/>

support systems (e. g., education of basic knowledge in accounting), and for the investment in working capital. In fact, 90% of the DER credits are allocated on a loan basis. In 2020, the DER dedicated 600 million F-CFA to the digital sector, and it wants to allocate more than 1 billion F-CFA in 2021. The DER intends to assist more than 22.000 enterprises to adopt digital solutions, according to P. A. Sarr, the minister in charge of the DER. On top of that, the DER realizes non-funded support through activities such as formalization, coaching, and incubation. However, it is still too early to give critical assessments of the role of the DER, but this is necessary to study the achievements of this government politics-based promotion instrument.

Another part of the essay gives an overview of three enterprises which are working with digital technology: first, an enterprise specialized in IT services, teaching programming, and web design; second, an enterprise that works on the creation of websites; and third, an enterprise which is specialized in online teaching at the secondary level. These three enterprises/entrepreneurs work in a market which is open to young entrepreneurs, a market which is neglected so far by Asian and Western companies. All the three enterprises have internalized a work ethics which is characterized by Western values, such as punctuality, an approach of individual valorisation, and creativity. These elements of the work ethics are needed to continue the path to the success of their enterprises. With their business strategy they bring together what they know about the Senegalese society and about the Senegalese markets and what they have learned in universities on management strategies, knowledge which is linked to global economic management taught in institutions in the Global North but also in Africa. So, the combination and amalgamation of knowledge from various sources matters for these enterprises; the entrepreneurs are using acquired knowledge on the Senegalese conditions and on global management issues. This use of knowledge is the basis for success, although these enterprises lack market power and the ability to grow through large orders and commercial/political/family networks.

The *second essay* is titled **Start Small, Dream Big: Socio-Technical Resources and Digitalization as Drivers of Firm Growth and Agility in Africa** and was written by **Emmanuel Yeboah-Assiamah and Aminu Mamman**. This essay seeks to explore how family businesses begin, grow, and expand into business conglomerates using the life cycle of a business conglomerate in Ghana, a company group which is operating in the beauty and cosmetic industry. Although this business started small, the specific dynamics and the innovative ambitions of the entrepreneur/manager bring out unique pointers and lessons. The essay is underpinned by the following research questions: How do such businesses grow over time? Which non-financial resources are required for business growth and sustainability? A purposive sampling technique was used to target the FC Beauty Group, which is an indigenous business entity in Ghana that has been in operation for over three decades and has since grown from a single business unit into a group

of companies using digitalization to keep the conglomerate together and to stay with modern technologies. The essay adopts the use of narrative enquiries and semi-structured interview techniques to elicit primary data from the entrepreneur/manager and her staff. The essay also makes use of secondary data, an effort which requires that the researcher identifies the information which is relevant to the activities and the trends of the business operations of the FC Beauty Group. The secondary data come from company reports, bulletins, newspaper reports, and from online information being relevant to the company. The findings and the key insights derived from the case study are presented along these themes: The power of the “technical skills” and sound management practice; the Integrated Business Model (IBM); doing the “extra-ordinary tasks” to be able to grow in the market and for thinking “outside the box”; the power of new media, and the role of social and of traditional media; the role of social networking and of human capital acquisition; the forms of branding and the role of strategic partnerships. The essay concludes that socio-technical skills remain the centrepiece of successful business management, business growth, and sustainability.

This essay shows how management approaches are learned and acquired in globalized institutions and how these approaches, coupled with digitization, could spark up business success in Ghana for those entrepreneurs who are ready to combine local factors with international knowledge. The use of social media, to bring the brand Forever Clair to the market has been a success story. Social media are in contact with customers so that customer queries can be raised on the platforms of the group and can contribute to assure business growth and innovation. In fact, these interactive tools optimize marketing activities and give access to the products of the enterprise. This essay is useful as it shows how growth and sustainability can be enhanced by digitization. The role of the entrepreneur is re-evaluated; digital transformation plays a leading role for entrepreneurship development and business success.

The objective of the *third essay* is titled **Analysis of the development of ICT in Senegal: The example of CYGMATECH**, and the authors are **Seydi Ababacar DIENG, Seydou BOCOUM, and El Hadji Malick POUYE**. The purpose of the essay is to analyse the development of digital entrepreneurship in Senegal as based on the interpretation of the scores of the ICT Development Index (IDI) for Senegal, and by focusing on CYGMATECH, a reference Senegalese start-up enterprise. The introduction and diffusion of ICTs, like any innovation, has the potential to promote an improvement in the performance of companies using them. However, the success of innovations differs from country to country, from region to region, and from company to company. Therefore, difficulties remain regarding the explanation of the rise of ICT performance in Senegal. To highlight the elements being responsible for the success of the start-up has required the use of a methodological approach which is based on research interviews with

the manager and with the companies which are benefiting from CYGMATECH services.

In the digital age, start-ups are multiplying in number, and they compete in ingenuity to offer tailor-made solutions to companies. Within this framework, CYGMATECH, a start-up dedicated to the production of latest generation software, intervenes to contribute to the popularization of ICTs in Senegal and in the sub-region. The products of CYGMATECH are first, ERP software packages (Enterprise-Resource-Planning/Integrated Management Software Packages) for the logistics of large companies; E-LEARNING platforms (for online education); CRM (Customer Relationship Management) solutions (to enable companies to manage customer relations); ALS (Automatic Loan Solution) packages (to allow people to get a bank loan quickly); DI (Digital Insurance) packages (as the insurance sector must adapt to the new behaviours of its customers who have perfectly integrated digitalization tools into their daily consumption patterns).

In recent years, new digital technologies and the Internet have provided companies in all sectors with the right tools to improve customer relations by developing personalization and by providing a higher efficiency level of services. CYGMATECH has the experience and the ability to design and to build ICT tools for organizations, such as for NGOs, governmental institutions, and research institutes; it is now a start-up in its consolidation phase. It is dedicated to the production of latest generation software; it intervenes in the markets to contribute to the popularization of ICTs in Senegal and in the sub-region, to suit the needs and specifications of enterprises, while paying particular attention to those critical elements that make an ICT project succeeding and sustaining.

The *fourth essay* with the title **From Informal to Digital: Lessons from two Case Studies in the Ivory Coast** is authored by **Abdul-Aziz DEMBELE**. The author proposes a comparative study of two technological innovation projects in the Ivory Coast. The first project is in agriculture and aimed at alleviating the problem of coordination between the actors of the rice sector. It led to the implementation of a seed information system (SIS) under the leadership of the FAO in collaboration with the Ivorian public authorities. The second project refers to an enterprise which is active in the environment sector and is aimed at solving the problem of the unhealthy accumulation of plastic waste. It has led to the implementation of an information system for collecting and recycling by "Coliba", an Ivorian start-up company. While the first project was abandoned in its pilot phase, the second project appears to be a "success story" of digital entrepreneurship. Based on an analysis of documents and interviews, this essay aims to analyse the relationships between the actors and the stakeholders of these technological innovations. The author argues that both projects intervened in sectors which are traditionally dominated by informal actors with whom the

project leaders had to negotiate and to find solutions. They had either to transform these informal frameworks or to adapt them.

The causes of failure and success of these two cases are demonstrated. Both projects took place in environments that are characterized by informal practices. The case of the seed information system (SIS) aimed at confronting and adapting the social world to the technical logic rather than accepting the knowledge of the topics by the population groups that are in the focus of the project. The second project was conceived and implemented with a series of local adaptations, by accepting and by using the knowledge and the capabilities of the informal waste workers. The start-up which was working in such a manner thereby operated far away from a globalized digital start-up, as the informal workers were optimally integrated in the waste management value chain and as the digitization process was used by including local adaptations. The seed information system (SIS) project failure was linked to an unjustified digital optimism which was far away from the local African agricultural production conditions. Thus, “glocalization” efforts are important for digital entrepreneurs in Africa that can assure so their success in operations and the growth of their enterprise.

3 The Strategy

As we can see in this Unit, digital entrepreneurship is shaping economies in African cities where the enterprises find conditions that correspond to their local projects, to their financial and logistical base, and to the capabilities of their staff. The digital specializations and solutions of the start-ups and enterprises which are presented in this Unit are of such a nature that they permit digital entrepreneurs to create products and facilities that are needed by small customers, by local producers and consumers, even by informal sector actors. The products and services supplied are sometimes even useful for enterprises, customers and consumers being outside of the local base of those digital enterprises which are considered in these four essays. This entrepreneurial knowledge is mostly locally specific and is based on rather new entrepreneurial experiences that are linked to local places. But there are cases where customers being outside of the local sphere can benefit from these products and services. The infrastructure that has been built recently, such as incubators, hubs, tech parks, etc. is important for these entrepreneurial activities, but the entrepreneurial spirit, motivation, knowledge, and ambition matters most for success. The infrastructure must be used collectively and should be expanded to other regions and to rural areas beyond the urban centres, even if for the time being other resources such as knowledge, entrepreneurial spirit, and a stimulating local environment may be absent from rural regions (see on this point: Friederici 2020).

The case studies show small growth effects related to the digital enterprises which are limited to urban centres; it is obvious that they can hardly be replicated in other sub-national regions. Specializations are needed to grow in a sustainable way, but they are limited to few digital entrepreneurs who are successful. The marketing efforts which are shown by the case studies are of relevance in West Africa, and they have contributed to the success of these enterprises. These digital entrepreneurs learn with the evolution of their enterprises, and they shape its history based on management rules which they know from their university studies abroad in Europe, America, or in Africa. Their local adaptations are decisive for the success of their enterprises. One can say that clear management rules plus effective local adaptation matter for successes.

Investors in the region should trust these entrepreneurs as they know the local markets better than the “outsiders” (see: Friederici, 2020). Local governments should improve the enabling environment and should, when possible, continue to accompany the processes of formalizing these enterprises to get out from the informal status. Financial support on a credit basis for formalized enterprises may be an asset for these enterprises; such enterprises are not numerous in West Africa, and therefore the allocation of financial resources must be done carefully. Evaluation of these follow-up measures is important as we do not know enough on the success of some enterprises and the failure of others.

Successful strategies will be those that combine international management and technological knowledge on the one side and local knowledge about markets and capabilities which are adapted to West African economies. These processes are studied in the ManaGlobal project that is coordinated in several African and European countries at the University of Rennes 2. ManaGlobal stands for “globalised governance norms and local management and business practices in Africa and on the Arab peninsula”. It is a research project that has received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 823744 (2019-2024). The comparative focus on enterprises in various countries makes it so important for informing national policymakers and for transforming digital entrepreneurship ecosystems.

ManaGlobal is an innovative and empirical research project that explores the different types of local management approaches in selected African and Arab countries; it analyses the gap between applying globalized norms and standards of management and practising business with all stakeholders locally. The basic idea of the project is very important for national economic reforms and for reforming the entrepreneurial ecosystems in African countries. The project investigates how local practices, that are too often described as of “poor governance and bad management”, can be transformed into economic opportunities by the development of hybrid and innovative management approaches. This transformation process should be promoted through fieldwork research and staff

exchanges, in addition to summer/winter schools, workshops and conferences that facilitate the knowledge sharing process between the partners, policymakers, and stakeholders. This ambitious project is being realized by a collaborative consortium of 16 African, Arab, and European partners, with inputs from eight countries, and involving researchers, business leaders, and institutional decision-makers.

The main aim of the ManaGlobal project is to study and to understand the hybridization of business and management practices in African and Arab countries, and to develop a theoretical framework that may help future business leaders and managers to successfully act locally while thinking globally. This project is important because it will provide a clearer diagnosis and a better understanding of the practice of business and management in African and Arab countries. All that would contribute to the improvement of local economies, the development of better transnational investments between European, African, and Arab companies, the creation of more employment opportunities, and the reduction of migration to the European continent.

The project is of great policy relevance for entrepreneurial ecosystems, and the overall objectives of the ManaGlobal project are:

1) To conduct collaborative empirical research involving experienced and early career researchers from all the partner countries and institutions.

2) To exchange knowledge and skills on conducting cross-cultural research and to build research capacity through research placements, workshops, seminars, conferences, and fieldwork.

3) To produce case studies based on concrete management experiences in "real life" situations through ethnographic study and the profiling of education, training, and business backgrounds of African/Arab successful company managers.

4) To develop a research-based theoretical framework for the understanding of business and management practices in African/Arab companies; and

5) To make recommendations to policy makers and decision-makers and to design training programmes on "business and management of organizations" in African and Arab countries to involve for future careers local and international leaders and managers.

This Unit focuses on case studies in the digital sector as we saw an accelerated change in the region as an impact of COVID-19. It was stated in this context (World Bank Group, 2020)⁷ that during the lockdowns, 25% of the firms in sub-Saharan Africa have accelerated the use of digital technologies and have increased investment into digital solutions to respond to COVID-19. This trend is confirmed

⁷ The Africa's Pulse, N° 22, October 2020; access for download: <https://openknowledge.worldbank.org/bitstream/handle/10986/34587/9781464816482.pdf?sequence=41&isAllowed=y>

by various other reports (see: ITU, 2021, *Digital trends in Africa 2021*: page 33).⁸ The pandemic has shown how important digital solutions are and how they can help to build a better future. As digital solutions are relevant beyond the health sector in all other spheres of society and economy, the digital entrepreneurship ecosystems are of increasing importance in the research community of the ManaGlobal project. The ILO together with the ITU and the African Union have launched a programme to improve skills for youth in Africa's digital economy. Senegal and Ivory Coast already benefit from this programme (see ITU-ILO-AU, 2020). For the research community of the ManaGlobal project the focus on employment creation for the youth through acquiring skills for the digital entrepreneurship ecosystems is of prime relevance.

Digital entrepreneurship in Africa does not replicate the Silicon Valley experiences. The demonstrated efforts as shown in the case studies are limited to local African spaces, and for the time being they do not show an economic development push and a large impact across the continent. Positive changes can be found, such as new jobs, new services, and the creation of new life-worlds, but we cannot speak of a visible trend of structural transformation through the evolving digital enterprises. But, the digitalization of the economy creates, with the help of digital tools, new socio-economic networks that are managed by entrepreneurs who have the necessary resources and capabilities.

It is important that these local efforts are reinvested in the local economic scene so that digital entrepreneurs will have growing success in changing societies and economies across the region and the continent. In this sense, these social actors may participate in Africa's twenty-first century voyage towards a socioeconomic empowerment of the continent (see: Friederici, 2020). This Unit of the African Development Perspectives Yearbook thus displays concrete business case studies in West Africa and for the digital sector of these economies. Doing this, this Unit develops our knowledge of businesses in the digital sector that contribute to African growth and employment strategies; technological accumulation and sustainable innovation are emerging throughout the value chains which are considered in the case studies. The links shown between global and local elements of the economic processes develop new knowledge in line with the ManaGlobal project.

⁸ See: ITU, 2021, *Digital trends in Africa 2021*; access for download: https://www.eib.org/attachments/country/africa_s_digital_solutions_to_tackle_covid_19_en.pdf

References

- AUC/OECD (2021), *Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs*, AUC, Addis Ababa/OECD Publishing, Paris, <https://doi.org/10.1787/0a5c9314-en>, and: Access for direct download: https://au.int/sites/default/files/documents/40545-doc-AfricaDD_2020_EN_web.pdf
- Deichmann, U., Goyal, A., and Mishra, D. (2016), *Will Digital Technologies Transform Agriculture in Developing Countries?* Washington, D. C.: The World Bank. Policy Research Working Paper 7669. Access for Download: <https://openknowledge.worldbank.org/bitstream/handle/10986/24507/Will0digital0t0veloping0countries00.pdf?sequence=1&isAllowed=y>
- Friederici, N., Wahome, M., and Graham, M. (2020) *Digital Entrepreneurship in Africa: How a Continent Is Escaping Silicon Valley's Long Shadow*. Cambridge: Massachusetts Institute of Technology Press. Information: <https://mitpress.mit.edu/books/digital-entrepreneurship-africa>
- Hopkins, C. (2015, October 5), "How Africa Grew More than 200 Local Tech Scenes", *The Daily Dot* (blog). Retrieved from: <http://www.dailydot.com/debug/africa-tech-hubs-hacker-spaces-incubators/>.
- ITU-ILO-AU (2020). Programme on Boosting decent jobs and enhancing skills for youth in Africa's digital economy; access for download: <https://www.itu.int/en/ITU-D/Regional-Presence/Africa/Pages/projects/2020/jobs-skills.aspx>, and as a brochure: https://www.ilo.org/wcmsp5/groups/public/---africa/---ro-abidjan/documents/genericdocument/wcms_758665.pdf
- International Telecommunication Union/ITU (2021), *Digital trends in Africa 2021*. ITU Publication. Access for download: https://www.itu.int/hub/publication/d-ind-dig_trends_afr-01-2021/, and: <https://www.itu.int/en/myitu/Publications/2021/03/29/08/47/Digital-Trends-in-Africa-2021>
- Kamdem, E. (2004) *Management et interculturalité en Afrique, expérience camerounaise*. Paris: L'Harmattan. L'Information: https://www.editions-harmattan.fr/livre-management_et_interculturalite_en_afrique_experience_camerounaise_emmanuel_kamdem-9782747523912-1240.html
- Madichie, N. O., Bolat, E. and Taura, N. (2021), "Digital transformation in West Africa: a two country, two-sector analysis", in: *Journal of Enterprising Communities: People and Places in the Global Economy*, Vol. 15, No. 2, pp. 246-257. Access for download: <https://www.emerald.com/insight/content/doi/10.1108/JEC-06-2020-0114/full/html>
- Manyika, J., Cabral, A., Moodley, A., Moraje, S., Yeboah-Amankwah, S., Chui, M. et al. (2013), *Lions Go Digital: The Internet's Transformative Potential in Africa*. McKinsey Global Institute, McKinsey & Company. Retrieved from: <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/lions-go-digital-the-internets-transformative-potential-in-africa>
- Schuerkens, U., M. Branine and A. Mamman (eds.) (2019), *Pour une sociologie du management en Afrique et dans le monde arabe*. Paris: L'Harmattan. L'Information: https://www.editions-harmattan.fr/livre-pour_une_sociologie_du_management_en_afrique_et_dans_le_monde_arabe_ulrike

- _schuerkens_mohamed_branine_aminu_mamman-9782343184555-64629.html
- Umeh, Elo, Digital Transformation in Africa Requires Homegrown Solutions, Harvard Business Review, December 15, 2021). Access for download: <https://hbr.org/2021/12/digital-transformation-in-africa-requires-homegrown-solutions>
- van der Merwe, J. (2016), “Theorising emerging powers in Africa within the western-led system of accumulation”, in: van der Merwe, J., Taylor, I. and Arkhangelskaya, A. (eds), *Emerging Powers in Africa*, pp. 17-38. International Political Economy Series. Cham: Palgrave Macmillan.
- World Bank Group (2020). The Africa’s Pulse, N° 22, October 2020; access for download: <https://openknowledge.worldbank.org/bitstream/handle/10986/34587/9781464816482.pdf?sequence=41&isAllowed=y>
- World Economic Forum, Regional Action Group for Africa, Attracting Investment and Accelerating Fourth Industrial Revolution Adoption in Africa, White Paper, January 2022: https://www3.weforum.org/docs/WEF_Attracting_Investment_and_Accelerating_Fourth_Industrial_Revolution_Adoption_in_Africa_2022.pdf
- Zefran, N. and M. Handler, Africa Powering Digital Transformation, April 5, 2021, Global Business School Network (GBSN): <https://gbsn.org/africa-powering-digital-transformation/>

New business opportunities in Senegal: Policy measures and actual entrepreneurship models¹

Ulrike Schuerkens²

1 Introduction

The improved and globalized connectivity has led to an expectation of significant development potentials for the African continent. Digitization in entrepreneurship has begun to be seen as an important driver of structural economic development (Friederici, 2019). The creativity of skilled individuals in the production and distribution of digital software and applications has led to a boom in digital entrepreneurship. Digital technologies need browsers, network sites, and software developments for the use of enterprises and individuals (Hopkins 2015). From a few African success stories of digital businesses at the beginning of 2000, numerous technology start-ups have recently been created. Policymakers and development organizations soon began to consider national digital enterprises and economies from digitization as an important source of economic development (Manyika et al., 2013). Rigorous research in this field is rather scarce in Africa and the question about the importance of digital entrepreneurship for economic development must be studied carefully (Schuerkens et al., 2019). Where and how entrepreneurial opportunities rise, just this is an idea that the study wants to deepen. Digital entrepreneurship is considered in recent publications as global in nature (Nambisan, 2017). It has been claimed that “Africa is about to be transformed and revolutionized by digital technologies and entrepreneurship.” (Friederici 2019: page 11) We therefore try to determine which entrepreneurial opportunities and practices have become possible through looking at three case studies for Senegal, and investigating which actors are involved in the process of digitalization and to see what they are doing. Moreover, we give an overview of

¹ The information used in this article was collected during missions conducted as part of the ManaGlobal programme, which has been supported by the European Union's Horizon 2020 Framework Programme through the Marie-Sklodowska Curie grant agreement 82374.

² Oumar Bâ has participated in the writing of the part of the article dedicated to the venture ClicMagic (one of the case studies). The author is thankful to the suggestions from the two anonymous referees and to the valuable comments from the Chief Editor of the African Development Perspectives Yearbook, Professor Karl Wohlmuth.

one of the organizations that support digital entrepreneurship in Senegal, the *Délégation de l'Entrepreneuriat Rapide* (DER). This is done because DER has been created by the Senegalese president and is one of the leading institutions to give financial and professional support to enterprises of young men and women. Thus, it is possible to appreciate the actual policy measures and their possible impacts on the IT sector in the coming years that will permit to young people to realize new ways of doing business.

We will give in the following six sections after the Introduction (in this section 1) information on the ManaGlobal RISE project³ and its theoretical approach (section 2) that has influenced the case studies. In section 3 follows an analysis of business and management practices in Africa. Section 4 formulates the methodological approach for the case studies. In section 5 (5.1 to 5.4) the case studies of the *Délégation Générale de l'Entrepreneuriat Rapide* and of the three enterprises which operate in the digital sector of Senegal (Volkeno, ClicMagic, and DIGICLEVER) are presented. Some remarks on the employment generation potential of new digital enterprises follow in section 6. In the last section 7, concluding remarks on the presented case studies are made and some policy recommendations for policymakers and researchers are suggested.

2 The ManaGlobal project and its theoretical framework

This study is based on research conducted through the ManaGlobal project⁴, which is an innovative research project that seeks to explore the type of management approaches practiced in selected African and Arab countries. ManaGlobal goes beyond literature reviews and critical academic debates to investigate the realities on the ground through collaborative, exploratory, and ethnographic research that will lead to a clearer diagnosis and a better understanding of business and management practices in African and Arab countries. As Africa and the Arab world are important regions for the European Union (EU), we consider that a project whose results will contribute to the improvement of the economic situation of these regions, could, last, but not least, present a blueprint for policies to reduce transnational migration to the European continent, which is a crucial scientific and political challenge.

There is a need to understand local and international business management in Africa because:

(i) there is an apparent gap in the literature on management and leadership in African and Arab countries, as most recent studies are limited in scope, and because their theoretical and methodological approaches are weak (Mellahi and

³ See on the project: <https://managlobal.hypotheses.org/1260>

⁴ See Schuerkens et al. (2019), and the website: <https://managlobal.hypotheses.org/>

Budhwar, 2010; Nkomo, 2011; Zoogah and Beugre, 2012; Mamman et al. 2015); yet, there are only few concrete business studies available which analyse the hybrid situations created by the intertwining of local and global business concepts in African cultural environments.

(ii) policymakers in general and managers in public and private sector organizations have faced increasing challenges in balancing the demands of globalizing corporate power with the demands of localizing cultural awareness and policy relevance of Senegalese socioeconomic situations.

(iii) the complexity of economic, social, and political change has very often resulted in contradictory and problematic outcomes, especially when development opportunities, in terms of labour and raw materials, are available but not properly utilized (D'Iribarne, 2003, D'Iribarne, 2009; Michalopoulos and Papaioannou, 2015).

The consequence of this lack of understanding of management practices is a simple focus on the symptoms of problems and not on the roots of the problems found in glocalization processes. The concept of glocalization can be explained by mixtures of local traditions and global approaches to management and governance. In fact, local traditions react to elements imported by globalization processes. These traditions may adapt, resist, or create hybrid or glocal responses that form new mixtures, or an interweaving of local origins and global elements introduced from outside to the given context. Often the origin of these global elements is the Western world and thus the Western discourse of management (Schuerkens, ed., 2014; Schuerkens eds., 2019). The results of this intertwining of processes are often linked to the development discourse of the regions that need to be analysed.

By studying Senegal, we aim to better understand a complex process of hybridization between (i) globalized norms of governance, mainly inspired by North American and European discourses, and (ii) local norms in the conduct of business that are the product of local customs and sometimes of political regimes. These factors are often neglected because they are specific but they profoundly modify the practice of business management and make the impact of management precepts which are taught in business schools unpredictable, as they are applied outside the legal framework of the economic and social context in which they were conceived. Our hypothesis from the state of the literature and our exploratory research is that hybridization processes take specific local forms, and that these forms can be distinguished for different generations of leaders in the South; in particular, this is applicable for the generation that is now forty to fifty years old and has recently experienced its first successes. In fact, there is a duality of global norms and requirements, originating from the global centres of financial capitalism and from the local ways of doing business and managing organizations. This duality introduces a great diversity - insufficiently studied - in the ways how companies are controlled and managed but leads also to a gap between what is officially declared and what happens in practice in the companies.

We understand that globalization cannot be reduced to a simple model of management convergence and to a unified form of corporate governance. Investment from traditional suppliers of capital and from post-colonialist countries (mainly European) is no longer the norm as many African countries continue to attract increasing volumes of investment from China, South Korea, and even emerging countries such as India, Iran, and Turkey (Alden and Alves, 2016). Beneath the process of legal, financial, and accounting homogenization, beneath transnational doctrines, regulations, standards, and business techniques, lies a plethora of different ways to run a business and to ensure its economic success. Moreover, recent successes of local African businesses, particularly in the food distribution and procurement sector, have outperformed their European and American competitors (Patterson and Winston, 2016; Ward, 2016). Therefore, this research is based on the understanding that, due to globalization, African countries are attracting investments and with them management practices from non-European countries, and that they are developing their own business practices despite still limited success. African countries are experiencing significant changes in their strategic alliances, especially with the growing presence of Chinese and other non-European investors in the region. Of course, these shifting economic and political allegiances pose a challenge to future European investors, and that is why this research is crucial for Europe at this time, as it will help to strengthen future collaborations between and among European and African companies and between academic institutions of the two continents before it is too late to recognise the new realities.

In this context, our main objective is to study and to understand the hybridization of business and management practices in African countries, and to develop a theoretical framework that could help future business leaders and managers to act locally and to think globally.

To achieve this main objective, several specific objectives (SO) were identified:

- SO1: Assess actual business practices and compare them with theoretical and "economic leader" visions to understand the causes of performance failures and successes.

- SO2: Examine the education, training, and business background of successful African business leaders against their actual "real life" management experience.

Through this research, our goal is it to move beyond the debate about convergence and divergence (Boyer, 1996; Gomez and Korine, 2009) of management and business practices between developed and developing countries and to consider the emergence of a hybridization of best sustainable management policies and practices (Caby, 2003; Schuerkens, ed., 2014; Yousfi, 2014) that are globally and locally applicable.

3 Business and Management Practices in Africa

Current business and management practices in Africa are characterized by administrative processes that are stifled by unnecessary bureaucracy, centralization, politicization, and corruption (Achtenhagen and Brundin, eds., 2016). Much of the bureaucracy reflects the management style of former colonial administrations. The politicization of management is explained by the close connection to governments and their use of control mechanisms. Family-inspired management, the so-called "Ubuntu management", reflects the significant cultural influence of African traditions on management practices (Branine, 2011; Kamoche, Siebers, Mamman, and Newenham-Kahindi, 2015). Ubuntu management emphasizes the importance of family and ethnic groups, and the respect for age and seniority. It is reinforced by the fact that many managers lack management training or expertise because they are politically appointed or familiarly chosen to perform tasks that they are not prepared or able to perform. The leaders of many business enterprises are never challenged and are respectfully obeyed without any questions asked about their decisions. Employees are dependent on their managers, and so they have no authority to do anything without their approval. Detailed instructions given by managers inform employees what to do even if they have done the job several times before (Ellis, Nyuur and Debrah, 2015; Jackson, 2013). However, on the positive side, African managers also attend to the material and personal needs of their employees as if they were family members (Branine, 2011; Kamoche et al., 2015). This attitude is explained by social values, such as belief in seniority, social class, and social divisions in status, which bring together accepted forms of authoritarian management and privileged paternalistic relationships between managers and their subordinates. It seems from the above that there is a consensus that describes management in Africa, at least on the surface, as more "people-centred" and "less rational" than the familiar Western management systems.

Therefore, it can be argued that the implementation of Western management policies and practices in Africa is confronted with strong cultural traditions that must be understood. Indeed, local family businesses often tend to imitate Western management models in the belief that they are "modern". These two types of organizations can be seen as competing, but they reveal strong arguments for hybridization through knowledge exchange, cross-investment, partnership, and strategic alliances.

4 Methodological Approach

To achieve these objectives, we need to profile and to learn from the careers of entrepreneurs and managers in the Senegalese case and to link them to national socio-economic characteristics.

The start was the conduct of in-depth surveys to profile the careers of entrepreneurs and managers of industrial and commercial enterprises in Senegal. To fully understand how business is done and how managers run their organizations in Africa, we interviewed them (generating qualitative data) and we used relevant documentary data (reports, biographies, Internet, etc.) to produce biographies of selected entrepreneurs, being owners of local businesses operating in Senegal.

And ManaGlobal's goal is it to study the educational background and the professional experience of local business leaders and managers - often (but not always) trained in higher education institutions and companies in Western countries. We believe that career profiling will help us to better understand the socio-economic, cultural, educational, historical, familial, and political factors that influence the way business and management are practiced in African countries. Methodologically, we also believe that this profiling process will help us to collect more data to produce case studies of selected companies.

The choice of enterprises for case studies is of crucial importance, especially in times of digital transformation. Beside of the start-ups and enterprises, the governmental support machinery is of relevance as it is the base of political connectivity to the private sector. Therefore, the interaction of political support and entrepreneurial action is of great interest, as the growth prospects of the entrepreneurial sector are thereby analysed. The next section studies the public support institution (DER) and the three case studies of new digital enterprises (Volkeno, ClicMagic, and DIGICLEVER). The competitive position of these enterprises is of great interest, as it determines their long-term growth potential.

5 Political Support of Digital Entrepreneurship and Case Studies of Enterprises

5.1 The Role of a Senegalese Public Support Institution for Entrepreneurship: Délégation de l'Entreprenariat Rapide (DER)

Interviews with staff of the Délégation de l'Entreprenariat Rapide (DER) took place to get first-hand information on this organization.⁵ Digital entrepreneurship

⁵ An appointment was made on July 4, 2019, at the DER and with Mr. P. A. Sarr; we had exchanged views on our respective projects. In addition, an intervention on the radio

is supported by political actors often reunited around incubators and innovation hubs (Deichmann and Mishra 2016). The DER in Senegal is such a political and economic project linked to the Senegalese presidency and chaired by the General Delegate for Entrepreneurship Papa Amadou Sarr. These institutions, such as the DER in Senegal, are seen as “enablers of digital entrepreneurship, functioning as powerful connectors of entrepreneurs and an array of partners (such as investors, mentors, governments, etc.)” (Friederici 2019: 13). These hubs were created with the target to assist young individuals to express their creativity and ambition and to allow them to create wealth and to address the needs of their surroundings (Hopkins 2015). In this study, we will present the DER by including empirical research on the efficacy and usefulness of this institution in the interaction with digital entrepreneurs; this will be done via one case study. As each country has its own economic context, this presentation is particular to the Senegalese ecosystem and not necessarily representative for the wider African context.

Hubs provide services (events, desk rental, and training) and spaces of social location points with an entrepreneurial purpose (Sambuli and Whitt 2017). The actions of hubs are understood as directed towards entrepreneurs. Interactions with other entrepreneurs are possible and useful, mainly for starting entrepreneurs that need support actions more often than already established entrepreneurs. As such, the DER depends on the active participation of digital entrepreneurs and requires the socioeconomic fit with their local environment. It is important to make available to project leaders not only educational and training measures, but also credits for young entrepreneurs, what the DER does in Senegal, the FAFCI (Fonds D’Appui Au Femmes Du Cote D’Ivoire)⁶ in the Ivory Coast, and the UNDP women empowerment programme in Cameroon⁷. These organisations provide support for women and men to qualify for entrepreneurship (Chigunta 2016). Often large parts of these groups are excluded from formal financial circuits due to the lack of a bank guaranty and even of a bank account. The DER has started to give credits in 2018 and to support small entrepreneurs with counselling activities; it has links to banks so that these small entrepreneurs begin to be accustomed to bank accounts and to bank services.

The DER dedicates parts of its credits to economic empowerment; DER brings together people who ask for small loans and banks but also microfinance

ETECH of the Delegate General on January 3, 2021, provided further information being of relevance for this part of the article:

<https://www.youtube.com/watch?v=8WIIUMjJCqA>. A further meeting with the DER was organized on July 30, 2021.

⁶ See more on FAFCI (Fonds D’Appui Au Femmes Du Cote D’Ivoire):

<https://dominiqueouattara.ci/en/to-support-ivory-coast-women/>

⁷ See on Cameroon: Promoting Entrepreneurship:

<https://allafrica.com/stories/202102050275.html>

institutions as sources for funds. The second part of its activity is related to much more structured entrepreneurs and allows for the financing on a credit basis of solid business projects, the creation of business support (e. g., education of basic knowledge in accounting), and the investment in working capital. Not less than 90% of the DER credits were on a loan basis in 2020; the rest was destined to support selected activities of start-ups. Around 17 billion F-CFA helped in financing 76,000 direct beneficiaries so that 65,000 bank accounts could be opened in 2018/19. The second window concerns the creation and the support of enterprises financed with up to 7 billion F-CFA such as start-ups that have been considered as potentially contributing to the socioeconomic development of the country. On top of that, the DER realizes non-funded support through activities such as formalization, coaching, and incubation. The institution has in-house experts who take care of these offers in partnership with other players in the Senegalese ecosystem to assure an efficient approach of their services. The goal is to help take off these fledgling start-ups and to encourage investment funds to take over and to invest in this sector. The DER places itself at the start of the business to help move the entrepreneur beyond the difficult preparation phase of start-ups. Around 2,000,000 US dollars have been invested in one year in the financing of 45 start-ups, operating in various activities (agriculture, digitalization, education, logistics, etc.).⁸ In Senegal, there exist further support organizations since 2012, such as the *Agence de développement et d'encadrement des petites et moyennes entreprises* (ADEPME/ADEPM), which is a support structure for small and medium-sized enterprises, and the *Agence nationale pour la promotion de l'emploi des jeunes* (ANPEJ), which is responsible for promoting youth employment. The links among and the functioning of these institutions are currently studied in our research programme.

The DER has received funding for the hub from the Emir of Abu Dhabi to the tune of 20 million Euros, as well as funds from the African Development Bank (AfDB). The organization deals with start-ups, SMEs, and incubators. For the year 2021, 57 billion F-CFA (87 million euros) were used to finance some 100,000 projects, often small projects from women, but also start-ups that receive several ten thousand of euros on a credit or share basis. Thanks to the French Development Agency/Agence Française de Développement (AFD) and the African Development Bank, 74 billion F-CFA (112 million euros) could be added in 2020. These sums make it probably possible to have an impact on young people and women in Senegal throughout the country. Around 1,100 million F-CFA (1.67 million euros) have been devoted to digital technology in Senegal; incubators give assistance and remote technical support. One of the key sectors is digital health, which will make it possible to set up health posts in all regions and departments

⁸ For this point the interview with P. A. Sarr Senegalese Minister in charge of the DER, was revealing.

to reduce the gap between well-equipped urban centres and the neglected hinterland. According to P. A. Sarr, Senegalese Minister in charge of the DER: "IT, digital and young start-ups can be useful in this fight."

The overall objective of the DER Project for the Support and Valorisation of Entrepreneurial Initiatives of Women and Youth/ *Projet d'Appui et de Valorisation des Initiatives Entrepreneuriales des femmes et des jeunes*⁹, Phase I (PAVIE I), intends to support the creation of jobs for youth and women through the promotion of entrepreneurship as Senegalese actors end up in self-employment if they have difficulties to find a job in the formal sector. Specifically, this project will contribute to the development of entrepreneurial initiatives of women and young people by i) access to financing their projects and by ii) technical support for entrepreneurs in both, in business lines and in business management, with a view to ensuring the viability and sustainability of their businesses. Its total cost is financed by an *Agence française du développement* (AFD) loan, comprising an African Development Bank (AfDB) loan of 48.8 million Euros, 20 million Euros in co-financing from the AFD, and the government's counterpart funds of 21 billion F-CFA. The three-year project, being ongoing until 2023, was designed on a demand-driven approach and is implemented in coordination with the private sector, particularly banks and microfinance institutions, to finance entrepreneurial initiatives of women and youth throughout Senegal, while providing technical and educational support in terms of business and business management. Ultimately, the project will enable to: (i) finance more than 14,000 entrepreneurial initiatives with a finance volume of about 61 billion F-CFA; (ii) generate or consolidate about 65,000 direct jobs and 89,000 indirect jobs, or a total of 154,000 jobs, 60% of which are for women; (iii) train more than 27,000 entrepreneurs, including more than 15,000 women, or 55%; (iv) support the digital transformation of 22,000 companies, and formalize 3,500 others (50% of which are headed by women). According to the statement by P. A. Sarr in July 2021 (on LinkedIn) "To date, more than 110,000 projects have been supported and accompanied for more than €100 Million in less than three years." Indeed, the project is ambitious, and waits for a deep evaluation process.

The project will set up a monitoring and supervision system for the supported initiatives to avoid a detour of objectives, as well as an investment monitoring

⁹ See on the empowerment programme PAVIE: <https://www.der.sn/en/node/5>; and the statement by the African Development Bank/BAD about PAVIE: <https://www.financialafrik.com/2022/01/27/senegal-la-bad-salue-les-resultats-du-pavie-initie-par-la-der/>

system.¹⁰ The State acts as a bank to be able to finance online applications. Other institutions, such as the ADEPME, oversee the educational support in the form of courses in management and accounting when necessary. This has led to the fact that countries such as Guinea-Bissau and Guinea-Conakry, but also Burkina Faso, have requested the DER to support their digital development programme. According to P. A. Sarr: "For us, it is a mission to help women and young people in this country to find an activity, to earn a dignified living. We help them to become autonomous through the digitalization of payments. The DER is the future of young people of this country... There is something to live for in this country." It may be of interest to see how neighbouring African countries can benefit from this state-led organization.

The DER has an innovation cluster to support start-ups by subsidizing their financing. The financial empowerment will enable the allocation of loans of up to more than one million F-CFA (equivalent to a sum of 1,518 Euros): "This approach will enable women to have credit, micro-credit with the use of the digital to go further," according to P. A. Sarr. This funding is given to the entire territory of the country, with local initiatives in urban centres, local administrative units, and even rural communities that may receive a funding from 100 Euros to 1000 Euros. The total current annual funding is of the volume of 30 billion F-CFA. The interest rate is with 5% lower than bank lending rates are (9 to 11%). During the first year of activities in 2018/19, the focus was on the digital economy, on technologies of innovation, and on the integration of women into the digital economy¹¹.

In the DER's current premises, there are a latest-generation Fab Lab, 3D-printers, robots, and drones. Co-operations are underway with the Institut Africain du Management (IAM) Business School¹², the Gaston Berger University of Saint-Louis¹³, and the Virtual University of Senegal¹⁴. These institutions should enable the creation of "future champions of start-ups", according to P. A. Sarr. The current head office of the DER has rooms for information, training, formalizing the company, analysing it, and dealing with issues such as customs, taxes, etc. A critical study of the accompanying measures of the DER is ongoing. So far, the DER is a political actor that is sometimes contested as it distributes money, a

¹⁰ See on the source about the supervision and monitoring system:

https://www.afdb.org/sites/default/files/documents/projects-and-operations/senegal_-_projet_dappui_et_de_valorisation_des_initiatives_entrepreneuriales_des_femmes_et_des_jeunes_phase_i_pavie_i_-_rapport_devaluation.pdf

¹¹ Interview with P. A. Sarr.

¹² See on the IAM Group: <https://www.groupeiam.com/>

¹³ See on the university: <https://www.ugb.sn/>

¹⁴ See about the Virtual University: <https://www.senegel.org/en/people-society/universities-and-training-schools/unidetails/9>

process that is rather complex but not openly displayed. Critical studies have not yet been publicized as the institution is a rather recent one.

This overview of the DER is completed in the following section by a presentation of a success story of a local enterprise that has received funding from the DER, of more than 30,000 Euros on a credit basis.

5.2 Case Study Volkeno: A Senegalese start-up in the IT sector, which was supported financially by the DER

Volkeno is a Digital Company and a Start-up Studio based in Dakar.¹⁵ Created in 2015 by a Senegalese having studied informatics in France at the Technological University Compiègne¹⁶; he has graduated as an engineer. His parents were both specialists of informatics so that they could support financially and intellectually his studies that were also supported by a student's grant. Volkeno was created with the assistance of Abdou K. Diallo's parents and three associated partners. Abdou K. Diallo was the project leader. The enterprise started in the flat of his parents before renting two flats that still exist. The start-up began with a turnover of 1,5 million F-CFA in the first year; 9 million F-CFA in the second year; 16 million F-CFA in the third year; and 70 million F-CFA in the fourth year. The last year of 2020 could demonstrate a turnover of 120 million F-CFA. Gains are mainly reinvested but also support numerous staff members. In 2021, the start-up has already trained some 4,000 students in programming and web design, as it is interested in capacity building of young Senegalese as part of its business strategy.

Volkeno is an enterprise which is dedicated for creating high value-added digital products and services. The enterprise is well known for creating innovative and eye-catching web and mobile applications and platforms for start-ups, businesses, organizations, and multinationals. A skilled and experienced team is ready to take on challenges to create high value products that are designed to scale up projects. Volkeno is positioned as a Start-up Studio with the aim of contributing to the development of Start-ups conceived and designed by young Africans. The objective is to contribute to the creation of high value-added technological products that solve local problems. As such, this strategy is rather widely used in African countries by plants that widen their economic spectrum for the first time. In addition, they also contribute to the innovation process of existing companies by accompanying them in their digital transformation. Their goal is it to have the largest IT centre in the West African zone. Volkeno's vision is it to contribute to the ongoing digital revolution by actively participating in the training of young

¹⁵ An appointment with the CEO in Dakar was organized at the start-up premises in July 2021.

¹⁶ See: <https://www.utc.fr/>

Africans and to encourage them to self-employment to reduce the unemployment rate in Africa, particularly in Senegal. They plan to create 1,000 start-ups in Africa within 10 years. As the future is digital, they plan to bathe in this future with their own solutions that consider societal realities.

The enterprise offers courses in their premises, but also gives online courses. Volkeno has received a credit of 36,000 Euros in 2018 from the DER that has to be reimbursed until 2025, with a delay accepted by DER due to the COVID-19 pandemics. The amount received was used to buy materials and to pay the salaries. During the COVID lockdown, online courses were offered, and remote home office work was done by the 47 staff members. Not less than 20 salaried staff members are on the payroll, and 27 qualified trainees receive 55,000 F-CFA monthly when they do not have another student grant (cf. the enterprise's website). These trainees are educated to obtain higher competencies in courses that cost some 30 euros per month and are prepared by staff members of the Start-up Studio. Qualified staff of the enterprise can receive up to 200,000 F-CFA per month.

Volkeno has two other rented offices in Thiès, some 70 km from Dakar, and in Guinea. These staff members take part in the activities of the enterprise by realizing remote office tasks. Abdou K. Diallo supervises all activities and validates projects and the recruiting. The staff costs some 5 to 6 million F-CFA per month according to the CEO. Abdou K. Diallo has continued his education with online courses, such as business administration. Volkeno's staff is invited to do the same so that the enterprise can continue to be at the forefront in its specialty. The Start-up Studio is an enterprise that looks for a viable economic model for its own enterprise. As such, Volkeno accompanies other start-ups to realize a successful business plan that may permit a turnover of some 10 million F-CFA in a rather limited time horizon. With the digital revolution being underway, all companies are now going digital to offer the best services or products to their consumers/customers. They are increasingly looking to get closer to their customers by providing them with well thought-out platforms or software in terms of user experience. Having a digital tool is more than essential these days, also in West Africa. With its expertise in digitalization, Volkeno designs all types of software projects (cf. their webpage). Their software engineering division takes on challenges every day to offer digital products with high added value, and to meet the international standards to hundreds of clients around the world. This vast pool embeds several IT services which vary according to the objective of their customers which are, especially, the design and the development of web applications. Volkeno's expertise in the digital environment of Senegal allows them today to develop all types of web applications according to the needs of their customers, whether it is just static, or dynamic, of an e-shop or e-commerce type, a web portal or just the management of content. Their team of experts provides the customers with the best product through a working methodology which is based

on empathy that puts the customer and the consumer at the heart of the development. The following examples of digital products are mentioned:

Mobile application design and development: The importance of mobile usage is no longer in question. Africa is witnessing an increase in the number of mobile users from year to year. If the customers are looking for a team of experts to design a hybrid or native mobile application, Volkeno provides this service, which accompanies the customer from the design phase of the interactive prototype to the final deployment of a mobile application on the stores (Play and App).

Design and implementation of web and mobile platforms: It is trendy nowadays to have a mobile-based web application to get closer to its users. More than 75% of the world's population use the cell phone as a daily means of communication (calling, texting, browsing, and shopping online). The goal here is to offer a simple and very intuitive web and mobile application with simple functionalities and a reduced user path without distorting the visibility of the searchable web.

Design and realization of modular sites: Volkeno provides their customers with different types of applications, depending on the objective they want to achieve. Modular applications are part of the services they offer to their customers to allow them to have platforms that can support multiple users simultaneously, without any malfunction or so that they do not feel a change in navigation.

Cloud native development services: Requirement levels are no longer where they were 20 years ago, as everything is growing fast, and as application development is becoming more and more complex with very advanced functionalities and high requirement levels. Faced with this, applications are increasingly designed to make the most of the features offered by the cloud. Volkeno's team of experts is also at the disposal of the customers to help them realize a cloud application project.

Creation of sites through CMS WordPress¹⁷, Drupal¹⁸, Joomla¹⁹: Volkeno also accompanies their customers according to their needs in the design of showcase sites, information portals, and e-commerce sites with open-source CMS, such as WordPress, Drupal, and Joomla.

Today, when creating any type of application, it is essential to put the end user at the heart of the project. That is why, at Volkeno, before designing or developing web or mobile applications, the staff first thinks about the end user to provide them with an intuitive and easy-to-use product that meets their expectations and needs. Digital marketing refers to all marketing techniques used to promote products and

¹⁷ See on CMS (Content Management System) WordPress: <https://mediag.com/blog/the-world-of-wordpress/>

¹⁸ See on the functions of Drupal: <https://api.drupal.org/api/drupal/functions/8.7.x>

¹⁹ See on the Joomla features: <https://www.joomla.org/core-features.html>

services through digital media and channels. Volkeno supports its clients in their marketing and communication projects, whether it is to consolidate a strong visual identity, to launch a product on the market, to generate qualified leads, to find new customers, or just to organize events. The presence of companies on the web is characterized by a strong graphic identity. All companies are directing their marketing and communication strategies towards the creation of different content formats, ranging from simple images to infographics or podcasts and videos. Through this service, Volkeno accompanies all its clients and partners to create the different formats of communication media to enable them to achieve their objectives.

More and more complex innovative projects are coming up with very high requirements. To meet this need and to offer a better service, Volkeno provides current and future customers with a division entirely dedicated to projects which are integrating the cloud. Every digital project needs support to keep the product up to date and to make the necessary corrections in case of malfunction in real time. This department provides companies with services based on its expertise, allowing them to outsource all IT support and maintenance to alleviate malfunctions and to anticipate possible malfunctions through regular project monitoring.

To conclude, Volkeno is a young and innovative start-up that has diversified products and services, also through a teaching department; all this assures that the enterprise is at the forefront of Senegalese start-ups. Moreover, due to online courses, the team can reach the African diaspora and other Senegalese or foreign regions, such as Guinea, where an office exists. The development of the start-up has been fast due to a directorate that understands its business. The credit from the DER has thus gone to a promising enterprise that attracts young Africans who wish to work in the IT sector. Two teaching models contribute to the success of the start-up: Bakeli, a platform that teaches for one-month competent web design, and Andu, a platform that permits to learn programming, digital marketing and infographics with interactive contents and exercises. However, the start-up is young and financial successes are rather limited as the charges are high and the business model supervised by the CEO seems too large and unspecified so that the goals of financial success are not reached for the time being.

Volkeno has thus created a business model that is innovative but rather unspecified. The CEO learned in France management tools that he tries to apply to the Senegalese socioeconomic sector. He is successful by motivating a group of young staff members, but economic success of the start-up is not yet attained. The credit of the DER permits to survive with an economic model that seems to be common in African countries, but which is not yet adapted fully to the local socioeconomic structure. It seems as if the business strategy must be revised as otherwise the start-up may realize economic losses.

5.3 Case Study ClicMagic: Creation of Websites

The company ClicMagic is creating websites.²⁰ Before the creation of this company, Amadou T. Gaye, its owner, was twice national champion of Senegal of the NGO *Students in Free Enterprise* in 2009 and in 2011, and the NGO is an association that promotes entrepreneurship at the global level. With seven other young men (some were students at AFI-Université de l'Entreprise Dakar²¹) he travelled to Germany to obtain this prize. His activity started at the University of Ziguinchor²² in the south of Senegal where he created a website to allow for hosting courses and departments. He launched an enterprise with several other students but the geographical environment in an insecure region of Senegal soon revealed the limits of this model. The company was created in 2012 with a capital of 25,000 F-CFA (38 Euros) by a group of six students from the University of Ziguinchor in the south of Senegal under the name of Karembeur LLC. At that time, no company was specialized in the creation of websites. These students had the ambition but not the experience of managing a company after a three-year course in computer science applied to management. The group decided to sell the common enterprise, and only A. T. Gaye was ready to re-invest: The other persons decided to remain in the plant as consultants. Three years later, this adventure terminated in a failure and A. T. Gaye decided to start alone another enterprise in Dakar.

A. T. Gaye had observed that the creation of websites was an informal activity done by individuals without the support of an enterprise. Knowing that Africa had already shown that it was a latecomer in Internet, A. T. Gaye reflected how to bring the digitalization to the Senegalese businessman. To give access to this digital opportunity, he developed a well-thought communication strategy and a business plan. Before moving to Dakar in June 2018, he created in his village, Marsassoum in the south of Senegal, during a time of reflection of eight months, a dozen models of websites for several activity sectors. The sale of these websites amounted to 65,000 F-CFA and was initially considered by his educational supporters as a too low price. But A. T. Gaye insisted to go this way "to sell websites such as hotcakes". This procedure has allowed him to sell these different models of websites in several copies: "Instead of creating sites for each person, I created sites for everyone. It's the hosting that will change." After an eight-month

²⁰ We had an appointment on January 12th, 2021, to collect the information presented in this part of the article. A second meeting was organized in April 2021. A discussion at the ManaGlobal conference in Dakar in June 2021 added some more information.

²¹ See on this university: <https://afi-ue.sn/>

²² See on this university: <https://www.university-directory.eu/Senegal/University-of-Ziguinchor.html>

stay in the village where he had only an e-mail access as a means of communication, he moved to Dakar.

By moving to Dakar, A. T. Gaye, 36 years old in 2021, created ClicMagic with the aim of gaining experience and developing the company. The name already shows that with a “clic” in a digital universe a magical event is created that offers the possibility to rule out digital problems. With a father who was involved in fishing and farming but was also active in the sheep and cloth trade, he had no real experience of entrepreneurship. He was the first in his family to graduate from college. His first locality was in a poor suburb in Dakar where the rent was low before moving to Yoff-Virage, near the former airport of Dakar, a suburb with a more favoured environment where he could welcome his customers without any problems.

The website of his enterprise announces creating applications that contribute to the creation of jobs and the success of commercial enterprises. To develop his enterprise, A. T. Gaye has focused on the relational marketing approach. Instead of high investments in advertisement, he gives young people the opportunity to earn a living and to assist in the communication of the enterprise. Most of these commercial staff members are students (some of them at AFI-Université de l'Entreprise²³) or young school leavers without diploma that can earn a living permitting them to afford their school or university studies. Young people are also included among his consultants that combine their courses at schools with an experience in an enterprise.

ClicMagic has been successful. From the beginning and up to three years, the enterprise realized a turnover of 250,000 F-CFA a week and one million F-CFA a month. With a turnover of three to five million F-CFA since 2018 annually, A. T. Gaye managed to sell 15 to 20 websites per month. At the time of COVID-19, the turnover has increased to 2.5 million F-CFA per month and should be stabilized around 5 million F-CFA in 2021 monthly with a sales team, essentially composed of about twenty freelance consultants who do the forecasting and of about five employees who are forming the technical team. The consultants earn for the sale of four sites per month 25% of 100,000 F-CFA, the cost of a site to be paid by the customer. Thus, these consultants earn around 100,000 F-CFA per month. In times of COVID-19, merchants have begun to ask for websites to avoid the loss of sales due to confinement and curfew. Only online stores could then make a substantial turnover so that the enterprise could survive. Thus, the number of site deliveries grew from 15 to 100 sites in 2021.

How to explain this success? In Senegal, enterprises that were specialized in the sale of websites did not exist before, so that ClicMagic could build on this advantage with a young team that was recruited to sell the product and to gain

²³ See on the university: <https://afi-ue.sn/>

commissions. The commercial staff was thus motivated and could assure the advertisement of the enterprise and its services. This marketing strategy contributed to the rapid development of the enterprise and its expansion due to the sale of so many websites in a couple of years. The owner of the enterprise had seen that this relational strategy was mostly adapted to the Senegalese and African environment, a success that traditional advertisement strategies could not realize. Calling entrepreneurs and visiting their enterprises have permitted to A. T. Gaye to have success. The consultants working for the enterprise could replace external investments that would have asked for complicated financial conditions by forming a pro-active task force.

A. T. Gaye tells during the interview about how he started financing his business: "I started doing graphic design in Casamance²⁴. In the university, I did computer science, then computer science and multimedia. I learned everything that is computer graphics and audio-visual production; I won contracts for business cards and others in universities and in some NGOs to be able to finance my business. These funds allowed me to take on young people that I trained myself... I found young people who had been to school²⁵, but who had dropped out. I trained them to transfer the skills because these young people wanted to settle down... They have managed to master everything that is computer graphics, audio-visual, website creation, and others." A. T. Gaye is aware that he is constantly obliged to perfect his training, especially the technological one, due to the rapid advancement in this field. At the time of COVID-19, he has chosen a school that offers online training courses, such as the Virtual University of Senegal. He is constantly trying to develop his enterprise: one possible way was to offer his customers the possibility to advertise their stock of articles on the internet. Moreover, he is currently trying to develop eMagic, a service that offers visibility to images of African origins.

To return to the salaries paid in his enterprise, they vary between 100,000 and 200,000 F-CFA. Those who excel are offered 2% to 5% of the company's profits. Engineers working in the company are essential and receive "good salaries": "If we are interested in you, instead of paying you 100,000 F-CFA, we pay you 300,000 F-CFA, but you will also earn 2% of all profits. These people should stay in the company for 10 years... There are two very important people who understood this project and accepted this shared part of the profits."

The company is situated in a rather peaceful neighbourhood near the old airport of Dakar, and a rather limited amount of money is spent on rent. The director of the company combines his entrepreneurial activity with the management of a radio station and a TV chain (Atlantique FM 106.1²⁶ and

²⁴ This is a region in southern Senegal.

²⁵ Meant is "attending for some time the high school".

²⁶ See: <https://www.atlantiquefm.com/>

Atlantique TV), located in the same building. The resulting savings in rent and the provision of a beautiful building impress potential customers and ensure confidence in the activity of creating websites carried out by ClicMagic. The websites that the company offers cost 100,000 F-CFA as opposed to other companies that charge up to three times this amount. The websites are offered in a bilingual manner in English and French. The customer can order the website on an online platform, receives an example of a site from several proposed models which can be adapted to his/her needs and pays it if he/she likes it. The site is then copied into his/her space and delivered.

The students who work for the company touch all activity sectors: marketing, communication, IT services, and webmasters. The students who develop websites can sell the site in two ways: he/she can sell a website and contract a percentage of 25% of its price; or sell the design and be paid 250,000 F-CFA by ClicMagic to which the website then belongs. The customers of the websites are trained by ClicMagic in a few hours training. For their online sales, they need to know how to put products and categories on the website; but also, how to organize a promotion and be able to distribute the products. The owner of ClicMagic is a developer who is ready to spend the night over in the company if there are lots of demands for websites. The technicians normally work ten hours a day, as these activities are very time-consuming, but they have assured profits in 2021 despite the COVID-19 partial lockdown.

Prospecting is done by the company who seeks to obtain a list of companies that are contacted by phone or by a visit on site to make understandable the usefulness of a website to a customer. Social networks such as Facebook and Instagram are used. The customers are accompanied for one year and many of them renew their adhesion by an assistance contract. This follow-up is organized by technicians who manage the Facebook and Instagram pages and others. For each website created, ClicMagic offers business cards and manages the Facebook pages. Each staff member working in the company manages at least 25 sites paid by the client at 25,000 F-CFA for one month and one site. These persons make daily reports and must make two personal posts on Facebook and Instagram. They receive a monthly payment of 100,000 F-CFA. The money earned from these activities pays for the rent of the house, the graphic concepts, and the editor. Thanks to these activities, ClicMagic is positioning itself as a main digital operator in Senegal, even if there are some competitors on the national market.

The staff of ClicMagic is trained by a teacher who owns a school. These persons learn the basics of marketing but also how to reach customers and how to organize a prospecting interview. This well adapted approach allows ClicMagic to have customers in Switzerland and the United States, but also in Guinea and Gambia: "The priority is that the person knows the different aspects of its activity."

An important aspect in dealing with customers is the creation of a relationship of trust: "The customer does not always have the data to believe you. So, there are a lot of questions that the customer asks. That's why you must settle these trust issues once and for all. Therefore, you may sometimes have to give all the references. If we ask for the pictures, it is to show the customers that we are the owner of this site." The services offered, such as support after the creation of the website and appointments, are not free: "We only sell the creation. In the first year, we offer hosting. For the other years, the customer pays for the hosting. In this sense, the company is innovative and is also present in Mauritania and Mali." A. T. Gaye has even contacts with French partners that can pay the website with Mastercard's.

ClicMagic is ambitious: "The objective is to employ young people throughout the national territory. We already have about 20 permanent sales staff. We recruit 15 people per month. In Dakar, we have up to 50 regular consultants. We need to have about ten people in each region. We create jobs because 1,000 people is not something to be neglected. We want to avoid another form of underdevelopment which is linked to technology. We must invite the Senegalese and the Africans to be in the digitalized world." ClicMagic thus creates jobs and will open three further branch offices in other regions to be nearer to the customers. Consultants working for ClicMagic not only create their own salary but also participate in their education in the digital sector that is a future sector for Africa. The enterprise contributes even to the preservation of the environment with the creation of websites that reduce the use of paper for advertisements. By accompanying the enterprises that buy a website, ClicMagic contributes to the economic success of these small entrepreneurs that are the workforce of the emerging Senegal and its economic future.

Regarding our theoretical framework, this enterprise has shown an adaptation to the local socioeconomic sector based on globalized management tools learnt in a Senegalese enterprise and adapted with success to the local socioeconomic environment by a convincing marketing strategy, but also by accompanying measures which are destined to entrepreneurs. As social contacts are important in the African environment, the CEO developed strategies to contact possible customers in their own enterprises and not in the premises of ClicMagic. The marketing approach is thus different from tools that were learned in management studies at the Senegalese university. Moreover, the low IT knowledge of most customers led to IT accompanying measures by ClicMagic that were gratefully accepted by the customers. These measures are in the interest of the customers as they defend their economic and financial successes. The CEO believes strongly in proximity to his customers and their enterprises, as that strategy contributes to his socioeconomic success.

5.4 Case Study DIGICLEVER: Digitalized Online Education adapted to the Senegalese context

The third case is about the start-up Digiclever²⁷ and that of an entrepreneur, Moussa Seck, who has just returned to Senegal after studying in France and obtaining a master's degree in management and business strategies at the University of Metz.²⁸ He worked in operational marketing in the Lorraine region in France. Then, he set up an entrepreneurial project of intergenerational co-location that he managed for eight years before transforming it into a project taken over by a social economy group. This project was supported by the Luxembourg government following a competition from which he emerged as the winner. This project started in 2014 and was called Cohabitat²⁹. Moussa Seck continues to participate in it remotely on a part-time basis. After 22 years in Europe, he wants to participate in the development of his country and to develop an educational project to contribute to the academic success of young people. Together with his brother who remained in Senegal, he created a company called Digiclever to use digital technology for school reinforcement. The company provides face-to-face and distance learning courses. The two brothers have set up a computer sales programme with easy payment conditions in five instalments. Moussa Seck works with a friend who has been a tutor for about 20 years, but in an informal way. This friend had done the baccalaureate with him and was convinced by Moussa Seck's ability to cooperate and to prepare for this new venture.

The company was formalized in September 2020 together with a notary. Moussa Seck injected a capital of 500,000 F-CFA (equivalent to 762 Euros) to pay the formal expenses. The rented premises are shared with another company. A website digiclever.sn (see footnote 26) has been created to set up advertisements for reinforcement courses. Teachers and professors have been recruited and close contact with school principals has been established. The latter have made classrooms available to the company. In January 2021, the courses which are offered by the company concern physics-chemistry, mathematics, and languages (French and English) for primary and secondary schools. The staff is salaried, but the teachers are service providers who are paid by the hour. Among them, there are retired teachers but also active teachers from the private and public sectors. Not less than 120 pupil participants were enrolled in January 2021 in privileged neighbourhoods of Dakar (Almadies and Plateau). The prospective students were identified by ten volunteers who collected the contact information of interested

²⁷ See on the start-up Digiclever: <http://www.digiclever.sn/>

²⁸ A first meeting with the entrepreneur was organized on January 15th, 2021. A second meeting took place in April 2021.

²⁹ See on the objectives of Cohabitat: <http://cohabit-age.lu/>

parents of students. These people were then contacted by phone by Digiclever, but also by the students themselves from the company's office. Their database included 650 families of which 120 families decided to participate. The prices are F-CFA 6,000 (equivalent to 9 euros) for the primary school level and F-CFA 10,000 (equivalent to 15 euros) for the secondary school level, with teaching for a period of 45 days. Ten students chose the distance learning courses during which the teacher sits in a small room to give his lesson. Students and teachers alike come to the platform and have access to a workspace with a login and password.

These lessons are recorded and can be broadcasted to other students. For face-to-face classes, Digiclever works with school principals: they sign a partnership agreement, and the company pays them 5% of the turnover generated within the school. This is a real-time interactive course, but students can send in exercises from their workspace which are then corrected and sent back to the student. The families who register are rather privileged ones and can buy a second-hand computer for a price of € 100. The chosen course model is then presented to high schools in Dakar, such as Galandou Diouf. In summer 2021, courses in Science, Mathematics, English, and Accounting were offered. The company also provides training for teachers on their platform to familiarize them with digital technology. As the company has just started, Moussa Seck hopes to achieve a turnover of € 10,000 to € 30,000 per year. His working capital amounts to € 10,000, that is mainly used to pay the rent. Thanks to his savings and his bank credits, he was able to start the company with his brother who is a senior manager of the Banque Centrale des États de l'Afrique de l'Ouest (BCEAO) and an audit manager. His brother has a master's degree in accounting and management from the Cheikh Anta Diop University in Dakar³⁰. Their father worked at SONATEL (telecommunications sector)³¹ and their mother worked at the post office so that the entrepreneurial sector was new for M. Seck.

The company Digiclever has developed flyers to pass information to interested students in schools. It is also present on Facebook and on other social networks. It has launched a recruitment offer for teachers and has received 800 applications, mainly from students with a Bac+3 level. To convince the schools to cooperate with them, Digiclever has offered a sum for the painting of the school and the distribution of school kits and painted boards. The objective is moreover to create small structures in the neighbourhoods that will be able to accommodate a dozen of the students for the courses.

In conclusion, this is a promising strategy in the face of a national education system with classes of 80 people that struggles to qualify young people. The marketing strategy is based on the social relationships of students, parents, and

³⁰ See the website of this university: <https://www.ucad.sn/>

³¹ See the website: <https://sonatel.sn/>

teachers, which resembles those of French distance training companies, such as Acadomia³². The health crisis has certainly facilitated the establishment of Digiclever, and its success soon can be expected along with few current competitors.

This enterprise testifies for diaspora members that return to Senegal with the management knowledge they acquired in France and that they apply to the Senegalese socioeconomic environment is a potential base for success. For the time being, the success of this enterprise is not guaranteed and depends on the implementation of a strategy relating of accompanying measures. The business model is innovative for Senegal even if the possible customers would be favoured social groups in Dakar. The CEO belongs to the generation of young leaders that applies management tools from Western countries in Senegal. The cooperation with public schools and their directors assures a business strategy adapted to the African context. Direct contact with the pupils' parents has permitted to recruit interested families in need of better educational accompanying measures of young pupils that are exposed to an overloaded school system with large classes where an individual approach depending on the difficulties of each student is not possible.

6 Entrepreneurship: An alternative to unemployment and underemployment?

Entrepreneurship is one of the levers that could help to meet the challenge of employment in Africa. The notion of entrepreneurship is associated with freedom, autonomy, and innovation in line with an entrepreneurial spirit defined already in the early 20th century by Max Weber. The subsequent definitions associated with it are of multiple focus because each specialist specifies them according to his or her priorities and the nature of capitalism (cf. Amaeshi, Okupe, Idemudia 2018). However, the processes of creating businesses in West Africa (e. g. in Senegal) do not conform to the requirements of the classic entrepreneurial model oriented by criteria of financial profitability. The stages of entrepreneurship (Initiation, Preparation, Start-up Foundation, and Consolidation) cited by Nkakleu (2018) are not often respected in Africa.

In the recent pandemic crisis, researchers further emphasize the need to permanently rebalance the excesses of the market in favour of the general interest and to re-embed the economy in the social sphere, a requirement that is paramount for Africa. Researchers see entrepreneurship in Senegal, particularly that of women, as a "safety valve" for the country's economy. The African Development

³² See on Acadomia training company: <https://www.acadomia.fr/>

Bank (AfDB), for its part, has already emphasized that women in Africa are very dynamic economic agents, and therefore need much special support. Beyond their income-generating activities, they are the main levers of the domestic economy and of family welfare. However, entrepreneurship in the African context is subject to multiple constraints. These constraints relate to the business environment, which differs according to socio-economic contexts, but also to financial inclusion factors, and to the cultural environment. Today, Senegalese authorities have put in place levers to support entrepreneurship among women and youth. These initiatives include the Senegalese Program for Youth Employment (PSE-J/Plan Sénégal Émergent (PSE)/Senegalese Youth Employment Programme)³³ and the Delegation for Rapid Entrepreneurship/Women and Youth (DER/FJ/Femmes et Jeunes). The PSE-J is an instrument that is part of the logic of providing higher professional training to young people. It is financed by the State. Its main mission is to facilitate the creation of businesses by young people, by providing training, technical and financial support, and advice to combat unemployment. The DER, on the other hand, is a structure set up by the state at the beginning of 2018. It is an instrument dedicated primarily to financing female entrepreneurs aged 18 and over and young men aged 18 to 40. In its first year of implementation, it has deployed about 30 billion F-CFA in financing individual projects at 100,000 F-CFA and up to 500,000 F-CFA each for the most part according to Papa Amadou Sarr, Minister, General Delegate for Entrepreneurship, The Presidency, Republic of Senegal. DER's main objective is to promote entrepreneurship by providing youth and women with credit and capacity building. In addition, it monitors businesses that have already received financing.

Financial education is also a priority in the country. In Senegal, the programme's focus on financial education is built around five themes (budgeting, savings, debt management, financial services, and financial negotiations) that can help to build the capacity of entrepreneurs. The shift from the approach that characterized microfinance in the 1970s to the logic that prevails today (with substantial failures to consider the real situation of clients: poverty, illiteracy, etc.) is, however, one of the main obstacles to the development of entrepreneurship and to financial inclusion. The barriers and constraints to financial inclusion for women and youth are mostly related to their entrepreneurial status. For example, the 2016 report by the Agence Nationale de la Statistique et de la Démographie

³³ See on the new programme: <http://www.apanews.net/en/news/senegal-to-launch-emergency-youth-employment-plan>, and: https://www.afdb.org/sites/default/files/documents/projects-and-operations/senegal-ar-project_for_support_to_skills_development_and_youth_entrepreneurship_in_growth_sect_ors.pdf

(ANSD, 2017) on the General Census of Enterprises in Senegal³⁴ has shown that entrepreneurs are the most vulnerable and pay the highest taxes proportionally. This structural "constraint" is linked to the fact that entrepreneurs are victims of information asymmetry: these women and young entrepreneurs are not familiar with the financial system - and in particular the tax system - which makes it difficult for them to access quick and sustainable financing so that they are not able to integrate possible tax reductions in their own business plans. Thus, entrepreneurs have less access to traditional banks, which require guarantees that are often out of reach, than to decentralized and often informal financial services, which apply exorbitant high interest rates. This situation contributes to the short- and medium-term failure of their activities.

It is obvious that the digital start-ups have since 2016, the "Year of employment" in Senegal, adapted to the demographic structure and to the skills and education situation of Senegal. The problem is that a significant part of the youth has never seen a school and if, many of them have not acquired the basic skills needed for the labour market. Therefore, DER and other employment creation programmes can play a role to mobilize women and men for entrepreneurship, but the volume and the direction may not be appropriate.³⁵ "Certificates of specialization" will provide in ten centres in short courses for such basic skills, mostly for those youth that have seen before a school, but the intended number of 10,000 youth to be reached in employment and entrepreneurship programmes is extremely small. More than this, a new entrepreneurial culture needs to come forth in Senegal.

7 Conclusions and Policy Recommendations

This essay displays that the digital technologies are enablers of transformations within business and self-employment practices in West Africa. Their use leads to socioeconomic developments but respects cultural heritage and considers regional complexities and their link to more developed globalized practices (Braun and Warner 2002). The case studies of digital entrepreneurs show their possible contribution to economic growth and their probable impact on society. As such, they demonstrate the global process of digitalization and its use in doing business

³⁴ See on the report ANSD/RGE 2016:

http://www.ansd.sn/ressources/rapports/Synthese_Resultats_PRCN.pdf, and:

<http://anads.ansd.sn/index.php/catalog/148/related-materials>, and:

<https://blogs.worldbank.org/nasikiliza/from-vocational-training-to-employment-in-senegal-encouraging-youth-to-be-the-engine-of-growth>, and:

<https://dhsprogram.com/publications/publication-fr331-dhs-final-reports.cfm>

³⁵ See on some figures and trends: <https://blogs.worldbank.org/nasikiliza/from-vocational-training-to-employment-in-senegal-encouraging-youth-to-be-the-engine-of-growth>

in Senegal. Individual aspects of the role of entrepreneurs are discussed as well as their links to regional economic conditions. As such, they demonstrate that entrepreneurship is considered a solution to the socioeconomic problems of Africa, as argued by Ratten and Jones (2018). However, it is necessary to examine individual countries rather than pretending to display regional case studies as there are different business systems in sub-Saharan Africa in the East, West, and South.

The three entrepreneur profiles above reveal a market which is open to young entrepreneurs, a market that is so far neglected by Western and Asian companies in Senegal. Two of them have acquired their know-how in the West and have returned to Senegal based on professional experiences already made abroad in France. All the three entrepreneurs have a work ethic characterized by Western values, such as punctuality, an approach of individual rather than group valorisation, and creativity as a main asset. They have the values needed in the business world where entrepreneurial success is realized only by those who continually renew their knowledge by trying, learning, and training, rely on social networks pre-existing to the entrepreneurial project, and expose themselves to innovations which are required by a company that wants to remain competitive (Achtenhagen and Brundin 2016). The owner of ClicMagic acquired his know-how at a Senegalese university; he was taught an idea of Westernized management that he was able to adapt with some success to the Senegalese context. The other two entrepreneurs adapted their knowledge learned in France to the situation of a Senegalese society that they are familiar with.

These profiles reveal that there is a group of middle-aged entrepreneurs who are at the forefront of entrepreneurs in Senegal. Abdou K. Diallo's success is based on an excellent professional background obtained in France and parents who could orientate his interests in informatics. Amadou T. Gaye has learned at a university in Senegal and uses his knowledge of the Senegalese society to succeed. Moussa Seck thanks to his training as a manager in France can launch a company that proposes school reinforcement. All the three have been able to bring together what they know about the Senegalese society and what they have learned from a particular Western apprenticeship to ensure their economic success (Branine 2011). All the three have completed higher education before going into a digital technology business (Nambisan 2017). With their acquired intellectual capacity, they support their activities in niche markets that are accessible to them in the face of a public employment market that offers them few chances for a professional future (Croce 2018).

To conclude, a trend towards the creation of small businesses is becoming visible, with entrepreneurial profiles being open for higher education graduates from Europe, but also from Senegal (Mamman et al. 2015, and Manyika et al. 2013). From the case studies various relevant policy recommendations can be formulated: There is an urgent need to combine the financial assistance programme of the DER to educational programmes such as that of the

ADEPM/ADEPME (Agence de Développement et d'Encadrement des Petites et Moyennes Entreprises).³⁶ First insights from a field study on the accompanying measures reveal that the credit allocation system of the DER is not sufficiently backed up by educational measures around management, accountability of enterprises, profit-driven measures in Senegal, knowledge on tax systems and on possible tax reductions. DER is a rather new political instrument that may have little impact on the economic outcomes of the financed enterprises without a professional accompaniment of these entrepreneurs who have ideas of possible projects but fail to have sufficient accounting knowledge to assure the long-term economic success of their enterprises. Entrepreneurs who have management knowledge either learnt in France or in Senegal have a comparative advantage, but even the CEO of Volkeno admits that DER has a follow-up plan of the credit reimbursement measures but does not deliver management support to the entrepreneurs that is urgently needed. Recent critics of this institution are becoming louder and louder so that the activism of its leader may not be sufficient in the following years when business failures appear because of the lack of knowledge of management tools.

Moreover, the accompaniment of business creations must be analysed, an analysis that has to be done to get insights into sustainability conditions of new enterprises. Better support measures as courses in the local language (Wolof) or in French on radio stations on the indigenous way of doing business in Senegal have to be promoted so that entrepreneurs can learn for instance from case studies that have been realized in the ManaGlobal project. Fruitful meetings of entrepreneurs must be organized, such as those held in the ManaGlobal Summer School in June 2021 in Dakar where entrepreneurs exchanged successfully with sociologists, economists and management specialists on their economic practices and the situation of their enterprises and their functioning.

References

- Achtenhagen, L. and Brundin, E. (eds.) (2016), *Entrepreneurship and SME Management across Africa: Context, Challenges. Cases*. Berlin: Springer.
- Alden, C. and Alves, A. C. (2016), "China's regional forum diplomacy in the developing world: socialisation and the 'Sinosphere'." *Journal of Contemporary China*, pages 1-15.

³⁶ See on ADEPM/ADEPME: <https://adepme.sn/contacts>, and: <https://www.facebook.com/macky2035/videos/adpme-services-accompagnementun-accompagnement-tout-au-long-de-votre-projetladep/431391867900225/>

- Amaeshi, K., A. Okupe, and U. Idemudia (2018), *Africapitalism: Rethinking the role of Business in Africa*. Cambridge, UK: Cambridge University Press.
- Agence Nationale de la Statistique et de la Démographie/ANSD (2017), *Rapport Global du Recensement Général des Entreprises (RGE)*, 101 pages.
- Boyer, R. (1996), "The convergence hypothesis revisited: Globalization but still the century of nations?", in: Berger, S. and Doré, R. (eds.), *National Diversity and Global Capitalism*, pp. 29-59. Cornell Studies in Political Economy, New York: Cornell University Press.
- Branine, M. (2011), *Managing Across Cultures: Concepts, Policies and Practices*. London et al.: Sage.
- Braun, W. H. and Warner, M. (2002), "Strategic human resource management in western multinationals in China: The differentiation of practices across different ownership forms", in: *Personnel Review*, 31: 5: pages 553-579.
- Caby, J. (2003), "La convergence internationale des systèmes de gouvernance des entreprises: faits and débats", for access: <http://docplayer.fr/2861995-2003-07-la-convergence-internationale-des-systemes-de-gouvernance-des-entreprises-faits-et-debats-jerome-caby.html>; Institut d'Administration des Entreprises de Paris (IAE Paris).
- Chigunta, F. (2016), "Entrepreneurship as a Possible Solution to Youth Unemployment in Africa", in: *People*, 10: 1.
- Croce, F. (2018), "La recherche du management africain au XXIe siècle: sous l'effet de la globalisation, vers un management africain 'métis'", In: *Revue africaine de management – African Management Revue*, 3 (1): pages 1-12.
- D'Iribarne, P. (2003), *Le Tiers-monde qui réussit: Nouveaux modèles*. Paris: Odile Jacob.
- D'Iribarne, P. (2009), *L'Épreuve des différences: l'expérience d'une entreprise mondiale*. Paris: Seuil.
- Deichmann, U. and Mishra, D. (2016), *World Development Report 2016: Digital Dividends*. Washington, D. C.: The World Bank.
- Ellis, F. Y., Nyuur, R. B. and Debrah, Y. A. (2015), "Human resource management in Africa", in: *Handbook of Human Resource Management in Emerging Markets*, Chapter 18, pp. 393-424. Cranfield School of Management: Cranfield, UK.
- Friederici, N. (2019) "Innovation Hubs in Africa: What Do They Really Do for Digital Entrepreneurs?", in: Taura, N. D., Bolat, E. and Madichie, N. O. *Digital Entrepreneurship in Sub-Saharan Africa, Challenges, Opportunities and Prospects*, pages 9-28. Cham: Palgrave Macmillan.
- Friederici, N., Wahome, M. and Graham, M. (2020), *Digital Entrepreneurship in Africa: How a Continent Is Escaping Silicon Valley's Long Shadow*. Cambridge: Massachusetts Institute of Technology Press.
- Gomez, P.-Y. and Korine, H. (2009), *L'entreprise dans la démocratie: une théorie politique du gouvernement des entreprises*. Paris: De Boeck.

- Hopkins, C. (2015, October 5), “How Africa Grew More than 200 Local Tech Scenes”, *The Daily Dot* (blog). Retrieved from: <https://www.dailydot.com/debug/africa-tech-hubs-hacker-spaces-incubators/>
- Jackson, T. (2013), “Reconstructing the Indigenous in African management research: Implications for International Management Studies in a Globalized World,” *Management International Review*, 53 (1), pages 13–38.
- Kamoche, K., Siebers, L. Q., Mamman, A. and Newenham-Kahindi, A. (2015), “The dynamics of managing people in the diverse cultural and institutional context of Africa”, in: *Personnel Review*, 44 (3): pages 330-345.
- Mamman, A., Kanu, A. M., Alharbi, A. and Baydoun, N. (2015), *Small and Medium-sized Enterprises (SMEs) and Poverty Reduction in Africa: Strategic Management Perspective*. Cambridge: Cambridge Scholars Publishing.
- Manyika, J., Cabral, A., Moodley, A., Moraje, S., Yeboah-Amankwah, S., Chui, M. et al. (2013), *Lions Go Digital: The Internet’s Transformative Potential in Africa*. McKinsey Global Institute, McKinsey & Company. Retrieved from: <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/lions-go-digital-the-internets-transformative-potential-in-africa>
- Mellahi, K. and Budhwar, P. S. (2010), “Introduction: Islam and human resource management”, in: *Personnel Review*, 39 (6): pages 685-691.
- Michalopoulos, S. and Papaioannou, E. (2015), «Further evidence on the link between pre-colonial political centralization and comparative economic development in Africa», in: *Economics Letters*, Elsevier, 126 (C): pages 57-62.
- Nambisan, S. (2017), “Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship”, in: *Entrepreneurship Theory and Practice*, 41 (6): pages 1029-1055.
- Nkakleu, R. (2018), “Introduction”, in: Nkakleu, R. (ed.), *Accompagnement des petites entreprises au Cameroun et au Sénégal. Compétences des dirigeants et performance*, pages 19-26. EMS Editions, 2018.
- Nkomo, S. M. (2011), “A postcolonial and anti-colonial reading of ‘African’ leadership and management in organization studies: Tensions, contradictions and possibilities”, in: *Organization*, 18 (3): pages 365-386.
- Patterson, K. and Winston, B. (eds.) (2016), *Leading an African Renaissance: Opportunities and Challenges*. Berlin: Springer.
- Ratten, V. and Jones, P. (2018), “Bringing Africa into Entrepreneurship Research”, pages 9-27, in: Dana, L. P., Ratten, V. and Honyenuga, B. (eds), *African Entrepreneurship*. Cham: Palgrave Macmillan.
- Sambuli, N. and Whitt, J. P. (2017), *Technology Innovation Hubs and Policy Engagement*. Brighton, UK: Institute of Development Studies (IDS). Retrieved from: <https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/12860>
- Schuerkens, U. (ed.) (2014), *Global Management, Local Resistances*. London and New York: Routledge.

- Schuerkens, U., A. Mamman and M. Branine (eds) (2019), *Pour une sociologie du management en Afrique et dans le monde arabe*. Paris: L'Harmattan.
- Ward, J. (2016), *Perpetuating the Family Business: 50 Lessons Learned from Long Lasting, Successful Families in Business*. Berlin: Springer.
- Yousfi, H. (2014), "Rethinking hybridity in postcolonial contexts: What changes and what persists? The Tunisian case of Poulina's managers", in: *Organization Studies*, 35 (3): pages 393-421.
- Zoogah, D. B. and Beugré, C. D. (2012), *Managing Organizational Behavior in the African Context*. London and New York: Routledge.

Websites for the Délégation Générale à l'Entreprenariat Rapide des Femmes et des Jeunes (DER) and for the three Case Study Enterprises in Senegal:

- Délégation Générale à l'Entreprenariat Rapide des Femmes et des Jeunes: <https://der.sn/>
- ClicMagic: <https://www.clicmagic.net/>
- DIGICLEVER: <http://www.digiclever.sn/>
- Volkeno: <https://www.volkeno.sn/>

Start Small, Dream Big: Socio-Technical Resources and Digitalization as Drivers of Firm Growth and Agility in Africa¹

Emmanuel Yeboah-Assiamah² and Aminu Mamman³

1 Introduction

The role of Micro, Small Scale and Medium Enterprises (MSMEs) in the economic development of developing countries cannot be overestimated (Maziriri & Chivandi, 2020; Obi et al., 2018). In Ghana for instance, at a recent launch of its new MSME policy in June 2021 in Accra, the President of Ghana reiterated that "...the sector employs more than 80% of the workforce and generates some 70% of the gross domestic product"⁴. The impact of family businesses and their activities for the growth of national and global economies has been established in an extant literature (Miroshnychenko/De Massis/Miller & Barontini, 2021; Basco/Calabrò & Campopiano, 2019; Farrukh Khan, Khan, Ramzani, & Soladoye, 2017). Family businesses are conceptualized to mean those firms with which a family has effective control over the strategic direction of the business, and the business in turn contributes to the family's wealth, income, or identity, and this type of business remains the dominant form of organization around the world (Astrachan & Shanker, 2003; IFERA, 2003). These firms mostly run their businesses based on small to medium household budgets which just meet the contextual economic situation of the people. Due to inadequate start-up capital many prospective businesspeople rely on family support, and consequently incorporate their family members to start, to run, and to grow these businesses into bigger ventures, depending on the strategic direction of the entrepreneur-manager.

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⁴ Ministry of Trade and Industry (MoTI), President Launches National MSME Policy, 10/6/2021; for download: <https://moti.gov.gh/article.php?id=NTE=>. At the launch of the MSME policy in June 2021 in Accra, the President of Ghana explained "we cannot realise this vision fully without creating and strengthening an agency for the MSME sector to play a lead role in the transformation process... "One might ask: why MSMEs? The answer is simple. It is because the sector employs more than 80% of the workforce and generates some 70% of the gross domestic product".

It is estimated that the family businesses serve not less than two thirds of the world's companies and generate between 70% and 90% of the global gross domestic product (GDP) on a yearly basis (Family Firm Institute, 2016). Based on the aggregate impact of family businesses, substantial governmental resources are used to incentivize Small and Medium-Scale Enterprises (SME) globally. These businesses mostly form the smallest basic unit of organizations which over time would develop into conglomerates and may grow towards the internationalization phase. This suggests that family businesses remain crucial in the whole architecture of entrepreneurship and for the internationalization of the SMEs. The SME Competitiveness Report (2016), edited by the International Trade Centre (ITC)⁵, suggests that SMEs, and particularly so the family businesses as in Ghana, form more than eighty-five percent (85%) of the businesses which are found within the private sector. This enterprise sector also contributes at least seventy percent (70%) of Ghana's gross domestic product (GDP), and approximately more than 50% of full-time employment in the private sector. Family businesses or SMEs serve as the instruments for the achievement of the national macroeconomic objectives. Accordingly, the SMEs and the Family Businesses have often been viewed as the fuel and the engine of the national economic vehicles, as efficient job creators, and as the seedbeds of big businesses (Abor & Quartey, 2010).

Despite its centrality, it appears that in the literature there is not enough enquiry into the operationalization, maturation, and consolidation activities of these business entities, especially within the African context. Much of the extant literature either deals with the processes of the transaction and integration phases of family business succession (see Fendri & Nguyen, 2019; Ragozzino & Reuer, 2007), or discusses those features which are related to family businesses (including motivation and the practical approaches to the succession, as well as the barriers) (see Gagne et al., 2021; Kiwia et al., 2019). Although these business units mostly start from a humble beginning, over time they need to demonstrate growth, innovation, expansion, and agility to be a sustainable business and to meet the test of relevance. In other words, to remain in business, these companies need to update their product range, to improve production processes, and perhaps to diversify their businesses into new products or markets, with a view of growing and becoming more viable. Consequently, these companies necessarily need to remain innovative and to become agile (Miroshnychenko et al., 2021). According to Laforet and Tann (2006), companies with a high innovative intensity incorporate innovation as a part of their business strategy and are goal-oriented in their innovation activities. For such companies, the organisational culture is

⁵ See on the editions of the SME Competitiveness Outlook; for download: <https://www.intracen.org/SMEOutlook/>

underpinned by values that promote the adaptive creation of new ideas that feed into the original business plan. Meanwhile, much research in business literature has not been done to explore how family businesses begin, grow, and expand into business conglomerates within African context. To fill this research gap, the study sought to investigate the life cycle of a business conglomerate in Ghana. The firm has excelled in the beauty and cosmetic industry. Although this business started small, the analysis of the specific dynamic and innovative “exploits” of the entrepreneur/manager brought out unique themes which will make a significant contribution to the entrepreneurship literature. The study is underpinned by the following research questions:

How do budding businesses grow over time?

How does digitalization help in firm growth?

What lessons can be learnt from businesses with small beginnings?

The essay has seven sections. After the Introduction in section 1, we find in section 2 an outline of the Theoretical Framework for Analysing the Growth of Enterprises and of the Methodology for the Research Strategy. In section 3 the origin and the evolution of the FC Beauty Group are presented, while section 4 addresses the Drivers of Growth of the FC Beauty Group. Section 5

discusses the Digitalization and the Organizational Growth of the FC Beauty Group. Section 6 outlines the role of the Unique Integrated Business Model of the established business empire of the FC Beauty Group. In section 7 Conclusions and Policy Recommendations are given.

2 Theoretical Framework and Methodology for the Research Strategy

2.1 The Theoretical Framework for Analysing the Growth of Enterprises

This study was underpinned by Penrose’s theory of firm growth (Penrose, 1959) which regards the firm as a bundle of resources and lays emphasis on the role of managers in deploying available resources to grow and to expand firms. Among other things, key tenets of the theory relate to the firm-specific and entrepreneurial skills of managers which would determine whether firms will grow or decline. Resources, including social capital, available to the firm are also crucial in driving the firm’s growth, expansion, diversification, and innovation. Penrose (1959) conceptualizes the firm as an institution created by individual (s) to serve the purposes of people and managers who get motivated by the quest for organizational survival and growth. The theory also suggests that managers strive for innovation and adaptation to the environment by deploying an array of resources available (see also Kor & Mahoney, 2000). The ability of managers to effectively integrate their management prowess with the unique resources and to enhance the dynamics are key to the positive evolution and growth. In essence, for

the firm to witness greater strides, there must be human motivation and conscious human decision (Kor & Mahoney, 2000), p. 2)

The ability to think outside the box, and even to enter new markets, requires an adaptable and versatile model of entrepreneurial prowess, including, *inter alia*, "... imaginative effort, the sense of timing, the instinctive recognition," and these traits are not readily available to all firms (Penrose, 1959, p. 37). Consequently, the knowledge base of managers (firm-specific) and the available resources (including social capital), integrated with the conceptual skills (entrepreneurial skills involving the ability to imagine), determine how best firms take advantage of their environments to utilize available opportunities and potentials. This point has been forcefully made by Boulding (1956) who contends that a firm's distinctive resources and competences have implications for the managers' ability to conceptualize and imagine the future which are key determinants of a firm's growth strategy. Another critical determinant of firm growth, according to Penrose (1959), involves what occurs in the firm's external environment denoted by the external demand for the organization's products and services. That notwithstanding, the external environment should not be made to pose unbearable constraints to the growth of the organization because "there are opportunities for profitable investment open somewhere in the economy" (Penrose 1959, p. 43), and a really "enterprising entrepreneur has not often ... taken demand as 'given' but rather as something he ought to be able to do something about" (Penrose 1959, p. 80). Consequently, the firm's productive prospects essentially entail the productive possibilities that the manager (entrepreneur) would take advantage of and leverage on for the firm's benefits (Penrose 1959, p. 31).

The literature and the theory discussed so far are relevant and can help to explain how the firm under study (FC Beauty Group in Ghana) evolved from a simple firm to a business conglomerate. The extent to which managerial innovation and the ability to leverage on available resources to grow and to sustain the firm are discussed below.

2.2 Methodology and Research Strategy

The study adopted the case study design within the qualitative research approach. A case is examined to understand an issue or to provide input to an existing theory. A case study is the preferred strategy when 'why' and 'how' questions are being asked as the focus of the study (Yin, 1994; Yin 2003). Qualitative research involves the use of soft data in the form of expressions, gestures, impressions, and symbols of the respondents as well as of the meanings people impose on certain phenomenon (Myers and Newman, 2007). Through this approach, the study was able to combine multiple data collection tools, such as in-depth interviews, Focus Group Discussions (FGDs), and observations, which provide a stronger evidence-based argument. This point has been argued by Cresswell, ed. (2009) saying that

a qualitative study, especially a case study, provides an assortment of information sources that are very interactive and humanistic. The purposive sampling technique was used to target the FC Beauty Group which is an indigenous business entity of Ghana which has been in operation for at least three (3) decades and has since grown from a single business unit into a business empire. Data was gathered between February and June of 2020. The study adopted the use of a narrative enquiry, a technique to seek primary data from the entrepreneur/manager and her outfit. Data were audio-recorded and were later played back for transcription. Data were organized into specific themes by taking note of the relevant trends. The study also made additional use of secondary data which enabled the researcher to identify information being relevant to understand the activities and the trends of business operations of the FC Business Group. The secondary data came from company reports, bulletins, newspaper reports, and from online information being relevant to the company (see box 1).

Box 1: Profile of FC Beauty Group Ltd as the Enterprise Organization Studied

FC Beauty Group Ltd. is a family-owned company, a business conglomerate with five subsidiaries and a foundation, which have grown and developed over the past three (3) decades in Accra, Ghana, West Africa. It has a staff strength of about 90 people. Since its inception, the company has trained over 6,000 people, mostly young girls across the subregion. It is essentially a family business, and its shareholders are the founder, Grace Amey-Obeng, her husband, Mr. Johnson Obeng, and their children, Barbara Sika Obeng, James Obeng, and Pokuaa Obeng.

The FC Beauty Group is a business conglomerate, which was established by a professional beauty therapist after she received training in beauty therapy from the advanced Western world. Upon returning to Ghana, she saw a huge market potential, which remained untouched. Being driven by the passion to practise what she has learnt, she decided to set up the business which has grown ever since.

Websites (selected):

<https://de-de.facebook.com/FCBeautyKlinik>

https://de-de.facebook.com/pg/FCBeautyKlinik/posts/?ref=page_internal

<https://www.beautynailhairsalons.com/GH/Accra/299329206773545/FC-Beauty-group-Ltd>

<https://gh.linkedin.com/in/grace-amey-obeng-204756a0>

3 FC Beauty Group: Origin and Evolution of the Enterprise

This section presents and discusses data which were gathered from the field through interaction with the FC Beauty Group. The data are analysed from the field and relevant sources by adopting a thematic analysis of well discussed and buttressed narratives and images. The main themes derived from the data are presented below.

3.1 Origin, Trends, and Evolution of the Firm into a Conglomerate

The firm started small, but penetrated the market in a novel way – The new business idea

Business start-ups must necessarily not kick-start with a fortune or huge capital but could evolve from a humble beginning. It was at a time when business players in the industry were primarily and predominantly stationed at some points where clients needed to take some time off their busy schedules to see their hairdressers and other beauticians. To penetrate the market, the entrepreneur (Grace Amey-Obeng⁶) adopted an approach that would make her customers sensitive and responsive. This involved a mobile service that was not existent so far in the industry. During fieldwork, it was explained: *It started off as a mobile therapy. She started off as a mobile therapist, moving from door to door and offering beauty services to clients and prospective clients as such.* Additionally, what she introduced into the market of Accra was something new and had not been the order of the day. It was put out: *At the time when it started, this whole concept of beauty therapy was new. What we had in terms of beauty was just the normal hairdressing salons and all that. She started introducing the makeup and facial therapy and all those things. And so, she was doing door to door business.*

Small Beginning, then Growing into a Business Empire: The Magic behind?

The company has grown into a business conglomerate as it has not less than five key subsidiaries under the FC Beauty umbrella. The company began as a small firm and has grown over time into a big, comprehensive, and inter-related group of business activities. In the interview session, this was highlighted: *We have the FC Skin and Beauty Clinic, that is our salon which offers beauty services and regular salon services; we have the FC Beauty College which does the training in beauty therapy, cosmetology, spa and all those allied courses; and then we have the Salon Equipment and Beauty Supplies, a business for selling and supplying other salons with their beauty equipment; then we have the FC Cosmetics Industries where we manufacture our products; and finally we have the FC*

⁶ See the profile: <https://gh.linkedin.com/in/grace-amey-obeng-204756a0>

Perfumery and Cosmetics which is like a retail and wholesale arm of the group. But we have also the Grace Amey-Obeng - Foundation which does all the Corporate Social Responsibility (CSR) activities.

The company has become internationalized in the sense that it has most of its college students coming from all over the West African and African sub-regions. An approach which the company uses is of interest. It uses their former students as “brand ambassadors” when they leave for their countries. A key informant explained: *First, we have a lot of students coming from the West African sub-region, especially from Nigeria, Liberia, and Sierra Leone, but also from the Central African sub-region, especially Central African Republic and Equatorial Guinea, but sometimes students come from the East Africa sub-region. They come to school over here and so when they finish the school and are going home to practice, they need our products to work with. So, they use basically our products. Therefore, we have a lot of people coming to buy our products to use them in their locations.*

Growing demand and opportunities for business growth and expansion

To expand the business, the entrepreneur introduced the idea of door-to-door service. People used the door-to-door services and the business started booming. It started operating like a ‘one-man’ salon at its current location, a shop at Accra-Circle. People bought into the new business model, and there was a growing interest and demand for the services. A key respondent intimated: *Demand for services increased and the entrepreneur was the only one who knew what to do in terms of offering these services. She decided to train some of her staff, also her sales staff, to help in offering the services which were growing in terms of demand. And so, the education side of the conglomerate also grew to respond to the growing demand for services.*

3.2 The increased demand saw the growth of side-businesses and of other subsidiaries

The most businesses usually emanate from small beginnings and grow over time to become business empires. Peterside (2003) observes that even the industrial revolution in Britain began with basic inventions such as a spinning jenny and a flying shuttle which steadily increased the productivity in the textile industry. The story of the FC Group provides a classic example of how a business entity could begin from basic services to quickly accelerate productivity gains and enterprise operations to become a business empire within a sector. The following examples for such subsidiaries give proof of this profitable trend:

a. FC Beauty College

The growth in demand for the services nearly overwhelmed the capacity of the founder since she was the only professional in the business. To respond to the growing demand, she adopted an in-house training approach which saw training other people for the purpose of providing beauty services as a solution to overcome the skills deficit. What followed was the creation of the FC Beauty College. During the fieldwork, lessons in the FC Beauty College which were in session were observed. The researcher and his assistant had the privilege to observe the process of teaching and learning. During the interview, a key respondent noted: *When she (the entrepreneur/ manager) trained two people, others were arguing if you train two people then why do you not train us also; so, the more the training work started spreading, the more people started coming, and eventually she had to get a bigger space for training to actually run the course. Various courses in beauty therapy, spa therapy, cosmetology, hairdressing, manicure, pedicure, and various other courses in beauty therapy were given. And so, this was the way how the college grew, and it has now grown to become the FC Beauty College which I believe you know is the leading beauty therapy institution in West Africa. And so, we are the pioneers when it comes to beauty therapy education in Ghana.*

a. FC Cosmetics Industry

The growth in demand and the need to expand operations consequently led to an increase in demand for FC's beauty products which the company sought to manufacture in-house because of the speciality of their operations and the need to have tailor-made products for the black skin. It was argued: *And then also, our product manufacturing bit also grew because you will need products to work on the clients. Those products were not around because of the uniqueness of the black skin, and so we needed to have products that have been specially formulated to address the black skin. We also had to go into the manufacturing of our own products. That is how it came that we have now our own factory that manufactures over fifty lines of skin care products to treat various lines of skin conditions. Our products, even though they are cosmetics products, they are therapeutic in nature. It means that you cannot go to the shelf and pick anyone you like and use. Somebody has to prescribe it for you because of the kind of skin condition that you are dealing with or which you are having; you may need a combination of this and that to address the issue, and somebody has to guide you considering the uniqueness of our products.*

The FC Cosmetics Industry is engaging in the production of beauty therapy products that consider the context of clients who are predominantly black. The products include Forever Clair Skin Care; Hair Care; FC Spa Collection; FC Rose Professional Line; and FC Make-Up Lines and are produced in a fully automated

state-of-the-art production facility. The picture below illustrates a sample of the products which FC Cosmetics Industry produces for the market.



The types of products are adapted to the market expectations. Blemish Control products and Sun Block products play a role on the market. Market research shows the trends of growth, and FC Cosmetics Industry can take a share of the market in West Africa.⁷

⁷ See new reports on the global blemish products market trends and about the global competition: <https://www.marketwatch.com/press-release/blemish-balm-product-market-compound-annual-growth-rate-cagr-top-players-size-share-and-forecast-to-2021-2027-2022-01-13>

4 FC Beauty Group: Drivers of Growth

4.1 Management Specialty, the Role of Human Resources, and the Outreach Policy

Scientific Training and Knowledge Driven Courses

It emerged that basic factors that helped the company to mature into a conglomerate had been the professionalism and the techniques adopted by its CEO. The company adopted a highly scientific approach to diagnose and to take trainees through before they graduate or will be allowed to provide service to customers. It was stated: *When it comes to training, we emphasize the science behind the knowledge. We teach a lot of scientific knowledge; we emphasize scientific knowledge even before you can start any of the training courses, and so we have to do about three months of anatomy and physiology to give you a firm grounding into what you are going to study. One of our unique selling propositions is that we do a lot of science training for our students before they start practising, and so it is not like just coming to start practising.*

Public Sensitization and Outreach through Different Media

When the entrepreneur/manager began in the initial phases, the new approach she brought to the market was quintessentially innovative. This enabled her to effectively penetrate the market and to win the confidence of customers. It is said: *We were doing a lot of outreaches, a lot of educational campaigns in the markets, with the market women, and you know because the people are abusing their skin and are using all sorts of harmful chemicals, and so they are suffering from the effects of skin bleaching and all that. Once we were demonstrating our method and they saw the efficacy or the effectiveness of our products they started patronising, and then the word spread. We were also doing some bit of media engagements, and eventually we have a column in The Mirror (an important mass media in Ghana), the leading weekend family newspaper, and you can see that we do a lot of education and sensitization in addition to our other mass media campaigns.*

4.2 Further Insights into the Drivers of Growth - Key Supplementary Factors

The FC Beauty Group is a leading brand in Ghana and the West African sub-region. The company did not start with a fortune or any jackpot yet has seen a steady growth over time. When the founder began the process, beauty therapy was a very new venture in the whole country. She basically started with the equivalent of about \$100 and the enterprise grew organically over time.

Initial Engagements

The founder has got passion for the kind of business she was venturing into. The CEO's mother (who had just passed on during fieldwork) used to operate a beauty salon. The daughter (founder of FC Beauty Group) when she was in secondary school (high school) used to work in the salon during vacation. It was from there that she developed interest and inspiration in the beauty industry at a tender age. Therefore, it was just a natural progression that, after secondary school, she went to the UK and to other schools in the US to study beauty care and related professions.

Social Networks as Brand Ambassadors

The company has devised an innovative approach to use their former students as growth-enforcing conduits to reach out to new markets. Given that the company also operates as a beauty therapy school, the students upon their completion and when setting up their own beauty businesses introduce and adopt the use of FC beauty products. Through this model, the beauty products have reached many new markets both locally, regionally, and internationally. During the fieldwork, this key trend has emerged: *“Exactly, our past students are our brand ambassadors. Because when they finish school and find themselves wherever they find themselves, they use our products and that’s how they come and buy our products, and they use them wherever they go. So, automatically once they are done with the beauty training school, they are our brand ambassadors. There is a programme like that to convert students to brand ambassadors. So, it also helps us to get some mileage on the market”*.

Through this approach, the FC Beauty products have flooded the local Ghanaian market and have also made far-reaching penetration into the African sub-region and beyond. A key respondent recounted: *“Our products are in Nigeria, we have them in Liberia, we have people coming from the Central African Republic, we have people from South Africa. Sometimes people from US, Switzerland, and UK come to buy our products. So, our products are out there, even though we do not export directly and officially the products, but the people come to get the products”*.

Media Relationship

The company has harnessed the power of the mass media and in recent times the social media to grow and to become the company of choice when it comes to beauty products and the services in Ghana and beyond. It was stated: *“We have done (effectively we made use of the media), we rode on the back of the media for a very long time. Like I told you, for a long time we had a page in The Mirror newspaper for running our products. We have done a lot of media sponsorships for our products and all that, and so we have a lot of mass media campaigns; we*

also have billboards, and we have sponsored some media campaigns and all that... ”.

4.3 Driving Growth through Capturing Synergies

A Unique Integrated Business Model

The comprehensive and integrated business model adopted by the company has been one of its competitive advantages. It has over time developed five inter-related business subsidiaries which are all related to the overarching goal of providing cosmetic and beauty services to clients. This is an integrated model well explicated below in section 6 which also throws much insight into how the model operates.

Professionalism and managerial competence

Although the FC Beauty Group is a family-owned business, the company pays particular attention to technical skills, to professionalism, and to a skill set in their operations and managerial undertakings. Despite incorporating family members in the governance regime, each of these are also engaged on their professional rights and competencies. A respondent who is not a family member intimated: “...All these things require technical competencies to work with. Our CEO is a Medical Beautician who is UK trained. She has gone to various professional courses and programmes in South Africa and other parts of the world. Production side is run by our CEO’s husband and son. The husband is a Cosmetic Scientist and the son who is the General Manager for the production facility also has a background in Pharmaceutical and Cosmetic Science. Our CEO’s first daughter also did something in Molecular Biochemistry which basically gives her the technical competencies to do what she does. Thus, helping with our school, skin clinic, manufacturing, and submission of colour cosmetics...”.

It was also observed that one critical success factor of the company is its belief in its human resources and regarding them as the firm’s most valued asset. The firm encourages its people to continuously train and to retrain on the job to enhance their professionalism and their productivity. For example, a key informant mentioned: “There is a lot of continuous improvement for every staff member working in various positions across the globe... Our field is very technical, and we are the only company that does the work we do in terms of manufacturing therapeutic cosmetics products for the black skin. To produce these products, you need to have consulted an expert who will recommend the product to you at the point of sales or wherever you are buying them... It has really helped us to produce superior products that have helped to resolve very complex skin issues.”

The technical competencies help the firm a lot, given that there are new companies that are coming up in the cosmetics space that may not necessarily have invested in the technical space.

Strategic Partnerships

The company forms strategic partnerships with both public and private entities which continue to expand its frontiers, relevance, and opportunities for business growth. It is currently collaborating with the Council for Technical and Vocational Training of Ghana (*COTVET*) to retrain and to upgrade the skill level of many Ghanaian beauticians. In other words, the company will enhance the professionalism and the skills of the people. It was stated: *We are currently running a programme with COTVET under the Ghana TVET (Technical and Vocational Education and Training) Voucher System. Under this system, we are training salon owners, beauticians, and hairdressers who are already working and are trying to enhance their skills. We have done it so far. So, we usually have such projects with state agencies.*

Respondents provided similar experiences of how this kind of activity has been done in the past as well: *We have in the past done training for the members of the Ghana Hairdressers and Beauticians Association (GHABA) in some of the regions including Northern, Volta, and Ashanti Regions. We trained some of their people for them under the Skills Development Fund (SDF). As and when the opportunities come for us to run such programmes and to enhance skills; we partner with organisations, and we do that so as we are open for such partnerships in moving forward.*

Another key respondent brought the argument closer home by explaining that: *Currently, our CEO was elected as the vice president for SND last month. She was the national treasurer for 4 years. She was a member for the national council of AGI. She has also been a chair for the toiletries and cosmetics sector of AGI. She is also a member for other professional organizations like the Ghana Cosmetologist Federation⁸, the Professional Cosmetologist and Beautician Association of Ghana, the Ghana Chamber of Commerce⁹, and other professional women organizations...Just to network, build the right strategic connections for the company. We have also built a very solid reputation. A lot of advocacies was done for women and the girl child in general. We also give back to the society through sponsoring the poor in our schools. We do donations here and there.*

⁸ See: <https://www.graphic.com.gh/news/general-news/ghana-cosmetology-and-wellness-federation-formed-to-ensure-welfare-of-members-patrons.html>

⁹ See: <https://www.ghanachamber.org/>

Internationally Relevant Actions

Although the company has not yet directly gone into exportation of products, it nonetheless has gained ground in the international business scene already. It is said: *For export, because we do not directly export, what we do is that people and distributors come and buy our products and just take them away to sell them. We recently sent some of our products to East Africa which were in demand there, and we are hoping that it will bring in additional revenues to us.*

Obviously, synergy effects are strong in the FC Beauty Group, and much more can be expected as the business activities get regional and international awareness.

5 Digitalization and Organizational Growth of the FC Beauty Group

The role of digitalization for organizational growth, competitiveness, and sustainability cannot be overemphasized (Viswanathan & Telukdarie, 2021). No matter how unique one's products and services are, no matter how robust the systems and procedures of business are aligned, in this era of a digital and a knowledge economy, these assets will go unnoticed and will not translate into demand for the firm's goods and services if it does not engage in digital marketing or does not take advantage of digital technologies in its design, production, distribution, and marketing. In the case of the FC Beauty Group, the use of both the traditional media (newspapers and TV) as well as the social media (a more recent development for Ghana) to effectively communicate and to market their brand products has gone a long way to position them at the media as a preferred local cosmetic product that suits the African skin. It goes without saying that entrepreneurs and businesses need traditional and more and more social media to effectively brand their products, to be in touch with their customers, and to reach prospective customers. Digital technology-using social media enable firms to be more responsive to customer queries and concerns, especially when such concerns are raised on the social media platforms. This makes the role of technology very quintessential for business growth and for its innovative drive. The FC Beauty Group and its subsidiaries have leveraged social media and digital technology to optimize its operations and its strategic positioning.

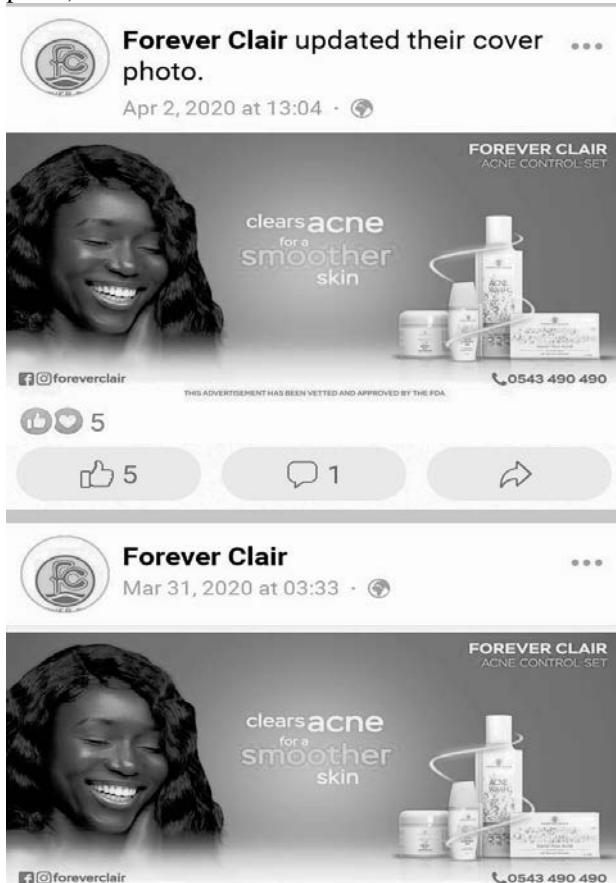
Digital Platforms and Social Media avenues

During the research investigation, it emerged from the study that the FC Beauty Group has several digital platforms and social media avenues which they use for their operations. An officer explained: *We are on Facebook, Instagram, WhatsApp, can be reached by E-Mail and we have a website. We are very active on Facebook, Instagram, and WhatsApp. We upload updates of our activities on the social media. We interact with people via these channels. They put their questions there and we do our best to answer them within 24 hours. We have paid*

advertisements on Facebook. We use our E-Mails and the website. We have lots of information about us over there as well. You can also call our numbers to interact with us.

Social Media and Innovative Marketing Techniques

By using the traditional and the social media, the FC Beauty Group has been able to carve a niche for itself by reaching out to its real and potential customers. It has many social media avenues, which are updated regularly to keep pace with the comments of its clients who may want to know more about the current products or to enquire into new product developments. This is particularly important given that the firm is operating across the African sub-regions. The picture below was extracted from the social media handles of FC Beauty Group (social media cover photo).



The role of social media, especially its relevance to marketing communication, has become a buzzword in the business world and academia (Adeola et al., 2020; Pantano et al., 2019; Dodoo, & Wu, 2019). Many forward-looking organizations have effectively adopted the use of social media to promote and to enhance their marketing strategies and their sales performance. The FC Beauty Group is not left behind in leveraging new digital technology to enhance its marketing strength and its brand equity.

More recent developments

During the investigation it was revealed that the adoption and the rigorous deployment of digitalization was only a recent development. This suggests that the company had relied heavily on newspapers, radio, and television as well as “word-of-mouth” and referrals for its business activities and marketing. In other words, it had not been very keen on digitalization. However, the outbreak of COVID-19 has served as a major catalyst for the firm to harness the benefits of digital technology and to optimize thereby its business activities. In terms of digitalization, it may be a “late starter”, but it is intensifying its deployment of digital platforms for marketing activities and for its teaching services. During the interview, it emerged: *It (adoption of digitalization) is very recent. We intensified it about 3 years ago, but we increased it since the outbreak of COVID-19. It is something that we are trying to embrace strongly. It forms an important part of our operations. ...It is cheap, it is more convenient, the access to information is faster, and it reduces in-person or face-to-face communication during the pandemic.*

This was corroborated by a respondent who hinted: *We might be a little bit ahead in terms of our school (FC Beauty College) due to the hybrid system of training that we use. I think our competitors are trying to catch up with us on this model. I am not able to speak on the rest of the issues. Some of our competitors are even doing better than we in terms of using social media to sell their products. Marketing Communication uses both the traditional media and the social media. They complement each other. But the young people are looking out very actively on social media so that it is just prudent to focus more on social media than on the traditional media. They are not watching TV or listening to radio, and so we just need to take our ideas to them by their own space and by their preferred media. So, we are flowing with the current.*

We are recognizing a digitalization along the whole value chain. This is considered for some segments of the value chain (see the box 2 below):

Box 2: Deployment of Digitalization along the Value Chain of the FC Beauty Group

Marketing:

We have social media handles and the website. So, we are pushing a lot of updates there, including paid advertisements and billboards. We have a dedicated team that solely focuses on our activities on social media.

Training:

Most of the young people have social media accounts so that it is only smart that we are there and put everything that we already have in the traditional media in a digitalized form on the social media; we pay some few dollars to get our sponsored advertisements to get an appreciable number of views and suggestions. We even offer free social media training for our students as part of our value proposition. They can do some of these things on their own after the online training. We are working to collaborate with other companies and technical universities, especially the Koforidua Technical University (KTU) to give social media training to our students and to other social media users. So, we will provide the training which will be certified by KTU.

Management:

Management has endorsed digitalization and social media. It is part of the broader strategy of trying to go digital. We are making sure that it is disseminated along the value chain. We communicate via emails. We do a lot of virtual meetings now. Our last management meeting was done virtually. This is cheaper and will cause less harm to environment since we will not be printing a lot of papers. We also conserve a lot of electricity. It is cost-effective to go digital.

Competition:

Competition will always be there. It is tough. We did not have a lot of beauty companies around when we started, but now we have a lot of them. We also have very cheap imports from China and elsewhere. We are trying very hard to use social media to reach an appreciable chunk of our customers.

Production:

Digitalization at FC Cosmetics Industry has enhanced production processes which improve standardization and quality assurance, reduction in production time, and large-scale production to meet the demand of a growing customer base. Thereby, the manual work and the related errors have also been reduced.

Distribution and Transport:

Most of the clients make orders or purchases using digital means, especially social media, so that the FC Beauty Group will receive them at their end. The company follows up and with the help of dispatch riders, who are using digital apps such as Google maps and Uber apps, the items are transported and delivered with ease to the clients at their respective destinations. This has led to an improvement in productivity in the supply chain, thereby reducing costs and errors. The door-to-door service operated by the FC Beauty Klinik is powered by digitalization as beauticians are able to respond quickly to orders and to offer services to clients at their respective locations, by using digital apps for their journeys.

Websites:

Koforidua Technical University (KTU): <https://www.ktu.edu.gh/>

Source: Authors

Digitalization and crisis management: COVID-19

In the outbreak of COVID 19 and its impact on social distancing among others, the FC Beauty Group, especially its FC Beauty College subsidiary has intensified its adoption of digital means to interact with its students. In other words, the COVID 19 crisis has compelled the FC Beauty College to adopt virtual means in its interaction with students. A key respondent explained:

The outbreak of COVID-19 has forced a lot of companies to be very innovative with how we operate. Our school (FC Beauty College) now uses the hybrid system where we blend the online teaching and in-person teaching. All our theory classes are done online through Zoom, Google Meets, and other online applications to roll out our theory lessons. It is the practical lessons that for the students need to come to the facility. They do not even stay for long to finish all their tasks. We upload assignments, videos, lecture slides, announcements, and other materials on the student portal.

Clearly, the reaction to the COVID-19 pandemic further demonstrates the entrepreneurial qualities of those running the FC Beauty Group. They can respond in a way that only a nimble and agile firm can achieve. They have the entrepreneurial acumen and innovative mindset to identify the tool and the instruments to address the challenges brought about by the pandemic.

6 Insights: How the Integrated Business Model Works

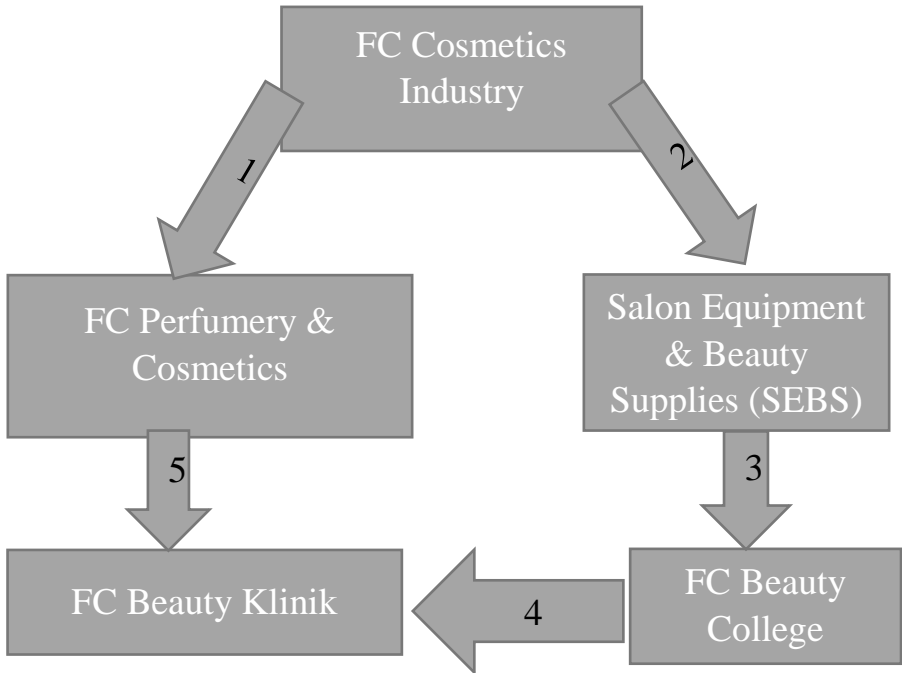
The unique integrated business model (UIBM) adopted by the company is one of the major assets creating its competitive advantages. The in-house methodology to detect and to develop 'home-grown' solutions that clearly suit the Ghanaian and African skin has made the FC Beauty Group a big name for the purchases and expectations of the households in the industry. It was stated in the interviews: *"I think that our unique approach to business is that we are the only company that has a 360-degree approach to beauty. We manufacture our own products; we treat and even train the people who are going to treat you, and we even supply the products. Most companies do not do that. So, we can provide for that 360-degree approach towards business, because of the existence of the unique integrated business model (UIBM), and this model has stood the test of time. And because our products are of very high quality and because they have been specially formulated to suit the black skin, we have gained competitive strengths"*.

A key respondent illustrated how the integrated business model is operationalized as well as the inter-linkages between the five key subsidiaries of the FC Beauty Group: *Our subsidiaries are autonomous entities that are operating on their own even though every entity works towards the bigger company. They work with unique objectives. The manufacturing wing has a different objective from the school even though there are some forms of linkages. They manufacture products that are used in our school. Our manufacturing wing also helps to supply some of our products to our students. So, there is correlation between us, the five entities. There is synergy between us, the five entities, and thus, we all work together to achieve our overall objective of becoming one of the leading beauty brands in Africa that produce superior products to address various skin and beauty issues.*

Dwelling much on the strength of the integrated business model, a respondent explained forcefully: *"It can never be a disadvantage to work this way. All the subsidiaries are doing unique things. They are all helping the company and its overall objectives. All of them are addressing various issues within the beauty space. There is a common goal that we are all trying to achieve, but we are using different means to achieve it. They complement each other. The factory produces the product and then we have the wholesale division, and the retail division which sells the product. We also have the school which uses the products for which we need to train the students. We have an enterprise that distributes the beauty equipment. We also have the skin clinic. We are giving a full beauty service."*

The inter-linkages between the five core subsidiaries of the FC Beauty Group are made visible in the figure below and are analysed in the box which is attached below.

Figure: Inter-Linkages between the five subsidiaries of the FC Beauty Group - The Integrated Business Model (IBM)



Notes:

1. The FC Perfumery & Cosmetics serves as the distribution outlet for the FC Cosmetics Industry
2. The SEBS also serves as an outlet for FC Perfumery & Cosmetics in terms of beauty products
3. The SEBS puts together professional training packs for students of the FC Beauty College
4. The FC Beauty College supplies beauty specialists to the FC Beauty Klinik

The box 3 below explains the inter-linkages of the five subsidiaries in more detail. It is argued that the integrated business model (IBM) works for the whole group of companies (FC Beauty Group).

Box 3: How does the integrated business model operate?

The FC Beauty Group has its core strength in its strong emphasis on the production of quality products and affordable customized Forever Clair (FC) products. FC Cosmetics are duly registered with the Ghana Standards Authority and the Food and Drugs Authority. Its product lines (Forever Clair Skin care, Hair care, Spa Collection, Rose line, and Make-up line) are produced in a fully automated state-of-the-art production facility.

The group is made up of 5 subsidiaries, and an NGO as a foundation. These are:

- FC Skin & Beauty Klinik Limited
- FC Beauty College Limited
- FC Cosmetics Industries Limited
- FC Perfumery & Cosmetics Limited
- Salon Equipment and Beauty Supplies (SEBS) Limited &
- Grace Amey-Obeng Foundation International (GAOFI)

FC Beauty College: It is the premier beauty therapy training institute in Ghana and West Africa, and it has trained over 6,000 students since its inception, most of whom are either working or are self-employed. The College offers courses in Beauty Therapy, Spa Therapy, and in Cosmetology at the Diploma and Advanced Diploma levels. Specialist Courses are available for practicing therapists as well. The school is registered with the Ghana Education Service on the computer selection programme as a Vocational Institute for Beauty Programmes, and it is accredited by the Council for Technical Vocational Education and Training (COTVET) as a Beauty Training Institute. The Curricula are based on the National Vocational Qualification (NVQ), the Council for Technical Vocational Education and Training (COTVET), and the International Technical Educational Certificate (ITEC) of UK.

FC Skin & Beauty Klinik: This is a solution centre for the treatment of complex skin and beauty needs of clients. It uses state-of-the-art equipment with well qualified Beauty Therapists and Cosmetologists who are recruited from the FC Beauty College. The Klinik offers the following services: Hair Treatment Services; Aesthetic Skin Treatment Services; Micro-pigmentation Services; Nail Reconstruction Services; Corrective Make-up Services; and Body Therapy Services.

FC Cosmetics Industries Ltd: This is the manufacturing wing of the FC Beauty Group which manufactures products for care and treatment such as Forever Clair Skin care, Hair care, Spa Collection, Rose line, and Make-up

line in a fully automated state-of-the-art production facility. The products are therapeutic in nature and require above-average packaging. Students at the FC Beauty College and Beauty Klinik are trained using FC Beauty Group's professional product lines. The products are distributed in various salons, cosmetic shops, shopping malls, and pharmacy shops.

FC Perfumery and Cosmetics: This is the distribution outlet for FC Cosmetics Industries. In other words, manufactured products from the FC Beauty Group are displayed and marketed via the FC Perfumery and Cosmetics platform which serves as a shopping outlet to link customers to the beauty products produced by the FC Beauty Group. It also keeps stock of other exotic and high-quality beauty products, such as perfumes and other skincare lines.

The Salon Equipment and Beauty Supplies (SEBS): This subsidiary of the FC Beauty Group focuses largely on putting together professional training packs for the students and graduates of the FC Beauty College. SEBS also imports and wholesales quality Beauty Therapy and Hairdressing equipment to meet local demands of hairdressers, salons, associations, schools, etc.

Websites:

Ghana Standards Authority (GSA): <https://www.gsa.gov.gh/>

Ghana Food and Drugs Authority (GFDA):

<https://www.google.com/search?client=firefox-b-d&q=Ghana+Food+and+Drugs+Authority>

FC Skin & Beauty Klinik Limited: <https://de-de.facebook.com/FC-Skin-Beauty-Klinik-1013389125343154/>

FC Beauty College Limited: <https://www.google.com/search?client=firefox-b-d&q=%EF%82%A7%09FC+Beauty+College+Limited>

FC Cosmetics Industries Limited: <https://directory.africa-business.com/business/a4814f1225/FC-Group-of-companies>

FC Perfumery & Cosmetics Limited:

https://www.ghanayello.com/company/15369/FC_Perfumery_Cosmetics

Salon Equipment and Beauty Supplies (SEBS) Limited:

<https://www.businessghana.com/site/directory/cosmetics/20393/Forever-Clair>

Grace Amey-Obeng Foundation International (GAOFI):

<https://www.facebook.com/gaofi/>

Ghana Education Service: <https://ges.gov.gh/>

Council for Technical Vocational Education and Training (COTVET):

<https://www.google.com/search?client=firefox-b-d&q=Council+for+Technical+Vocational+Education+and+Training+%28COTVET%29>

Source: Compiled by Authors

The figure and the box show how intensive the inter-linkages among the five subsidiaries are. Also, many stakeholders from outside are involved (standards-setting and other government offices and agencies, training institutions, media and advertising companies, suppliers of inputs and services, etc.

7 Conclusions and Policy Recommendations

Data from the study demonstrate how small beginnings with a steady and robust management approach, coupled with digitalization, could spark up business growth, innovation, and expansion. Although the case study in question is a business from humble beginning, the FC Beauty Group has grown into a formidable empire in the cosmetic industry of Ghana, through systematic management processes and through technical knowledge accumulation, but together with digital marketing efforts and by harnessing relevant resources, The following are key lessons, and important policy conclusions could be derived from the study:

The Power of “Technical Skills” and Sound Management Practices

Firstly, the entrepreneur/manager of the FC Beauty Group had technical skills in the beauty cosmetology venture; she sought to enter the field with professional training and knowledge received from Western countries. She only needed to contextualize the accumulated knowledge in the Ghanaian and the African space. The entrepreneur/manager had developed passion in this field since teenage days where her initial engagements and socialization processes had made her attracted by businesses related to cosmetics and beauty therapy. This inspiration came from her mother who operated a salon shop, and as a teenager she had spent her time in the salon during her vacations. From this, we can see that entrepreneurial activities which are borne out of already existing space were crowned with a further quest for technical and formal knowledge and skills in the business area. So, it was a long way to go and to influence the success of the business. Thus, the role of upbringing, formal and informal, of knowledge and skills cannot be over-emphasized when trying to understand the success of a firm and of its founder even in African context.

Doing the Extra-Ordinary and Thinking Outside the Box

For entrepreneurs to effectively penetrate a particular business space and market which is already dominated by others, one requires a well thought-through process which allows for a successful “entry strategy” and an “enter to stay capacity”. The case in point illustrates how at a time of entry the space was dominated by traditional salon shops stationed at a glued location; but observing the plight of the middle class and of some workers who would not have the luxury of time of

commuting to these “prime” points in town, the FC Beauty Group penetrated the market by beginning with the first mobile beauty therapy service. Through this entry and penetration strategy, the business started well and grew steadily over time since it effectively scanned the business environment to strategize a more bespoke service. In a word, an entrepreneur needs to identify a “niche” when entering to an existing market. Otherwise, the entrepreneur will be crowded out by the “first movers”.

Business Model

As businesses grow, managers tend to spread their capital in many other ventures because businesses are counselled “not to put all their eggs into one basket when they grow”. However, the risk is that many businesses spread their capital into many unrelated ventures which they may have no experience in or which they are unable to monitor. This might greatly affect the core business as the other peripheral and unrelated ventures only end up becoming unprofitable and succeed only in drawing resources and attention from the successful branches of the business. However, key lessons from this case study are that it is useful to invest in related areas such that the initial business serves as the core whilst the subsequent ones reinforce or provide forward and backward linkages to the core business. Although there are some start-up enterprises in Ghana with signs of competitiveness, the integrated business model of the FC Beauty Group remains unmatched and became a great source of its competitiveness.

Social Networking and Human Capital

More related to the above, the success or ability for products and services to reach a wider audience and to penetrate other markets involves the role of people. The basic idea of social capital however is that one’s family, friends, and associates constitute an important asset that can be called upon in crisis, can be enjoyed for its own sake, and/or can be leveraged for material gain (Putnam 1993; Woolcock & Narayan 2000). It is ‘the aggregate of the actual or potential resources which are linked to the possession of a durable network of institutionalized relationships of mutual acquaintance or recognition’ (Bourdieu 1986, p. 248). For Bourdieu (1986, p. 243), social capital is ‘made up of social obligations and connections which are convertible, in certain conditions, into economic capital and may be institutionalized in the form of a title of nobility’. This is clearly what the FC Beauty Group has done using its former students as conduits to reach many markets within the country and abroad. Through this process, the company’s products are active as brands on regional African and on global markets, serving targeted places, groups, and clients.

Branding and Strategic Partnerships

Businesses become success stories when they “brand” their corporate image and their products. The FC Beauty Group has branded itself as an indigenous firm whose beauty products particularly suit the African black skin. Consequently, on their social media handles, one could see chocolate to dark-skinned females being used for their branding purposes which enable customers to easily relate to and to identify with. Additionally, the ability of businesses to build strategic partnerships with other private or public entities will widen their operations and their market scope, their visibility, and their credence depending on the nature of the partnership.

A shift from traditional media to Web 2.0 in the business model

The data reveal that the company had previously been neck-deep with the traditional media (both TV and newspaper) to promote its activities and to conduct its marketing. However, in recent times the company is making a steady digital revolution which has also been boosted by the outbreak of COVID-19. Currently, the company has several social media and other digital platforms where staff and management interact; the company interacts with customers and prospective customers as well as with dedicated staff who handle these platforms. There is also a shift from traditional face-to-face classroom lectures towards a more digital mode of instruction adopted by the FC Beauty College.

The lessons provide empirical support to Penrose’s theory which lays emphasis on the role of managers in deploying available resources to grow and to expand firms. The ability to think outside the box, and to even enter new markets, requires an adaptable and versatile model of entrepreneurial prowess, including inter alia, “... imaginative effort, the sense of timing, the instinctive recognition”, and these traits are not readily available to all firms (Penrose, 1959, p. 37). Consequently, the knowledge base of the managers (firm-specific) and the available resources (including social capital), integrated with the conceptual skills (entrepreneurial skills involving the ability to imagine), determine how best firms take advantage of their environments to utilize available opportunities and potentials. This was clearly observed in the FC Beauty Group case. Observing the normal trend in the external environment, the manager (entrepreneur) imagined a novel business model. Indeed Penrose (1959) contends that “there are opportunities for profitable investment open somewhere in the economy” (Penrose, 1959, p. 43), and a really “enterprising entrepreneur has not often ... taken demand as ‘given’ but rather as something he ought to be able to do something about” (Penrose, 1959, p. 80). From the lessons and insights above, the firm leveraged on all available resources, especially the non-pecuniary ones, including inter alia specialty knowledge, strategic alliances, media power, social capital, including former students and trainees, to help drive the firm growth and to penetrate new markets, including international penetration. This sums up what

Penrose (1959) maintains when he suggests that an organization's productive prospects essentially entail all the productive possibilities that the manager (entrepreneur) would take advantage of and can leverage on for the firm's benefits (Penrose, 1959, p. 31).

The shift from traditional media to Web 2.0 and to the digital revolution, which has been boosted by a complex crisis (COVID-19), adds to the body of literature which contends that organizations grow over time and respond to emerging trends to survive, to remain competitive, and to sustain themselves in business. The nature of the market and the dynamics of clients and their demographics mostly dictate the pace as to how companies need to retool their business model to reach out and to catch-up with them. Social media adoption remains high for contemporary youth and that necessitates a digital revolution among firms. No matter how sound the management regime, without the adoption of right digital means to interact and to market products and services, firms will remain redundant and less competitive. The ability to read the market, to target prospective markets, and to deploy right digital means to engage and to serve their needs will enable firms to continue to grow and to remain competitive.

Note

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References

- Abor, J. & Quartey, P. (2010). Issues in SME development in Ghana and South Africa. In: *International research journal of finance and economics*, 39(6), pages 215-228.
- Adeola, O., Hinson, R. E., & Evans, O. (2020). Social media in marketing communications: A synthesis of successful strategies for the digital generation. In: *Digital Transformation in Business and Society* (pp. 61-81). Palgrave Macmillan, Cham.
- Astrachan, J. H., & Shanker, M. C. (2003). Family businesses' contribution to the US economy: A closer look. *Family business review*, 16(3), pages 211-219.
- Ayyagari, M., Demirguc-Kunt, A., & Maksimovic, V. (2007). *Firm innovation in emerging markets: The roles of governance and finance*. The World Bank.
- Basco, R., Calabrò, A. & Campopiano, G. (2019). Transgenerational entrepreneurship around the world: Implications for family business research and practice. In: *Journal of Family Business Strategy*, 10(4), 100249.
- Boulding, K. E. (1956). *The Image: Knowledge in Life and Society*. Ann Arbor Paperbacks: University of Michigan Press

- Bourdieu, P. (1986). The forms of capital, in: J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education*, Greenwood, New York (1986), pp. 241-258
- Cresswell, J. W. (Ed.). (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). Los Angeles: Sage.
- Dodoo, N. A., & Wu, L. (2019). Exploring the antecedent impact of personalised social media advertising on online impulse buying tendency. In: *International Journal of Internet Marketing and Advertising*, 13(1), pages 73-95.
- Family Firm Institute/FFI (2016). *Global data points*. (Accessed 4th December 2021; Retrieved from <http://www.ffi.org>)
- Farrukh, M., Khan, A. A., Khan, M. S., Ramzani, S. R. & Soladoye, B. S. A. (2017). Entrepreneurial intentions: the role of family factors, personality traits and self-efficacy. In: *World Journal of Entrepreneurship, Management and Sustainable Development*, 13 (4), pages 303-317
- Fendri, C. & Nguyen, P. (2019). Secrets of succession: how one family business reached the ninth generation. In: *Journal of Business Strategy*, 40 (5), pages 12-20
- Gagne, M., Marwick, C., Brun de Pontet, S. & Wrosch, C. (2021). Family business succession: What's motivation got to do with it? In: *Family Business Review*, 34(2), pages 154-167.
- Grundström, C., Öberg, C., & Rönnbäck, A. Ö. (2012). Family-owned manufacturing SMEs and innovativeness: A comparison between within-family successions and external takeovers. In: *Journal of family business strategy*, 3(3), pages 162-173.
- International Family Enterprise Research Academy (IFERA). (2003). Family Businesses Dominate: International Family Enterprise Research Academy (IFERA). In: *Family Business Review*, 16(4), pages 235-240.
- International Trade Centre (ITC) (2016). *SME Competitiveness Outlook 2016*. Available at: <https://www.intracen.org/SMEOutlook/SMECO2016/> (accessed on December 20, 2021)
- Ip, B., & Jacobs, G. (2006). Business succession planning: a review of the evidence. In: *Journal of Small Business and Enterprise Development*. 13(3), July 2006
- Kiwiya, R. H., Bengesi, K. M., & Ndyetabula, D. W. (2019). Succession planning and performance of family-owned small and medium enterprises in Arusha City–Tanzania. In: *Journal of Family Business Management*. December 2019. Access: <http://www.suaire.sua.ac.tz/handle/123456789/3023>
- Kor, Y. Y. & Mahoney, J. T. (2000), Edith Penrose's (1959) Contributions to the Resource-based View of Strategic Management. In: *Journal of Management Studies*, 41 (1), 2004, pp. 183-191
- Laforet, S., & Tann, J. (2006). Innovative characteristics of small manufacturing firms. In: *Journal of Small Business and Enterprise Development*. 2006/13, pages 363-380. Access: <http://dx.doi.org/10.1108/14626000610680253>
- Maziriri, E. T. & Chivandi, A. (2020). Modelling key predictors that stimulate the entrepreneurial performance of small and medium-sized enterprises (SMEs) and

- poverty reduction: Perspectives from SME managers in an emerging economy. In: *Acta Commercii*, 20(1), pages 1-15
- Miroshnychenko, I., De Massis, A., Miller, D., & Barontini, R. (2021). Family business growth around the world. In: *Entrepreneurship Theory and Practice*, 45(4), pages 682-708.
- Myers, M. D., & Newman, M. (2007). The qualitative interview in IS (Information Systems) research: Examining the craft. In: *Information and organization*, 17(1), pages 2-26.
- Obi, J., Ibidunni, A. S., Tolulope, A., Olokundun, M. A., Amaihian, A. B., Borishade, T. T. & Fred, P. (2018). Contribution of small and medium enterprises to economic development: Evidence from a transiting economy. In: *Data in brief*, 18, pages 835-839.
- Pantano, E., Priporas, C. V., & Migliano, G. (2019). Reshaping traditional marketing mix to include social media participation. In: *European Business Review*. Volume 31(2). Published 1 April 2019. Pages 162-178
- Peterside, Ch. S., 2003. Small and Medium Enterprises (SME) as critical growth engines. Actualizing Their Potentials in Nigeria. Friday 19, 2003. Available: <http://nigeriaworld.com/articles/2003/dec/192.html>. Accessed: 25.11.2017.
- Penrose, E. T. (1959). *The Theory of the Growth of the Firm*, Oxford: Blackwell.
- Putnam, R.D. (1993). The prosperous community: Social capital and public life. In: *American Prospect*, 13, pp. 35-42
- Ragozzino R. & Reuer, J. J. (2007). Initial public offerings and acquisition of entrepreneurial firms. In: *Strategic Organization*, 5(2), pages 155-176.
- Scholes, M. L., Wright, M., Westhead, P., Burrows, A., & Bruining, H. (2007). Information sharing, price negotiation and management buy-outs of private family-owned firms. In: *Small Business Economics*, 29(3), pages 329-349.
- Viswanathan, R., & Telukdarie, A. (2021). A systems dynamics approach to SME digitalization. *Procedia Computer Science*, 180, 816-824.
- Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. In: *The World Bank Research Observer*, 15(2), pages 225-249.
- Yin, R. K. (1994). Discovering the future of the case study method in evaluation research. In: *Evaluation practice*, 15(3), pages 283-290.
- Yin, R. K. (2003). *Case Study Research: Design and Methods*, 3rd ed., Sage, Thousand Oaks, CA, USA.
- Zahra, S. A. (2003). International expansion of US manufacturing family businesses: The effect of ownership and involvement. In: *Journal of business venturing*, 18(4), pages 495-512.

Analysis of the development of ICT in Senegal: The example of CYGMATECH¹

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1 Introduction

Information and communication technologies (ICT), especially the advanced ones such as artificial intelligence, biotechnology, and robotics, are controlling an increasing share of socio-economic activities. Analysing the impact of the “digital revolution”, considered as industry 4.0, the authors Curien and Muet (2004) claim that almost all sectors, such as education, health, and culture, have undergone notable changes.

Over the past decade, the use of technology has changed the way people communicate and interact with each other all over the world. ICT focuses on the use of communication and technological tools to achieve important goals in the promotion of health, education, and information. Satisfactory results were obtained in the sectors of health, education, microeconomic activities, prevention, and response to disasters. For example, new digital technologies and the Internet have provided companies in all sectors with tools to improve customer relations by developing personalization and by providing a higher level of services.

The digital economy, based on ICT, is evolving in an increasingly knowledge-based world. It enables economies to acquire and to share ideas, skills, services, and technologies locally, regionally, and globally. It also helps to make the world economy more integrated through the principle of low-cost digitalization (see Katz et al. 2010).

However, developing countries, particularly the sub-Saharan countries, remain relatively marginalized because they are characterised by the digital divide⁵. This is compounded, according to the International Telecommunications

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⁵ The digital divide, in terms of computer use, is the ever-increasing gap between digital-rich and digital-poor persons and institutions. The split between those who have ready

Union (see: ITU, 2014, ITU 2016, ITU 2021, ITU Digital World 2021), by disparities in access, use and skills between and within countries. Indeed, the ITU has developed an index, called ICT Development Index (IDI), to measure and to assess the level of development of the ICT sector. The analysis of statistics relating to the development of digitization, mentioned below (in section 2), reveals that Senegal is performing poorly. For example, not more than one in two Senegalese has access to the Internet (Internet World Stats, 2020). However, the economic role of digitalization for Senegal was emphasized quite early (Katz/Koutroumpis, n. d., and Katz/Koutroumpis 2014).

These results suggest, among other things, the need of analysing the development of entrepreneurship in the digital field in Senegal, by favouring an essay. In the digital age, start-ups are multiplying, and they compete in ingenuity with other companies by offering tailor-made solutions to companies. From this perspective, it seems interesting to study the case of Cygmatech, a reference Senegalese start-up. The questions are:

What are Cygmatech's products, performances, and contributions to the economy?

What are Cygmatech's resilience strategies in the face of the main risk factors?

The objective of this essay is to analyse the activities and the results of Cygmatech. The main working hypothesis states that the socioeconomic environment does not favour the emergence of companies in the digital economy sector. To prove this hypothesis, the essay starts with an analysis of the ICT sector in Senegal and the policies of the Government. Then the case of Cygmatech can be better evaluated in context. To achieve this objective, the methodological approach is mainly based on the use of documentary data and qualitative data. The example of Cygmantec will help us to better understand the real situation of start-ups in the digital sector in Senegal.

This study is part of the theoretical framework of research relating to the ManaGlobal project, the objective of which is to explain and to analyse the different management approaches practiced in certain African and Arab countries (Schuerkens, 2022). ManaGlobal favours the study of the realities on the ground by relying on collaborative, exploratory and ethnographic research to establish a complete diagnosis and to allow for a better knowledge of the commercial and management practices of local and international companies in these countries (Schuerkens, 2022). ManaGlobal also aims to fill the gaps in existing studies relating to management and leadership in target countries by strengthening the theoretical and methodological approaches used so far and as characterized by their weaknesses, which are noted by many authors including Mamman et al.

access to computers and the internet, and those who do not have, is a global problem now, and many programmes address it.

(2015). Indeed, rare are the works which simultaneously account for the global and local contexts. Recourse to the concept of glocalization (an integrated view of globalization and localization) becomes necessary since it allows one to appreciate the interrelationships between global and local practices of governance and business management (Schuerkens et al., 2019).

This study makes it possible to detect the elements of success, but also the difficulties encountered by the actors of the sector. The lessons learned from this case study will allow public authorities to adjust their development policy for the digital economy.

The remainder of the article is structured as follows: After the Introduction in section 1, the section 2 provides an overview of the ICT sector in Senegal and the role of the government's digital transformation policies. Section 3 is a review of the literature related to ICT companies and start-ups in Senegal. Section 4 presents Cygmatech and its products, while section 5 analyses Cygmatech's performance and its contributions to the economy and society of Senegal. Section 6 explains the main risk factors encountering the company, and it outlines Cygmatech's resilience strategies. Section 7 will present the outcomes and the implications for public policy and for private sector reforms in Senegal. Section 8 concludes and presents policy recommendations.

2 The ICT Sector of Senegal and the Digital Transformation Policies of the Government

To reduce this divide, developing countries have deployed resources in terms of infrastructure and human skills. In Senegal, the creation of the Telecommunications and Post Regulatory Agency (TPRA, in French *Autorité de Régulation des Télécommunications et des Postes/ARTP*⁶) is an illustrative example. This agency structure's mission is to facilitate access to technologies and to regulate telecommunications activities. Through the Plan for an Emerging Senegal (PES)⁷, Senegal has set a new course by focusing on the structural transformation of its economy to achieve strong, sustained, and sustainable growth. The PES is thus based on the development of new engines of growth around agriculture, agribusiness, social housing, mining, and tourism, but also on a consolidation of traditional engines of growth, such as the telecommunications sector, which is the locomotive of the digital economy. This represents the

⁶ See on TPRA/ARTP: www.artp.sn

⁷ Senegal has decided to adopt a new development model to speed up its march towards emergence. This strategy, named Plan for an Emerging Senegal (PES), forms the reference framework for the country's economic and social policy over the mid- and long-term. See: <https://www.presidence.sn/en/pse/emerging-senegal>.

foundation on which the digital transition of the whole society will be built, with an upheaval in the lifestyles of populations and the economic models of companies. It is in this context that the «Digital Senegal 2016-2025 Strategy» (Republique Du Senegal 2016) was developed⁸. It embodies Senegal's ambition to maintain a position as an innovative leading country. This strategy is a long-term vision; it is made up of prerequisites and priority axes articulated around the slogan «digital technology for all and for all uses in 2025 in Senegal with a dynamic and innovative private sector in a high-performance ecosystem ».

In Senegal, various digital incubators are working for the emergence of talents, for example: CTIC, which stands for (in French) *Accompagnateur de Croissance TIC Dakar*⁹, IMPACT HUB DAKAR¹⁰, and JOKKOLABS¹¹. These are institutions which bring together start-ups to manage their finance needs or to take stakes in new enterprises to promote growth. West Africa has joined the movement; many co-working spaces and a few incubators have started to emerge in most countries, especially in Niger with the “Niger Centre Incubator of SME (CIPMEN/Centre Incubateur des PME au Niger)”¹², and in Mali with the CREATEAM (Centre Révélateur et Accélérateur de Talents d'Entreprises)¹³.

In addition, the African Union (AU)'s resolution of January 2007 instructed all the member countries to devote at least 1% of their gross domestic product to research and development and to revitalize African universities. Along the same lines, the AU Commission called for the establishment of centres and networks of excellence, in collaboration with higher education institutions in other countries. They recommended that the international community provides \$ 3 billion over 10 years to establish these centres of excellence. Some such centres were already established over Africa, also Sub-Saharan Africa.

Through the Presidential Council on Higher Education of Senegal, the President of the Republic took 11 decisions, the first of which concerned the reorientation of the higher education system towards science, technology, and short vocational training courses. The directives related to the orientation of the

⁸ See on the strategy (summary and full report):

<https://www.itu.int/net4/wsis/archive/stocktaking/Project/Details?projectId=1488401022>, and the full report *Republique Du Senegal 2016*; access:

<https://www.sec.gouv.sn/sites/default/files/Strat%C3%A9gie%20S%C3%A9n%C3%A9gal%20Num%C3%A9rique%202016-2025.pdf>

⁹ See on CTIC: <https://www.cticdakar.com/>

¹⁰ See on Impact Hub Dakar: <https://dakar.impacthub.net/>

¹¹ See on the Jokkolabs initiative: <http://innovafrica.org/en/project/jokkolabs/>

¹² See on the incubator and start-ups landscape in Niger:

<https://medialandscapes.org/country/niger/innovation/main-profiles>

¹³ See on this institution: <https://www.facebook.com/Lincubateur-Createam-927943447313058/>

higher education towards Science, Technology, Engineering and Mathematics (STEM), and short technical and vocational courses played a role. New impetus was given to research & development and innovation by decision 8.

Senegal also developed a new and quite rich university map of Seven Public Universities, including a Virtual University with its Open Digital Spaces. The Virtual University has become, in less than 10 years, the second largest university in Senegal in terms of staff. Also, several private institutions of Higher Education have emerged, as well as a network of Higher Professional Education Institutes. All these new institutions are evaluated, validated, and monitored by a National Quality Assurance Authority for Higher Education, Research, and Innovation¹⁴.

Moreover, Senegal has four Centres of Excellence, a Digital Technology Park, a Data Centre, and since 2019 a Super Calculator with a power of 537 teraflops¹⁵, which is one of the most powerful in sub-Saharan Africa. Yet, a panoply of high-tech materials already acquired by Senegal remains in slow use. These acquisitions include, among others: a Quantum Learning Machine (QLM), compression and transmission electron microscopes, a complete equipment for a plant biotechnology laboratory, a research telescope, and a planetarium. But the reality concerning uses is unsatisfactory. The technological jewel (the supercomputer), which was delivered and installed since 2020, has been at a standstill since then, the microscopes have been installed without follow-up, and the rest of the equipment is in boxes since delivery. This is a worrying situation for a country which aims to join the peloton of African leaders in the field of scientific and technological research.

On June 22, 2021, a National Data Centre for Senegal was inaugurated.¹⁶ It is reported that the new data centre is located at the Digital Technology Park in the city of Diamniadio, and that it will be managed by Senegal's state IT firm State Informatics Agency (ADIE/Agence de l'Informatique de l'Etat).¹⁷ Government data which are hosted abroad or in local storage locations that do not comply with international standards must be repatriated to the new centre. Another

¹⁴ See on the Autorité Nationale d'Assurance Qualité de l'enseignement Supérieur (Sénégal)/ANAQ-Sup; access: <https://www.4icu.org/institutions/sn/1049.html>

¹⁵ See on the meaning of teraflops, the calculating speed of a computer equal to one trillion floating point operations per second: <https://www.merriam-webster.com/dictionary/teraflop>

¹⁶ See on this move towards "digital sovereignty", as it is associated with a complete reliance on Chinese technology: <https://www.rfi.fr/en/africa/20210625-senegal-to-move-all-government-data-to-huawei-run-data-center-china-africa-macky-sall-information-technology>

¹⁷ See: RFI (Radio France Internationale), Senegal to move all government data to Huawei-run data center, Issued by RFI on 25/06/2021; see the online text: <https://www.rfi.fr/en/africa/20210625-senegal-to-move-all-government-data-to-huawei-run-data-center-china-africa-macky-sall-information-technology>

development refers to the national innovation policy. While waiting for the ignition of the mega-computer which researchers at the Virtual University of Senegal¹⁸ should be the first to be able to take advantage of, the search for innovation is dragging its feet at a time when countries like South Africa and the Ivory Coast are already taking the opportunity to boost their digital economy. The result is that much more effort is needed to advance innovation policy and digital transformation in Senegal.

Despite some government measures and the efforts of digital sector players, performance is still weak, as shown by statistics from The ICT Development Index (IDI). The IDI is a composite index that until 2017 combined 11 indicators into a composite score. It is used to monitor and to compare developments in information and communication technology (ICT) between countries and over time. The IDI was published from 2009 to 2017 (see ITU 2014, ITU 2016, and ITU 2017). In March 2017, an extraordinary meeting of the Expert Group on ICT Household Indicators (EGH) and of the Expert Group on Telecommunication/ICT Indicators (EGTI) adopted a revised set of 14 indicators to be included in the IDI.¹⁹ According to the ITU statistics source, Senegal has an index of 2.66 in 2017 while it was 2.68 in 2015. Thus, in the world ranking, Senegal drops from the 124th rank in 2012 to the 142nd rank in 2017²⁰. It was ranked 132nd in 2015, what is a decline of 10 places in two years and by 18 places in five years. At the African level, Senegal is ranked on the 14th place in 2017, while it was on the 11th place in 2015. More specifically, the Internet penetration rate is 56.7% of the population, and the Facebook participation rate is 22,1% (Internet World Stats, 2020). There is an ongoing discussion at ITU to revise the IDI.²¹

Furthermore, the Networked Readiness Index (NRI) 2020²² analysis is based on four (4) pillars; Senegal has a rank 100 in the world, with a score value of 36.90. For the four pillars Senegal has the following scores: Technology (27.71); Impact (40.74); People (31.09); Governance (48.05), meaning that there are unfavourable values for the pillar “Technology”. But favourable ones for “Governance”. The

¹⁸ See on this Virtual University project: <https://www.tipconsortium.net/senegals-virtual-university-a-case-study-on-transformative-innovation-policy/>

¹⁹ See the ICT Statistics for 2021 and the reasons for the changes of the ICT Development Index methodology: <https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx>, and: <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf>, and: <https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2016/MISR2016-w4.pdf>

²⁰ See the IDI for 2017: <https://www.itu.int/net4/ITU-D/idi/2017/index.html>

²¹ See on the debate about IDI methodology changes: https://www.itu.int/en/ITU-D/Statistics/Documents/events/egti2020/IDI2020_BackgroundDocument_20200903.pdf

²² See on the NRI methodology (NRI 2020): <https://networkreadinessindex.org/>

Global Innovation Index (GII) 2020²³ places Senegal at rank 102 with a score value of 23.75 being lower than the median score value of 30.94.

3 Literature review

The digital economy affects, especially through ICT, all sectors of the economy across the board, regardless of the level of development. An abundant literature has shown its various contributions to productivity growth at the level of countries and industrial sectors. However, most of the empirical work pioneered by Oliner, Sichel et. al. (1994, pages 273-334) and Jorgenson and Stiroh (1995, pages 295-316) has mainly taken place in American and European countries. These authors have established a positive contribution of investments in IT to the growth of the economy. For Oliner, Sichel et al. (1994, pages 273-334), the contribution of computer capital to economic growth, measured by GDP, is low because it constitutes a very small part of the physical capital. Depending on the methodologies used and the assumptions made, this contribution is only 0.16% to 0.39% over the period 1970-1992. But considering only the expenditures for computer equipment is too restrictive. We need to look at all parts of the “computing services”, that is, spending on hardware, software, and IT manpower. We then realize that the contribution of IT to growth is doubling.

Work has also been carried out in developed and developing countries on the determinants of ICT adoption, given its impact on the acceleration of economic development (Birba and Diagne, 2012, pages 463-472). During the last two decades, most developing countries in Africa have demonstrated a significant improvement in information and communication technology (ICT) adoption and usage (Kayisire, David & Jiuchang Wei, 2016). A probable cause of the high adoption rate of ICT in Africa and of the relatively low level of financial development in Africa could be attributed to the low innovation capacity and the low ICT-innovation interaction attained by the region. This implies that ICT alone might not be sufficient to mitigate financial underdevelopment (Ejemeyovwi et al., 2019). ICT adoption, innovation and financial development are strongly interrelated in a digital world, and this is also the case for Africa. It was found that the ICT-innovation interaction positively drives financial development (Ejemeyovwi et al., 2021).

Furthermore, Siegel and Griliches (1992, pages 429-458) show that industries which are using much of ICT tend to be more productive. These authors demonstrate a positive and statistically significant correlation between the growth

²³ See on the GII methodology (GII 2020):

https://www.wipo.int/global_innovation_index/en/2020/

of aggregate factor productivity and the rate of investment in computers during the 1980s. The literature review also indicates that mobile telephony and broadband access can lead to competitive markets, to massive job creation, and to GDP growth. Several economic studies in emerging countries, notably with Jensen (2007) in Kerala in India, Klonner and Nolen (2010) in South Africa, Katz et al. (2011a) in Brazil, and Katz (2011b) in Peru reveal that the telecommunications ecosystem responds to real concerns and improves the well-being of the people. For example, in Kerala (India) the introduction of mobile telephony has positively impacted the demand market in the fishing sector (Jensen, 2007). Similar effects can also be seen in African countries as the fishing sector is much dependent on reliable mobile connections; Uganda is such a case. Banana producers in Uganda have also been able to circumvent the perishability of products by improving the supply chain based on lower distribution costs thanks to mobile phone coverage (Muto/Yamano 2009)²⁴.

In Africa, there is generally a delay in taking full advantage of the digital tools. But the onslaught of mobile technologies and the liberalization of markets have allowed the rapid deployment, and in some cases at lower cost of information and communication networks. The mobile telephony market is particularly important for developing countries, where it is growing faster and where it appears as a tool that allows technological leapfrogging. The number of new telephone connections in low- and middle-income countries has exceeded that of middle-income and high-income countries since 1998 (World Bank, 2021, WDI/World Development Indicators). More recent studies on ICT for Africa come to similar assessments (ITU 2021).²⁵ For Bellucci and Otenyo (2019), the rise of digitalization in Africa is due to the increased accessibility of ICT tools, such as computers and mobile phones, and the development of skills, especially among the young population. Although they see real progress in different sectors, they remark a relative weakness in the level of applicability of digitalization in Africa.

While most studies tend to focus on developed economies, more recent studies provide evidence of these benefits in the case of emerging countries and developing countries, particularly for Africa. In East and Southern African the grain markets constitute a promising avenue for improving the production of the smallholder farmers and the livelihood of the people as based on the ICT-supported Green Revolution in Africa (Karuho, Ones & Kate Collins, 2020). In Kenya and Tanzania, the introduction of mobile financial services has reduced both the cost of banking services and the transaction charges, leading to a sharp

²⁴ See on the Uganda banana case the study by Muto and Yamano 2009: https://www.researchgate.net/publication/226474951_Mobile_Phone_Coverage_and_Market_Participation_The_Case_of_Banana_Marketing_in_Uganda

²⁵ See the ITU study for download: <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf>

reduction in the unbanked population; all economic sectors and all regions have benefitted. M-Pesa became an important brand from and for Africa²⁶.

Likewise, the introduction of new mobile-health applications in Ghana and Cape Verde has resulted in more accessible and affordable quality health services.²⁷ Tagodoe, A. and Ndiaye E. H. M. (2008) and Tagodoe, A. (2006) studied the relationship between the spread of law and the internet in West Africa to reveal the importance of this medium of communication. Myovella, G. et al. (2021) analyse the determinants for digital divide in Sub-Saharan Africa (SSA) by considering inequalities in internet use and broadband subscriptions. The study considers 41 countries in the region which are geographically linked, and it allows for considering spatial interdependence. The results are interesting. They reveal that key factors are GDP per capita, gross capital formation, political stability, regulatory efficacy, and electricity infrastructure. These factors directly affect the digital divide. However, it is emphasized in the study that GDP per capita, population growth, government consumption, trade openness, and electricity infrastructure also indirectly affect the digital divide through spillover effects. The AfCFTA (African Continental Free Trade Area) may be an institution to allow for a more rapid progress towards digital transformation and development.

In Senegal, the World Food Programme (WFP, 2021) demonstrates that the success of digital solutions in rural areas largely depends on the ability of the designed models to meet the needs of stakeholders in the agricultural world and to adapt to their constraints. The case study presents the challenges and lessons learned on payment digitalization in rural areas of the country. At the same time, the Rapid Entrepreneurship Delegation (RED)²⁸ fund, which is a fund of 30 billion FCFA (\$50 million USD), was launched by the President of Senegal to catalyse entrepreneurship all around Senegal. The RED fund was created for targeting youth up to 40 years and women from 18 years old and up, but with no age limit. It was launched in April 2018; it has become a real catalysing employment creator, and just 5 months after the official launch, in August 2018, it had already disbursed 10 billion FCFA (around 16.67 million USD) across 45 departments (departments are like sub-regions in the country's administration) to 15,000 entrepreneurial beneficiaries. The programme founders were calling these entrepreneurs

²⁶ See on the whole story about the African Fintech Revolution:

<https://www.netinterest.co/p/m-pesa-and-the-african-fintech-revolution-3c1>

²⁷ See on mHealth the case of Ghana: <https://allafrica.com/stories/202111100110.html>, and for the mHealth case of Cabo Verde:

https://run.unl.pt/bitstream/10362/36479/1/A_Implementa_o_da_Telemedicina_em_Cabo_Verde.pdf

²⁸ See on RED: ICT works, December 19, 2018, DER Senegal: Innovative Government Funding for African Entrepreneurship; access: <https://www.ictworks.org/der-senegal-government-innovation/#.Ydx5N1kxnc>

“employment creators”. The President of Senegal has twin goals of this programme for employment creation - first, creating 200,000 jobs directly and more jobs indirectly, and second, increasing the rate of banking penetration (financial inclusion) which is currently only at around 20% in Senegal.

Ultimately, the literature shows the importance of the digital economy in everyday life, but also in productivity statistics. It is at the heart of all high value-added organizational investments in all sectors of the economy. The digital ecosystem is fascinating with protean and shifting particularities. The rate of change is very fast, hence the strong need to adopt a permanent technological watch posture to avoid of being on the margins. Thus, based on innovative ideas, ICTs, which are one of the majority shareholders of the digital economy, are used as a formidable tool of relevance and not as a simple purpose, by providing solutions to concrete problems that impact the whole company.

It is now important to look at Cygmatech, mainly analysing its history, activities, performances, and contributions.

4 Presentation of Cygmatech: Its history, products, services, and resources

The methodological approach adopted consists in combining interview and documentary research. The instrument of the qualitative survey is an interview guide. This guide includes the following five themes: company overview, company products and resources, business performance, business challenges, and response strategies. The interview took place in the form of a conversation oriented towards the objectives of the research. Thematic analysis was used to exploit and to analyse interview transcripts. The literature search is used to collect factual and statistical data relating to Senegal's digital economy sector and public policy measures concerning this sector.

Three specific hypotheses arise from the main hypothesis presented in the introduction. The first hypothesis states that the digital economy sector offers profit and growth opportunities for start-ups. The second specific hypothesis states that the oligopolistic configuration of the digital economy sector makes it difficult for start-ups to promote and to flourish. The third specific hypothesis is that the public authorities' strategy for the development of the digital economy sector appears to be ineffective.

In the age of digitization, start-ups are multiplying and competing in ingenuity to offer tailor-made solutions to companies. Within this framework, Cygmatech, a Senegalese start-up, dedicated to producing the latest generation software, is intervening to contribute to the popularization of ICT in Senegal and in the sub-region. Cygmatech has four offices located in Atlanta, New York, Dakar, and Douala.

4.1 Company history

The Cygmatech creation is the result of the observation, by one of the future members, relating to technological advances in the world. The latter had asked himself the following question "*What can we do for our country regarding the digital transformation?*". This is how Cygmatech came into being in March 2018 in Atlanta, USA. The creators are four Senegalese students, two computer engineers, a big data analyst, and a project manager. They set themselves the goal of first offering innovative solutions to local businesses and then exporting their experience worldwide. They started working with two major banks in Central Africa. The goal was to digitize the loan application process and the integration with their core banking system. It was a remarkable success.

The Chief Executive Officer (CEO) has got 25 years of IT experience. He was department director of AON and CONDUENT, both companies being part of the S&P 500 list. He did his primary and middle education in Senegal, his secondary studies and his bachelor's degree in the United States. He did his entire university classes in the United States to become a Computer Engineer. So, he is a genuine product of the American educational system. He is a co-founder of Cygmatech. He has been instrumental to the success of Cygmatech. He is the CEO and oversees the IT department of Cygmatech.

The staff of Cygmatech is made up of business analysts, software developers, database specialists, and project managers; the consultants are specialized in Cloud Computing: Amazon Web Services (AWS), AZURE (of Microsoft), and Google Cloud Platform. Cygmatech has a staff that is spread all over the world, by using modern collaboration solutions. Cygmatech uses IT tools and has not only virtual offices (employees can be located anywhere in the world). Cygmatech has employees in India, Ukraine, Georgie, and Egypt – around the world, but also has representatives in countries where it has contracts for accounting and secretarial services. Atlanta and Dakar Cygmatech are planning to move the headquarters to Dakar. There are some aspects of the start-up which cannot be disclosed. As Cygmatech is expanding, the company would like to keep a low profile. The goal in the short term is to build strong relationships with some of the clients in Africa. Cygmatech needs to get stronger by taking a more significant position in local markets.

4.2 Products and Services

Cygmatech is a company that has subcontracts with banks which comprise 80% of its customers. Cygmatech is assisting companies in transiting from legacy

to the digital world: data conversion (making stored data accessible)²⁹, split (one entity for splitting to become two different companies), divestiture (when a company group sold one of its subsidiaries), and data deconversion (the opposite process of data conversion). Each of these terms for actions has a transformative effect in the client's business. It helps banks and institutions to make their data more reliable and to improve the quality. It helps them to ensure a successful transition between their "legacy system" and a modern digital system, capable of meeting the demands of the modern world.

Cygmatech also has "ready-to-use" software that can be "customized" within a reasonable time frame according to the specific needs of each company. These are the following:

- Digital Credit Processing (DCP): These are solutions which automate the credit application process. The entire decision-making circuit is automated. The implementation of credit applications, disbursements, as well as the preparation of all necessary documents are digitized.

- Integrated Management Software Packages, such as Enterprise Resource Planning (ERP): This is an information system where the various processing operations (transactions - execution), the traditional functions of a company, are integrated around a single data and process repository. ERP is the classic instrument for Enterprise Resource Planning. It is, therefore, an application that allows the improvement of the exchange of information between the various functions of large companies in a reliable way, and especially allows for the overhaul of the management procedures within the organizations.

- E-learning (Platforms for online education): The latest generation solution is provided that allows the management of universities and schools to offer online courses while maintaining quality education.

- Customer Relationship Management (CRM): It is used to enable companies to manage customer relations.

- Automatic Loan Solution (ALS): This is to allow people to quickly get a bank loan. It is a powerful micro loan system. This solution is built to process thousands of loan applications per hour. It can approve or deny a loan application in less than 30 seconds, using a very advanced algorithm and scoring model. Cygmatech can use for example socio-economics information (mobile phone number, social network information, and other random information from a client to define his solvability). Cygmatech is using the model with Orange Cameroun and a local bank to provide nano credits. These credits are to be offered by using model scoring technology, primarily developed on an artificial intelligence basis. The entire process, from client enrolment to disbursement, is fully automated. This system requires no human intervention and fraud is reduced to zero thanks to a

²⁹ See on the term "data conversion": <https://www.safe.com/what-is/data-conversion/>

preventive risk management model. In the first two months the resource persons have processed for the client over 600,000 applications with zero downtime. The company works as based on a Service Level Agreement.

- Digital Insurance (DI): The insurance sector must adapt to new behaviours of its customers who have perfectly integrated digital devices into their daily consumption patterns.

Digital Credit Processing (DCP) remains the leading product of Cygmatech in terms of revenue, with 80% of the sales generated (this field of business is easier to customize). Cygmatech has huge potentials in CRM and ERP. They are however taking longer to build relations with clients. Each customer is unique. It can take months for a project to take off. The company must go through intensive Analysis, Scope of Work, Gap Analysis, Estimates, Negotiations, Contractual matters, Team building, and then finally must start the Development process (which can take 4 to 18 months depending on the size of the scope). Cygmatech relies on building a strong partnership with some companies to expedite the development process to the market. Cygmatech is still a start-up; the staff considers the company still as a start-up. Cygmatech has passed the Minimum Viable Product (MVP).³⁰ And, the products of Cygmatech are maturing as the company is slowly consolidating its position in the Banking and Financial Industry (BFI) market. Cygmatech is looking for more resources through investment to consolidate its position Africa. This will then be the most challenging phase of Cygmatech.

4.3 Company resources

The analysis of Cygmatech's resources is carried out according to the following three phases. In the start-up phase, Cygmatech depended on contributions from its four shareholders (25% per shareholder). Cygmatech is founded as LLC (Limited Liability Company) which is based in the United States. The resources drawn from its products and services, amounting to around 3 million US\$, were entirely reinvested for strengthening know-how, optimizing management tools and, increasingly, for using artificial intelligence (AI).

In the development phase, Cygmatech first began to seek markets in the United States and then in Africa through tenders. Several contracts were won in Africa (Senegal, Cameroon, and Gabon).

³⁰ MVP means that a basic version of the product is ready (so it is a minimum viable product), with key functions attached. See on the definition and the scope: [https://www.agilealliance.org/glossary/mvp/#q=~\(infinite~false~filters~\(tags~\(~mvp\)\)~searchTerm~'~sort~false~sortDirection~'asc~page~1\)](https://www.agilealliance.org/glossary/mvp/#q=~(infinite~false~filters~(tags~(~mvp))~searchTerm~'~sort~false~sortDirection~'asc~page~1))

In the consolidation phase, Cygmatech is executing health assistance contracts with E-health for partners with a regional presence. Other contracts have also been executed in E-learning with commercial and multinational banks in Africa. Most of these service contracts concern the conversion of core banking and the digitization of banking professions, such as cashiers, authorized representatives, and financial analysts.

Cygmatech has evolved from a small local company with a small footprint to a more organized and accomplished entity. It has gained tremendous experience in its processes. The company can now handle several projects at the same time in various parts of the world. It has now a much better understanding of its core businesses. It uses the feedback from their customers to make changes in its organization by hiring specific profiles. Over the years, Cygmatech has acquired experience and has adjusted its strategy towards growth.

5 Analysis of Cygmatech's performance and of its contributions

5.1 Cygmatech's performance

Performance is a polysemous concept, which can be broken down into several aspects. In this essay, two types of performance are considered, financial and social performance. It is important to note, with the words of the Director General, that the socioeconomic and the cultural environment do not promote the development of companies in the digital transformation process. Indeed, the very slow pace of digitization coupled with a relative ignorance of digital devices in the West African sub-region reduces the development opportunities of companies in the sector. Also, says the Managing Director, Cygmatech is facing stiff competition in the West African market, making it more difficult to find new customers and markets.

Cygmatech has achieved a good financial performance as its turnover increased from 14 million CFA francs in 2019 to 72 million CFA francs in 2020. Its profit stand at 4 million CFA francs in 2020. The CEO recognizes the existence of a demand for digital services but, according to him, French and American companies have almost won all the African markets and most of the contracts over the past two years, despite of the competitive advantages of firms like Cygmatech.

Social performance is assessed here through its Corporate Social Responsibility (CSR). Corporate Social Responsibility (CSR) is a form of international private business self-regulation which aims to contribute to societal goals of a philanthropic, activist, or charitable nature by engaging in or supporting volunteering or ethically oriented policy practices which refer to practices and policies undertaken by corporations that are intended to have a positive influence on the world. The key idea behind CSR is for corporations to pursue other pro-

social objectives in addition to maximizing profits. Cygmatech helped to set up E-Learning in a religious university in Touba, a holy city of the Mouride brotherhood of Senegal.

In addition, Cygmatech has an efficient quality management system because it has obtained the ISO 9001 (version 2015) certification.

5.2 Cygmatech's contributions

Cygmatech has created around ten direct jobs for the following specialisations: Support specialist, Computer programmer, Web developer, Systems analyst, and Network engineer. This was achieved in three years of practice. The indirect impact on employment is more difficult to assess because these are employees involved at times to accomplish specific tasks. The Chief Executive Officer (CEO) refers to *"the well-being of his employees at work"*. For him, *"working at Cygmatech is above all about nurturing his passion. We are a very enthusiastic team."* This assertion seems credible insofar as the workforce, being very small, could facilitate more courteous and more cooperative relations.

Cygmatech as a company is subject to the tax regime of the country of residence. It exports services to some African countries, such as Cameroon and Gabon. The export of digital services needs to be developed in the African space. This is *"a path to be explored"* further, because *"services have become 'raw materials' like any other product"*, according to the Chief Executive Officer (CEO). As for investments, *"Cygmatech reinvests most of its income in the improvement of its existing products or in the development of new products"*. This technology watch behaviour could, at least in part, justify its financial performance.

Cygmatech's impact on the environment is very positive, says the CEO, as *"all our hosting companies use systems based 100% on renewable energies"*. As a local production unit, Cygmatech wishes to make a significant contribution to local communities. *"Our wish"*, says the Managing Director, *"is to join communities to create partnerships and to have a positive impact on the life in our community"*. In the short term, Cygmatech, a relatively young company, does not seek to influence local policies, according to its CEO. He states: *"Our challenge is to adapt to our local environment and work with leaders at the local level to make them aware of the major projects of the 21st century in our field"*.

In the long term, Cygmatech intends to influence the legislation and the regulation of the economy of the respective country. A supporter of dialogue with all stakeholders, which can have an impact on the life of a company, the Chief Executive Officer (CEO) considers that consultation between all stakeholders, companies, authorities, regulatory bodies, and legislators is essential. These exchanges must be focused on *"how to accelerate certain reforms that can bring qualitative changes to our country"* in the digital sector.

6 Main risk factors and resilience strategies of Cygmatech

The main risk factors facing Cygmatech can essentially be summarized in two points.

First, as it is mentioned above, the digital world is relatively unknown, at least considering the importance of its challenges, by African companies, particularly in Senegal. The Managing Director speaks of "*Africans' reluctance to change because digital transformation is a novelty in Africa*". He thinks that Cygmatech is not well known in Africa. For him, there is "*a high risk that American and French companies will win all the markets*". However, African companies like Cygmatech have competitive advantages regarding local language, social behaviour, and culture. But these competitive advantages need to become exploited, and project cases show that this route can be followed successfully. The products diversification may allow a successful redirection of marketing strategies.

Second, the behaviour of Cygmatech's client companies does not seem to favour the growth of its activities. Indeed, the General Manager points to "*slowness in payments and archaic decision-making procedures*". These are often "*long and inefficient*"; which could generate moments of crisis or major difficulties. To overcome such barriers is an important challenge for companies like Cygmatech.

The operations decisive for successful resilience strategies are, for the Chief Executive Officer (CEO), of three types. The first operation consists in carrying out a policy of "*popularizing our products by working closely with our political leaders*". The second decisive operation is "*to initiate the changes and to reverse this culture of wait-and-see*". The third and last decisive operation relates to the promotion of Cygmatech by "*developing a new strategy to make it more profitable*". So, successful resilience strategies need pro-active measures towards the environment of the firms and towards the internal structure and organization.

According to the CEO, the leadership of its managers has enabled Cygmatech to overcome its difficulties. The business plan to work with other start-ups intends to pool the common forces to be able to compete against American and French companies.

The research interview played a leading role and the analysis of the data allowed it to highlight the performance, the strategies, but also the difficulties encountered by Cygmatech, and more generally of the start-ups in the digital economy sector. The case of Cygmatech validates the first specific hypothesis. Indeed, this start-up has been able to take advantage of the opportunities offered by this sector despite its very young age (2 years) by achieving good performances. The difficulties of access to markets confirm the plausibility of the second specific hypothesis; the few large companies in the sector share among themselves most of the market potential. In addition, the analysis of statistics shows that the level

of development of the digital economy in Senegal is relatively low; this testifies to the ineffectiveness of the digital development strategy of the public authorities, referring to the third hypothesis.

Three main lessons can be drawn from this case study. First, the digital economy remains a promising sector for start-ups and even for potential entrants in view of the opportunities offered. Secondly, given the oligopolistic nature of the sector, the development of start-ups requires a public policy that promotes subcontracting and reservation of certain market segments for them. Finally, Senegal should review and strengthen its development strategy for this sector to ensure a significant promotion of digital technology entrepreneurship and therefore of economic growth.

7 Conclusions and Policy Implications

New digital technologies and the Internet have in recent years provided companies in all sectors with tools to improve customer relationships by developing personalization and by providing a higher level of services. Cygmatech has the experience and ability to design and to build ICT tools for organizations, such as NGOs, governmental institutions, research institutes, and is a start-up in its consolidation phase. It is dedicated to the production of latest generation software; it intervenes to contribute to the popularization of ICTs in Senegal and the sub-region, to suit their needs and specifications, while paying particular attention to those critical elements that make an ICT project to succeed.

Despite awareness of the opportunities offered by digitalization, particularly in terms of decent and fulfilling jobs, public authorities are not sufficiently and consistently supporting digitalizing digital start-ups. Indeed, according to the Senegal Digital Strategy (2016, p. 17), “*entrepreneurship is very marked among professionals in the sector. However, young digital entrepreneurs receive very little support, both before and after starting their businesses.*”. Therefore, they must implement different forms of incentives – including tax exemptions and some direct financial and non-financial support measures – to promote digital innovation. Senegal's digital entrepreneurial ecosystem is “*small but dynamic*” and remains “*fragile and embryonic*”; its growth being obstructed by weak support “*at the regulatory level*”; according to the International Bank for Reconstruction and Development (IBRD, 2019, p. 68). The results of the analysis of Cygmatech's case corroborate the difficulties of access to finance and markets which are highlighted by the IBRD report (of 2019).

Different pillars need to be implemented to address the gaps in the legal and regulatory framework to boost a prosperous and inclusive digital economy. The governance of the Telecommunications and Postal Regulatory Authority must be reformed to facilitate the removal of the constraints faced by start-ups like

Cygmatech, and especially the development of the ability to penetrate public markets needs to be supported. Specific support measures for start-ups remain essential. The State must promote the latter's access to public procurement; international experience shows that many avenues are open in this direction. Access to finance remains a major obstacle for companies in the dynamic and innovative digital ecosystem. However, the problem of financing is not specific to digital start-ups since nearly four out of ten Senegalese entrepreneurs mention the “*lack of access to finance as the main factor limiting their growth*” (IBRD, 2019, p. 68). The DER (Délégation générale à l'Entrepreneuriat Rapide) seems to provide a timid response but is far from fulfilling the many expectations and perspectives.

The Digital Senegal 2016-2025 Strategy (DS2025) includes a precise budget and funding mechanism, indicating that 73% of the budget must come from the private sector, 17% from the public sector, and 10% from public-private partnerships (PPPs) (Alessandro, 2020). The Senegalese case demonstrates the importance of having a strong national development plan, such as the PES, accounting for the resources which are available in the country, pointing out major gaps and deficiencies, setting clear and realistic objectives, indicating priority economic areas, and paving the way for sectoral public policies to implement the plan within a precise time frame and budget. DS2025 highlights the crucial importance of digitalisation, the task to transform the economy structurally and sustainably, and the necessity to implement the Sustainable Development Goals (SDGs) in Senegal. Existing support structures, such as incubators, must strengthen their cooperation and pool their strengths – skills and networks – to better support the digital start-ups. However, the relevance of the various measures to be taken by the State and the adequacy of the institutional support structures must be discussed with all the actors in the digital sector – including, especially, the entrepreneurs and the investors – so that they are appropriate and efficient.

The innovation chain in Senegal is weak, as the innovation policy is largely uncoordinated. The technological supercomputer as a symbol of progress has been at a standstill since 2020. This is a worrying situation for a country which aims to join the peloton of leaders in the field of scientific and technological research. While waiting for the ignition of this mega-computer which researchers at the Virtual University of Senegal should be the first to be able to take advantage of, the search for innovation is dragging its feet at a time when countries like South Africa and the Ivory Coast and others in Africa are taking the opportunity to boost their digital economy. Cygmatech will benefit from an effective and efficient innovation policy when all elements of the innovation chain are interacting. It is not enough to improve some elements of the innovation system independent from the situation of others.

The State, with the height of its omnipotence and its decision-power, shapes the life of the Nation. The Government has the propensity to place almost all public orders to French, Chinese, Indian, and Turkish companies which would present

more financial and technical guarantees. To boost local businesses, it should give a certain national preference to start-ups like Cygmatech as part of the public procurement markets with around a 5% to 10% market share. The government should but cooperate only with those indigenous firms which already have proven their entrepreneurial capacity to finalize such contracts in a positive way. Competition is key as a field for public action, and international experiences show that governments can cooperate with private small businesses to create competitive conditions (via public orders, financial support, technology partnerships, protection of intellectual property, institutional arrangements, etc.). A full Agenda for Action should be worked out along the lessons of successful emerging countries. The new infrastructure endowments like the new supercomputer and the new national data centre are at the commissioning stage, but such projects and institutions should always become part of an Innovation Strategy and a Digital Sector Strategy. The popularization and mobilization of core business actors should be amplified for a grip in the field of the Information Technology Outsourcing (ITO) and the Business Processing Outsourcing (BPO) transactions.

References

- Aker, J. C. (2008). "Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger." Department of Agricultural and Resource Economics, University of California, Berkeley. For download: <https://www.oecd.org/countries/niger/41713177.pdf>
- Alessandro, C. (2020). "The Digital Senegal 2016-2025 Strategy, as an Appropriate Instrument to Implement the Sustainable Development Goals. The Digital Senegal 2016-2025 Strategy", NPRP/National Priorities Research Programme 10-1203-160007, ISSUE BRIEF, 15.03.2020. For Download: <https://zenodo.org/record/3723490#.Yfe3Cvgnxncs>
- Bellucci, S. and Otenyo, E. E. (2019). "Digitisation and the Disappearing Job Theory: A Role for the ILO in Africa?", in: International Development Policy, pp. 203-221. <https://journals.openedition.org/poldev/3085>
- Birba, Ousmane/Abdoulaye Diagne (2012). "Determinants of adoption of Internet in Africa: Case of 17 sub-Saharan countries", in: Structural Change and Economic Dynamics, Elsevier, vol. 23(4), pages 463-472. Access: <https://www.sciencedirect.com/science/article/abs/pii/S0954349X12000392>
- Curien, N. and Muet, P.-A. (2004). La société de l'information, Rapport, La Documentation française, Paris ; access by Download: <https://www.vie-publique.fr/sites/default/files/rapport/pdf/044000180.pdf>

- Ejemeyovwi, Jeremiah O./Evans S. Osabuohien/Ebenezer I. K. Bowale (2021). “ICT adoption, innovation and financial development in a digital world: empirical analysis from Africa”, in: *Transnational Corporations Review*, 13 (1): pages 16-31, access: <https://doi.org/10.1080/19186444.2020.1851124>
- Ejemeyovwi, Jeremiah/Queen Adiat/Edikan Ekong (2019). “Energy usage, internet usage and human development in selected Western African countries”, in: *International Journal of Energy Economics and Policy*, 9(5); pages 316–321. Access DOI: <https://doi.org/10.32479/ijeeep.7611>
- Global Innovation Index (GII) 2020. Access: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020-intro4.pdf
- IBRD/International Bank for Reconstruction and Development (2019), “Digital Economy for Africa (DE4A) : Country Diagnostic of Senegal”, The World Bank, 100 pages. For Download: <https://openknowledge.worldbank.org/bitstream/handle/10986/31841/Country-Diagnostic-of-Senegal.pdf?sequence=1&isAllowed=y>
- Internet World Stats (2020) Taux de pénétration internet, Sénégal ; Access: <https://www.internetworldstats.com/africa.htm>
- ITU Digital World 2021. Access: <https://www.itu.int/en/itu telecom/Pages/world2021.aspx>
- ITU (2021), Measuring digital development, facts and figures 2021, ITU/International Telecommunication Union, Development Sector, Geneva, Switzerland; access: <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf>
- ITU (2017). ICT Development Index (IDI) Worldwide for 2017: <https://www.itu.int/net4/ITU-D/idi/2017/index.html>
- ITU (2016). Measuring the Information Society Report. Access: <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2016.aspx>, and the full report: <https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2016/MISR2016-w4.pdf>
- ITU (2014). Measuring the Information Society Report. Access: <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2014.aspx>, and the full report: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf
- ITU (2012), Conférence Mondiale des Télécommunications Internationales (CMTI-12). <https://www.itu.int/en/wcit-12/Documents/final-acts-wcit-12-fr.pdf>
- Jensen, M. (2007). Afriboîtes, télécommunications, cybercafés: les TIC en Afrique. In: *Revue Coopération Sud (UNDP)*, n°1, pages 112-127.
- Jorgenson, D. and Stiroh, K. (1995) “Computers and Growth”, In: *Economics of Innovation and New Technology*, volume 3, issue 3-4, pages 295-316. Access: <https://www.tandfonline.com/doi/abs/10.1080/10438599500000008>
- Karuho, O. & Collins, K. (2020), African grain markets constitute a promising avenue for improving smallholder farmers’ production and livelihoods based on ICT Green Revolution in Africa, for Access: <https://agra.org/wp-content/uploads/2020/07/Grain-Markets-Report-7-26-20.pdf>

- Katz, R., Avila, J., Meille, G. (2011a). The impact of wireless broadband in rural America. Washington, D. C.: Rural Cellular Association
- Katz, R. (2011b). Evaluacion del Impacto Economico y Social de una Modificacion del Marco Tributario de las Computadoras Personales en Peru. Telecom Advisory Services, LLC, Stanfordville, NY
- Katz R. L., Koutroumpis P. (n.d.), The Economic Impact of Telecommunications in Senegal.
https://www8.gsb.columbia.edu/citi/sites/citi/files/files/Senegal_Telecoms_Report_version%20finale%5B1%5D.pdf
- Katz R. L., Koutroumpis P. (2014) “The Economic Impact of Telecommunications in Senegal”, in: O’Neill J., Noam E., Gerbarg D. (eds.), *Broadband as a Video Platform. The Economics of Information, Communication, and Entertainment* (The Impacts of Digital Technology in the 21st Century). Springer, Cham. Access: https://link.springer.com/chapter/10.1007/978-3-319-03617-5_11
- Katz, R. L., Vaterlaus, S., Zenhäusern, P. and Suter, S. (2010). The Impact of Broadband on Jobs and the German Economy. In: *Intereconomics*, 45 (1), pages 26-34. Access : <https://www.intereconomics.eu/contents/year/2010/number/1/article/the-impact-of-broadband-on-jobs-and-the-german-economy.html>
- Kayisire, David & Jiuchang Wei (2016), ICT Adoption and Usage in Africa: Towards an Efficiency Assessment, In: *Information Technology for Development*, 22:4, pages 630-653, Access: <https://www.tandfonline.com/doi/abs/10.1080/02681102.2015.1081862>
- Klonner, S. and Nolen, P. J. (2010): “Cell Phones and Rural Labor Markets: Evidence from South Africa”. Verein für Sozialpolitik, Research Committee Development Economics. Publication or Manuscript. Access: <http://repository.essex.ac.uk/2917/>.
- Mamman, A., Kanu, A. M., Alharbi, A. and Baydoun, N. (2015), *Small and Medium-sized Enterprises (SMEs) and Poverty Reduction in Africa: Strategic Management Perspective*. Cambridge: Cambridge Scholars Publishing
- MPT/Ministère des Postes et de Télécommunications (2016). “Stratégie Sénégal Numérique 2016-2025”, 47 pages. For Download : <https://www.sec.gouv.sn/sites/default/files/Strat%C3%A9gie%20S%C3%A9n%C3%A9gal%20Num%C3%A9rique%202016-2025.pdf>
- Muto, Megumi/Takashi Yamano (2009), Mobile Phone Coverage and Market Participation: The Case of Banana Marketing in Uganda, December 2009, in: *World Development*, 37(12), pages 1887-1896; access: <https://ideas.repec.org/a/eee/wdevel/v37y2009i12p1887-1896.html>
- Myovella Godwin, Mehmet Karacuka, Justus Haucap (2021), Determinants of digitalization and digital divide in Sub-Saharan African economies: A spatial Durbin analysis. In: *Telecommunications Policy*, Volume 45 (10), Issue 10. Access: <https://www.sciencedirect.com/science/article/abs/pii/S0308596121001282>
- Networked Readiness Index (NRI) 2020; access: <https://networkreadinessindex.org/2020/countries/senegal>

- Oliner, S. D., Sichel, D. E., Triplett, J. E., & Gordon, R. J. (1994). Computers and Output Growth Revisited: How Big is the Puzzle? In: *Brookings Papers on Economic Activity*, 1994 (2), pages 273–334. Access: <https://doi.org/10.2307/2534658>.
- République Du Sénégal (2016), *Stratégie Sénégal Numérique 2016-2025*, Octobre 2016; access : <https://www.sec.gouv.sn/sites/default/files/Strat%C3%A9gie%20S%C3%A9n%C3%A9gal%20Num%C3%A9rique%202016-2025.pdf>
- Schuerkens, Ulrike et al. (2019). *ManaGlobal: Globalized Governance Norms and Local Business Practices. Secondment in Ghana*. D. Sack. Access: <https://managlobal.hypotheses.org/1266>
- Schuerkens, Ulrike (2022), “New business opportunities in Senegal: Policy measures and actual entrepreneurship models”: an essay published in this Unit 2 of the *African Development Perspectives Yearbook*
- Siegel, Donald and Zvi Griliches (1992), “Purchased Services, Outsourcing, Computers, and Productivity in Manufacturing”, in: *Output Measurement in the Service Sectors*, Edited by Zvi Griliches, Chicago: University of Chicago Press, pp. 429-458.
- Tagodoe, A. and Ndiaye E. H. M. (2008) “Les expériences africaines de la diffusion libre du droit sur le Web: bilan et perspectives”, In: *Lex Electronica*, vol. 13, N° 1, (Printemps / Spring 2008). Access: https://www.lex-electronica.org/files/sites/103/13-1_tagodoe-ndiaye.pdf
- Tagodoe, A. (2006). “Diffusion du droit et Internet en Afrique de l’Ouest”. In: *Lex Electronica*. Vol. 11, n° 1. <https://tribunejustice.com/wp-content/uploads/2016/10/Amavi-tagodoe-Droit-et-Internet.pdf>
- World Bank, 2021, *World Development Indicators (WDI) database*. Washington, D. C: World Bank.
- World Food Programme/WFP (2021). « Agricultural insurance & digital payments: challenges of payment digitalization in rural areas of Senegal ». Access: <https://www.wfp.org/publications/2021-agricultural-insurance-digital-payments-challenges-payment-digitalization-rural>

From Informal to Digital: Lessons from two Case Studies in the Ivory Coast¹

Abdul-Aziz Dembele*

1 Introduction

The spread of digital technology in the countries of the South, particularly in Africa, has been accompanied by a series of discourses that can generally be divided into two main orders. The first order is about the promotional and optimistic discourses. Mainly carried by the international development system (World Bank, IMF, NGOs, and other philanthropic organizations), political leaders and, to a certain extent, international consulting agencies (see Mettling, 2019; Huet and Richard, 2017), these discourses emphasize the great potential that digital technology offers African societies. It is said that since the digital revolution, Africa has made "technological leapfrogs" (Huet and Richard 2017) with the mobile phone boom and the rapid adoption of the internet. For the proponents of this discourse, digital technology is a source of innovation, accessible at low cost and now indispensable to all activity sectors. As a result, Africa's integration into globalization and its socio-economic development would henceforth depend on digital technology. Thus, since the end of the 1990s, a growing number of initiatives and interventions, most of them financed by international donors, are in line with this logic of putting digital technology at the service of Africa's development. The second order, in response to the first, is critical. It is carried by a number of academic discourses (see Carmody, 2012; Nederveen Pieterse, 2010; Leye, 2009; Mansell, 2006; Thompson, 2004; Wade, 2002). For authors of this second order, the spread of the digital is part of a global political economy that perpetuates old forms of dependency in African economies. According to this critical perspective, the development of digital technology involves unequal power relations and its promotion in Africa in the form of privatization and liberalization measures, notably in the telecommunication sector, is mainly based on the logic of providing conditions

¹ This article is based on my ongoing PhD thesis on the topic of the digitalization process in the Ivory Coast. I would like to thank the reviewers and editors for their relevant recommendations. The author is thankful to the suggestions from the two anonymous referees and to the valuable comments from the Chief Editor of the African Development Perspectives Yearbook, Professor Karl Wohlmuth.

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for the accumulation of a new capitalism, the digital capitalism, as inspired from the North. Moreover, these discourses question the adequacy and relevance of initiatives in favour of digital development in regions characterized by poor access to basic social services, such as education and health. All these arguments suggest that the general optimism surrounding digital technology is either a way to divert attention from the real problems of African societies, or is a "technological determinism" or even a "technological fetishism"(Nederveen Pieterse, 2010). Of course, there are other more nuanced discourses, but these two orders seem to dominate the debates surrounding digital technology. They constitute, in a word, the two extreme poles of a continuum between two determinisms which are assumed or implicit: an optimistic technological determinism and a critical socio-historical determinism.

This chapter aims to contribute to this debate. The approach followed in this sense consists in the analysis of two projects of digital promotion in Ivory Coast. One project, which "did not work" and one which "has worked". One was abandoned in its pilot phase; the other one can now be described as a "success story". The first project, developed by the Food and Agriculture Organization of the United Nations (FAO) in 2013, was the implementation of a rice seed information system (SIS) with the aim of improving national production. As for the second project, it is a start-up "Coliba" which was created in 2016 and has specialized in the recycling of plastic waste. We will see that far from being a simple initiative launched by young entrepreneurs, the start-up is in a way the product of a development intervention initiated by an NGO with the aim of promoting digital entrepreneurship in Africa.

The method used for this research is mainly qualitative, based on interviews conducted with the stakeholders of the two projects. Interviews about the SIS project were conducted in 2016, and the ones about the "Coliba" project were conducted in 2021. The surveys have also been complemented with bibliographic research and the analysis of documents. The purposes were to reconstruct the context in which these two projects operate, understand the motivations that led to their conception, and finally, provide information on the modalities of their implementation.

The world of development practitioners is usually inclined to publicize its success stories and does very little to inform about its failures in the field. The academic world, on the other hand, is very critical, especially when it highlights the failure of projects and their inappropriateness to the contexts in which they are implemented, but it discusses very little about success stories. This chapter is an attempt to fill this gap by analysing both project failure and project success in the same framework. By showing the reasons for the contrasting outcomes of these two projects, we will conclude our discussion by looking at the lessons that can be learned from comparing them.

2 The Rice Seed Information System “SIS”, its Justification Context, and its Abandonment

In mid-2007, in anticipation of the increase in oil prices, Vietnam announced its suspension of the allocation of a new export quota to face potential tensions on its domestic rice market. This decision was followed a few months later by India, Pakistan and, in January 2008, by Thailand. This movement of anticipation and particularly of national protection, in contradiction with the rules of the World Trade Organization (WTO), was going to result in what has been called the "rice crisis". It should be noted that these countries, in addition to China and the United States, account for around 80% of the world rice supply. The world rice market, highly concentrated in terms of supply, is also characterized by its residual aspect, since only 7% of world production is traded, which means that exports depend less on the prices offered on the world market than on exporters' national imperatives and priorities (Lançon and Mendez del Villar, 2008). On the other side of the world market, global demand is considerably distributed among all world regions, with a strong presence of West Africa. In the majority of countries in this region, rice is the most important cereal consumed, ahead of maize, millet and sorghum (Mendez Del Villar et al., 2011). For these countries, which have historically been dependent on rice imports, the surge in world rice prices and the subsequent "hunger riots" in some of their cities have put the issues of food sovereignty and food self-sufficiency back on the political agenda. Since this crisis, Ivory Coast, and other countries in the region, such as Guinea, Senegal, and Mali, have launched national strategies to stimulate rice production, thus manifesting a "return" of the State in this sector after the liberalization phase of the 1990s. International institutions have also contributed to this movement. As Lançon and Mendez del Villar (2008) point out, while the 2010 decade, marked by very low world rice prices, had been interpreted by liberalization advocates as proof of the efficiency of a global agri-food market, the social tensions linked to soaring prices put the issue of food security back on the international agenda and prompted a number of public interventions, particularly in West African countries.

The Western Africa Rice Improvement Project/Amélioration de la Productivité Rizicole en Afrique de l'Ouest (APRAO) was one of these interventions.² This short-term project (2010-2013) was funded by the Government of Spain and was implemented by the Food and Agriculture Organization of the United Nations (FAO). With an overall budget of US\$5.8 million, it was aimed at the countries in the region most affected by the surge in rice prices, namely Mali, Mauritania, Niger, Senegal, and Ivory Coast. Several specific objectives were pursued, among

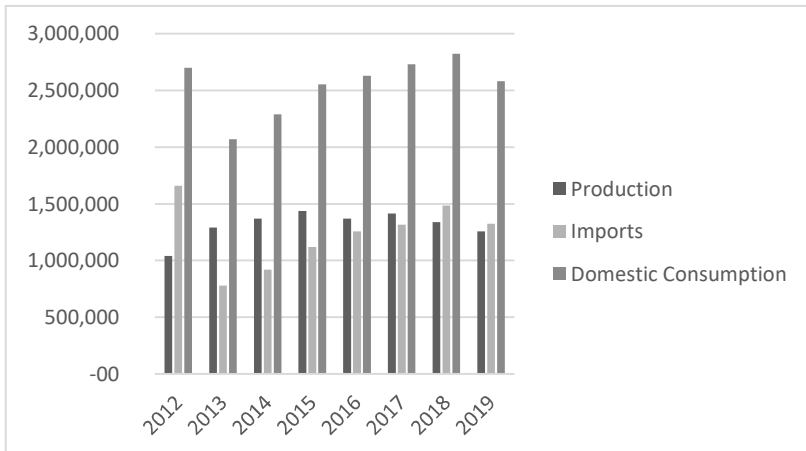
² See: <https://www.fao.org/ag/aprao/aprao-project/approach/capacity-building/en/>. APRAO is the abbreviation of “Amélioration de la Production de Riz en Afrique de l'Ouest”.

them were those "promoting the use of quality seeds" and "securing the production of certified rice seeds" in these countries. Within this framework, Ivory Coast was chosen to carry out the SMS-based information system for seed marketing (SIS) pilot project. Before discussing this project in more detail, it is appropriate to give an overview of the rice situation in Ivory Coast, and then to present the ICT4D paradigm in which it is embedded.³

2. 1 Rice in Ivory Coast: Historical and Structural Dependence on Imports

Like most West African countries, Ivory Coast is historically and structurally dependent on rice imports to satisfy its national consumption. At the time of the crisis, in 2008, Ivory Coast imported 757,000 tons of rice for an average national consumption estimated at 63 kilos per capita. In 2009, imports amounted to 919,000 tons at a total cost of 235 billion CFA francs (ONDR/ Office National du Développement de la Riziculture, 2012). This situation does not seem to be improving. As shown in figure 1, after a relative decrease in 2013, in recent years imports represent almost half of the national rice consumption.

Figure 1: Rice in Côte d'Ivoire, Macro-economic evolution



Source: Computed from FAOSTAT, <http://www.fao.org/faostat/en/#data>

³ There is a lot of activities to work on ICT for Development, also through physical and virtual conferences; see: <https://www.ict4dconference.org/>. ICT4D is "leading the international and cross-sector discussion on digital development since 2010".

If we can highlight the natural assets of Ivory Coast, such as its relative abundance of cultivable land (lowlands and plains), good rainfall, the existence of good quality, high-yielding rice varieties and, to a lesser extent, farmers' know-how (ONDR, 2012), we cannot fail to mention the growing gap between the growth rates of its production and its consumption (4% for growth of production versus 6% growth for consumption in 2012) (ONDR, 2012). The Ivorian government and international donors (ONDR, FAO reports) have identified the use of quality seeds by farmers as one of the most important means of boosting national production. This is the logical consequence of the idea that the use of quality seeds allows a reduction in the cost of production borne by the farmer and is accompanied by a net increase in productivity (ONDR, 2014a). The SIS project is part of this framework of promoting the use of quality seeds, but it is primarily part of the ICT4D initiatives.

2.2 From the ICT4D Paradigm to the SIS project

ICT4D initiatives emerged in the first decade of the 2000s. The objective of these initiatives is to design and implement development projects around digital technology. The spread of digital technology in the Global South initially gave rise to a series of research studies and publications relating to the conditions of distribution and use by local populations (see Donner and Escobari, 2009). This moment was marked by two seminal studies, the first by Robert Jensen (2007) on fishermen in India, the second by Jenny Aker (2010) on farmers in Niger. Both studies, which were impact studies, concluded that mobile phone use by the populations studied was accompanied by a reduction in market price dispersion and transaction costs. In other words, phone use by these populations, as compared to control populations not using phones, resulted in improved market access. The ICT4D research programmes were created as an extension of this work, using digital technology as a tool for development and poverty alleviation. There is now an abundant literature highlighting the potential of digital technology in all areas of activity (health, public administration, agriculture, etc.). For example, a number of publications for development practitioners to design ICT4D projects have emerged in recent years (see Heeks, 2018; Unwin, 2009); alongside the implementation of various projects funded by international donors, NGOs and other philanthropic organizations. From the initial fundamental research, we are witnessing more and more applied research making digital technology an essential component of development projects. The SIS project is part of this movement.

A framework document was drafted by the SIS designers. Archived and available at the *Agence Nationale d'Appui au Développement Rural* (ANADER) in

Abidjan⁴, this document presents the context of the implementation of the SIS, the problem justifying its relevance, and its operating mode. The first step I took during my field study in 2016 was to cross-analyse this document and the reports of the Ivorian public administration. A fundamental discrepancy appears from the outset, and it is appropriate to focus on it for a moment as this is necessary to understand the failure of the project.

The use of quality seed as a means of increasing national rice production, as we have indicated, is unanimously recognized. However, the identified reasons for the lower rate of use of these seeds by farmers – reasons from which the strategies to be implemented can logically be derived – differ from one side to the other. For the *Office Nationale du Développement de la Riziculture* (ONDR), the Ivorian organization in charge of implementing the rice policy, the reasons lie in the low availability of these seeds due to the high production cost and, above all, its low acquisition by farmers (ONDR, 2014a). The diagnosis made by the project designers is quite different. It can be summed up in the following statement from the framework document: "Despite the unmet demand for quality seeds, producers are struggling to find profitable markets for the sale of their seeds, and often encounter difficulties in selling their production". As a result, the problem of quality seed use in terms of relative abundance, according to the SIS designers, is superimposed on, or even opposed to, another in terms of relative abundance, according to the ONDR. Then, while the ONDR's seed policy, through various means that I will not present here, can be summed up in these two points: increase the production of quality seeds and make them accessible to farmers at lower cost, the SIS designers start from the idea – rather a hypothesis to be tested – of the existence of a quality seeds productive capacity justifying the implementation of a seed information system to allow better coordination of actors in the seed market. According to the SIS framework document, the aim was to provide buyers with up-to-date information on the availability and quality of certified rice seed, and to provide producers with information on the varieties and volumes requested by buyers.

The first point to note that will help us to understand the failure of the SIS is its justification, which differs largely from the diagnosis of the ONDR, regardless of the latter's validity. The second point to note is the type of seed involved in the SIS. In the Ivorian context, three types of seeds have been identified: the farmers' seeds, the so-called "acceptable quality" seeds, and the certified seeds. We will see later what distinguishes them and their respective weight on the Ivorian market. It should simply be kept in mind that the SIS was exclusively concerned with the promotion of certified seeds. Let us now turn to the SIS operating mode.

Rather classical for an information system, it has three aspects: technological, organizational, and promotional. On the technological level, the designers adopted

⁴ See the website of ANADER: <http://www.anader.ci/>

the SMS-Gateway technology, a platform enabling the collection and distribution of data by automatic transmission of SMS text messages. Equipped with an internet connection and a mobile phone, the project participant with access to the application can consult the information stored on the platform in real time. The application comes with a set of facilities for the participant. The information can be organized and elaborated for analysis, distributed by email, web or SMS and even downloaded, which gives it a practical dimension for decision-making.

At the organizational level, the user license is held by FAO and by the Government of the Ivory Coast. The main infrastructure of the platform is installed at the headquarters of the *Agence nationale d'appui au développement rural* (ANADER) in Abidjan. Three participant profiles are defined: the administrator, the user, and the operator. The administration belongs to the license holders. They have the necessary system authorizations related to its configuration and updating. The operators are the main beneficiaries of the project. They are farmers' cooperatives and seed producers. According to the framework document, they are identified and selected as based on the results obtained during the previous campaigns. A list of producers that we were able to consult was thus established. Only SMS coming from the numbers registered on this list can be received in the SIS. Finally, users only have the right to consult the information contained in the SIS via internet, SMS, or email. They are essentially either persons (natural or legal) interested in purchasing seeds, or other national or international actors involved in the seed sector.

At the promotional level, the project designers organized a series of communication activities with the various stakeholders in the sector. A pre-evaluation field mission led by an FAO staff was conducted in Abidjan with an information and sensitization meeting for all project stakeholders. It should be noted that the main beneficiaries of the project, i.e., the cooperatives and seed producers selected by the project were given free smartphones with the SIS application to accelerate the project start.

With an estimated budget of US\$172,000 and a launch planned for July 2013, the pilot phase of the project, planned for six months before the generalization to the countries in the region, was abandoned without any official reason. The analysis of data collected during my field survey in 2016 allowed me to identify a series of reasons for the abandonment of this project, which at first glance seemed to be a possible response to the problem of the use of quality seeds by producers. At first glance, as I mentioned the divergence in diagnosis between the project designers and the ONDR, it seems that the SIS was a good solution to the wrong problematic. The argumentation of this point of view is based on a historical and descriptive analysis of the seed system of the rice sector in the Ivory Coast.

2.3 The Inappropriateness of the SIS to the Ivorian Context: Lessons from History

As early as 2012, i.e., one year before the launch of the SIS, in a report on rice seed production and marketing, the ONDR noted that only 7% of rainfed rice areas and 40% of irrigated rice areas were planted with quality seeds, which represented a 10% rate of use of certified seeds for all cultivated areas (ONDR, 2012). If such a finding seems to challenge the thesis of the relative abundance of SIS promoters, it is only partially valid. One could always object, in the minds of the designers, their availability without the farmers being informed. In the same spirit, and this is what is mentioned in the framework document, one could also put forward the idea that, although they have the potential to produce certified seed, producers are not encouraged because, in the absence of reliable information on potential buyers, they are unable to make production forecasts in terms of volume and variety to meet the demand. It is easy to understand that posing the problem of the use of certified seed in these terms necessarily amounts to proposing solutions in terms of reducing information and communication costs, thus making the SIS appear to be the appropriate solution. The seed issue in Côte d'Ivoire, far from being reduced to simple information and communication issues, is more complex. Historical and political factors, which should be examined in greater detail, account for the low rate of use of quality seeds by farmers.

In Ivory Coast, the public authorities have long shown a sustained interest in promoting quality seeds among farmers. This seems to be a constant factor in the history of rice policies in the country. In this regard, it should be noted that, as early as 1908, laboratory research on rice and millet was conducted under the colonial state. It was at this time that the first initiatives for the distribution of (non-local) quality seeds were launched with the colonial logic of "putting farmers to work" and the obligation to cultivate collective fields (Chauveau, 1985). The principle of financial autonomy that governed the administration of the colonies made it necessary to stimulate food production, particularly rice, in a country that, as early as 1930, had to turn to imports from Indochina and French Sudan to satisfy its consumption (Becker and N'guessan, 2004). The post-colonial State, like its predecessor, made a point of developing a modern seed sector as one of the main means of increasing national production. Briefly, this seed experience can be divided into two main phases: the state phase (1960-1978) and the liberalization phase (1978 to the recent period).

The State phase is characterized by state intervention at all levels of the rice seed sector. To provide the country a seed industry, the State built three seed farms and as many seed storage centres. New varieties from other countries were introduced. The production of certified seeds was launched with the creation of a seed laboratory within the *Centre National de Recherche Agronomique (CNRA)* in

Abidjan⁵. Thus, from 1963, within the framework of the "rice operation" to achieve food self-sufficiency, the seeds selected by the research stations were multiplied and distributed in the country. This phase was particularly marked by farmer supervision and support for the development of farmers' organizations. Cultivation contracts – within the framework of the "SODERIZ operation" launched in 1971, including the distribution of seeds of improved varieties and the purchase of the production at harvest – were promoted to encourage farmers to cultivate rice. This operation was both a success and a failure.⁶ Success, because 1975 was the only year in which the country achieved its goal of rice self-sufficiency, with production covering all its needs. Failure, because the SODERIZ operation was considered too costly for the State and was abandoned in 1977 (see Dozon, 1979).

A period of gradual liberalization of the rice sector began in 1978. Although the State handed over the marketing and processing of rice to private operators, the seed sector remained under its control. In 1985, the *Office des Semences et des Plantes (OSP)* was created, a public organization in charge of the management of seed farms, production, marketing, and distribution of seeds.⁷ It was during this period (1978-1985) that seeds, usually sold for a fee, began to be distributed free of charge to farmers. This policy of free distribution continued to be applied for several decades in the framework of various development projects. We will see later how this practice has largely contributed to the singular organization of the seed sector in the Ivory Coast and to what extent it can be considered in understanding the failure of the SIS. At the end of the 1980s, the process of liberalization of rice production also reached the seed sector. The debt crisis common to sub-Saharan African countries and the application of structural adjustment policies (SAPs) led the public authorities to make savings and to gradually disengage from seed production. Expenditure linked to seed production, notably the rehabilitation and maintenance of industrial complexes, was considered as too costly. The sale of seed farms was envisaged as part of privatization programmes. When they were taken over by private groups, most of the time they ended up in failure. The various buyers encountered difficulties in marketing the seeds produced (MINAGRA et N.B.B. Consultant, 2002). The experience of modernization of the Ivorian seed sector seems to be definitively closed in 1994 following the dissolution of the

⁵ See the website about CNRA: <https://cnra.ci/le-cnra/>

⁶ See about the history of Soderiz: https://www.memoireonline.com/11/13/7795/m_L-histoire-d-une-societe-rizicole-en-Cte-d-Ivoire-le-cas-de-la-societe-de-developpement-de-118.html

⁷ See about OSP (Office des Semences et des Plantes/Office of Seeds and Plants): <https://assets.worldbenchmarkingalliance.org/app/uploads/2021/02/Regional-landscaping-report-Western-and-Central-Africa.pdf>

Compagnie Ivoirienne pour le Développement du Vivrier (CIDV), the last national public establishment in charge of the management of the seed industrial policy.⁸ The national seed system built in the 1970s was almost completely dismantled. Since then, the seed sector has been mainly based on informal practices and peasant production.

The Ivorian seed sector is far from meeting the characteristics given to it by the SIS designers. The potential to produce quality seeds that meet the ambitions of food self-sufficiency did exist. However, the private sector has not taken over following the retreat of the State. One could speculate on the reasons of such a situation, which would go beyond the scope of my topic which aims rather at establishing a state of fact belonging to a historical process: the low seed production capacity because of both the dismantling of the State seed complex and the absence of private initiative in the production of quality or certified seeds. Does this observation exhaust all the reasons for the failure of the SIS? Clearly not, because under conditions of sustained support from public institutions and development stakeholders to support the emergence of a private sector, the relevance of the project could be argued to function as a complement to this nascent private sector. Using a descriptive analysis, I will now show how the Ivorian seed sector, dominated by the peasant system, is crossed by a set of contradictions challenging this hypothesis.

2.4 Between the Formal and the Peasant System, the Contradictions of the Ivorian Seed Sector for Rice Seed Production in the Ivory Coast

As mentioned above, three seed production systems coexist in Ivory Coast: the formal system, the peasant system, and the community system.

The *formal system* consists of three phases: the genealogical phase, the reproductive phase, and the dissemination or marketing phase. The genealogical phase is exclusively the domain of scientific research. In general, it consists of either the creation of new varieties or the improvement of existing varieties. Once the seed has left the laboratory, it is entrusted to the producers/multipliers and to the technical supervision institutions. This is the reproductive phase. Finally, the seed is packaged and stored until it is distributed or marketed. This process, governed by legislation, includes a whole series of tests and quality control procedures that ensure the certification of the seed produced. In Ivory Coast, the formal system is divided into three circuits: the ONDR circuit, the donor circuit, and the private sector. The ONDR circuit produces seed to be made available to farmers for a fee. The donor circuit takes place within the framework of development aid. In this

⁸ See on CIDV and the history of rice policy: http://www.ondr.ci/infos_riz_politiques_rizicoles.php

case, the distribution of seeds can take the form of a punctual provision of free seeds in response to the food crisis situations such as the one in 2008. The last circuit, the one performed of the private sector, is generally mentioned from a theoretical point of view. In practice, within this formal system, which provides less than 20% of national seed production (ONDR, 2014a), the private circuit seems non-existent. As a proof, the balance sheets of the certification procedures covering the 2013-2016 periods, of which I had received a copy during my field survey, make no mention of private initiatives. In fact, the producers' cooperatives and seed producers identified by the SIS designers are seed multipliers, i.e., farmers with whom the two main sponsors (ONDR and donors) sign a seed multiplication contract in exchange for payment. Therefore, they represent a simple component of the certified seed production process that does not originate from them. In the absence of requests from these sponsors, they generally belong to the peasant system.

In this *peasant system*, one finds the historical pattern of the farmer himself managing the various aspects of seed: supply, production, conservation, and marketing. In other words, the farmer is both rice grower and seed producer. Based on endogenous knowledge transmitted from generation to generation or in a community way, he selects the varieties and seeds that are best adapted to his environment. The seed is self-produced at the end of each production cycle from the best seeds, and it is saved for the next cycle. The practice is reproduced until the yield of the seed at production is reduced. To obtain supplies and renew his seed stock, the farmer can then turn to community exchanges, the local farmers' market, or even the formal system. This system represents 80% of rice seed production and over 70% of food crop seed production in the Ivory Coast. In rice production, the weight of this system can be explained by its ability to reproduce almost indefinitely and at little cost to the farmer (compared to the cost of certified seed), giving him/her relative autonomy vis-à-vis the formal system. However, from the point of view of the authorities, this cost saving is paid by the poor quality of the seeds used, which results in varietal heterogeneity (which would affect the quality of the rice) and yield losses at harvest.

The third system, the *community system*, known as the "community seed system", has thus been introduced with the aim of improving the farmer's system and renewing its seed patrimony through the diffusion of new or improved varieties. This new scheme is quite different from the logic which was prevailing. Previously, the aim was to promote the spread of certified seeds among peasants. Due to the high cost of the certification process and the absence of a private seed sector, the production of certified seed was usually in the public domain. In this new scheme, the certification process is shortened at the variety development stage. New varieties released by research are made available to peasant organizations in addition to technical support. The classic quality control activities, usually conducted by third parties, are made endogenous to the peasant system. The idea is,

on one hand, to provide know-how to peasants by initiating them to "good practices" of seed production (conservation and maintenance of varietal purity of the seed) and, on the other hand, to rely on networks of exchange and the local market of peasants and peasant organizations for the dissemination of new varieties, hence the name "community system". Seeds produced through this intermediary system (between the formal system and the peasant system) are called to be "of acceptable quality" or as "good to sow".

In the Ivory Coast, this system was initially implemented in the early 2000s under two development assistance projects: the Community Based Seed System (CBSS) project⁹ and the Africa Rice Initiative (ARI) project¹⁰, both jointly funded by the Government of Japan and the World Bank (MINAGRA et N.B.B. Consultant 2002). Originally, these projects were designed to respond to emergency situations due to poor crop seasons. "Acceptable quality" seeds produced under this community-based system are distributed free of charge to farmers and farmers' organizations to boost production. Expected to be one-time (usually three years), these practices seemed to be the norm at the time of my field study. In the early 2000s, Ivory Coast experienced a long period of socio-political crises, which was compounded by the 2008 food crisis. The response to food insecurity, which has been on the agenda of international donors since then, has promoted the free distribution of "acceptable quality" seeds to farmers in the context of various projects. This is another parameter that helps to understand the failure of the SIS.

Indeed, while not assessing the merits of these various projects, one cannot avoid pointing out several inconsistencies and contradictions that exist between them and the SIS. Institutional inconsistency, for example, between the National Rice Development Strategy 2008-2018, implemented by the ONDR (Ivorian office), and a project called CBSS (2005-2010), funded by the Government of Japan and the World Bank, did exist. While the ONDR promotes the use of "certified seeds" among farmers in exchange for payment facilities (on credit or in type), the CBSS aims to increase the production and dissemination of seeds of "acceptable quality". The incoherence of these projects reflects, more fundamentally, an opposition between the logic of the "formal system" and that of the "community system". This incoherence is especially pronounced since it is not unusual to find the same actor, the donor, on both sides of the spectrum. For example, from 2005 to 2010, Japan is financing a project for the "production and dissemination of selected seeds", while from 2011 to 2014 the World Bank is financing a project for

⁹ See about the CBSS project: <https://ccafs.cgiar.org/resources/publications/community-based-seed-systems-cbss-or-community-seed-bank>

¹⁰ See on the partners of these projects: <https://www.mofa.go.jp/region/africa/nerica.pdf>, and: https://www.jica.go.jp/english/publications/brochures/c8h0vm0000avs7w2-att/initiatives_africa_en.pdf

the "production and dissemination of certified seeds", accompanied by "support for the harmonization of national texts with community regulations" and "capacity building for seed producers and the official service in charge of certification". For its part, the FAO (the SIS project's initiator) launched a "production and distribution of certified seeds" project in 2012 (ONDR, 2014b). Last but not least, the contradiction becomes totally obvious when one notices that the SIS, which was supposed to promote the use of certified seeds, was part of the large FAO-led APRAO project, which included another project for "production and dissemination of selected seeds" (ONDR, 2014b:13).

One could, superficially, deduce that the ends justify the means, so that the stacking of projects, beyond their incoherence, is beneficial to the country in terms of increasing national production which could be achieved, among other means, by making quality seeds available to farmers. Unfortunately, in the Ivorian context, this point of view seems difficult to support given the dominant weight which the peasant system continues to hold. Consequently, the real impact of these projects and their relevance should be seriously questioned.

On the other hand, as far as the SIS is concerned, the description of the institutional and organizational context of the Ivorian seed sector, that I have just made, seems to question the hypothesis of a private sector in rising that could have benefitted from such an initiative under the condition of sustained support from public institutions and development partners. We are forced to note a series of contradictions unfavourable to the emergence of a private seed sector. They can be summarized under the idea of a promotion on both sides of the formal system (certified seeds) and the community system (seeds of acceptable quality). When one compares the conditions offered to peasants for the use of seeds, expensive in the formal system, relatively less expensive or even free on some occasions in the community system, and generally cheaper in the peasant system, it is difficult to imagine the emergence of a private sector under such conditions, since in the base case-scenario the development of the community system is favoured. And, the peasant system remains dominant, given that the cost of acquiring seeds remains a determining factor for the peasant. In addition, as an obstacle to the emergence of a private seed sector, one can mention the practices of free seed distribution, which seem to be part of the Ivorian seed order, both historically and currently. Once again, it is not a question of making a judgment on the rightness or merits of these practices, but one of underlining the limitations they represent to the rise of a private sector, looking here to make the diagnosis of the SIS's unsuitability to the Ivorian context. Of course, there are other exogenous factors that explain the absence of a private seed sector in the Ivory Coast, but our aim was mainly to focus on endogenous factors.

2.5 The SIS: a predictable failure beyond its abandonment

After these historical and descriptive analyses, there is no doubt about the invalidity of the main hypotheses regarding the SIS. Concerning the hypothesis of the existence of a seed market, the historical analysis has shown the absence of private actors in the seed sector. On one hand, probably due to its strategic character and especially for political reasons, the sector was historically invested by the State; on the other hand, since the retreat of the State in the 1970s, the only initiatives taken by private actors in this sector have ended in failures. Regarding the hypothesis of the country's productive capacity, we have seen that following the retreat of the State from the seed sector, almost the entire seed complex was dismantled, opening the way to reinvestment of this sector by the peasant or informal system. This is a set of historical facts that question the relevance of the SIS and help to understand its abandonment, and so we have tried to push the analysis further by putting forward the additional hypothesis of the possible relevance of the SIS under the conditions of sustained support from public institutions and development practitioners to the emergence of a private seed sector in Côte d'Ivoire. But the descriptive analysis of the seed sector shows on one hand the still dominant place held by the peasant system, and on the other hand the overlapping of several projects being not favourable to the emergence of an Ivorian private seed sector. Indeed, while some projects are in line with the State's desire to promote the formal system, others emphasize the community system. In a sector largely dominated by the peasant system and in which the emphasis is placed on the use of "acceptable quality" seeds freely distributed to peasants in some cases, it seems difficult to imagine the emergence of a private seed sector, even though actions in this direction are undertaken within the framework of these same projects.

In the end, the abandonment of the SIS was not due to its non-appropriation by the beneficiaries, who in fact appropriated the smartphones they received, but more fundamentally to its unsuitability to the Ivorian context. Moreover, it can be hypothesized that, once implemented, the SIS would certainly not have been as successful as its designers had imagined. Its failure was predictable, beyond its final abandonment. This is what an agent of the Ivorian Ministry of Agriculture told us during an interview. The question of why and how the national authorities were able to endorse this obviously doomed to failure project is open to debate. The reasons may lie in the unequal power relations between the project's designer, who is the main funder, and the beneficiary. Still, for the purposes of this comparative study, we will turn now to another project that has had a different outcome and that can be described as a success story: the "Coliba" project.

3 From the New Focus on Digital Entrepreneurship in Africa to “Coliba”, an Ivorian Success Story

The spread of digital technology in Africa has generated a lot of interest among policymakers at both the national and international levels. This enthusiasm was initially based on the idea that the populations of these regions could and should benefit from the potential of digital technology. It is in this spirit and in the context of the fight against poverty that a series of ICT4D interventions and projects - such as the SIS project - supported or financed by international donors, NGOs and philanthropic organizations have emerged. In recent years, attention seems to be focused more and more on digital entrepreneurship in Africa, whose emergence needs to be supported or encouraged. Several initiatives have been taken in this direction. At the national level, most of the continent's states have undertaken actions or investments for the development of start-ups' incubators or other actions in this direction. This is the case of the kLab in Kigali (Rwanda)¹¹, the iHub in Nairobi (Kenya)¹², the MEST in Accra (Ghana)¹³, or the CcHub in Lagos (Nigeria)¹⁴. At the level of international development institutions, the World Bank launched the XL Africa¹⁵ programme in 2017 to accelerate the development of 20 promising start-ups through their connection with institutional investors. For its part, the French Development Agency (AFD)¹⁶ launched in 2018 the Digital Africa initiative with a €65 million fund to support start-ups on the continent.¹⁷ In addition, there is a range of funds and events dedicated to digital innovation financed by various philanthropic organizations, NGOs, and multinationals (Friederici, Wahome, et Graham 2020).

The Ivorian start-up “Coliba”, discussed here, was born resulting of one of these initiatives launched by the German NGO “Ampion”¹⁸ with the aim to digitalize the plastic waste recycling sector in Abidjan. Before presenting what could be seen as a “success story” of digital entrepreneurship in Africa, it is appropriate to give an overview of the waste management system in Abidjan and to briefly discuss the rationale underlying of what can be considered as the “digital entrepreneurship factory” in Africa.

¹¹ See on Rwanda's kLab in Kigali: <https://www.klab.rw/>

¹² See on the iHub in Nairobi, Kenya: <https://ihub.co.ke/>

¹³ See on MEST (Meltwater Entrepreneurial School of Technology) in Accra, Ghana: <https://gh.linkedin.com/school/mestafrica/>

¹⁴ See on CcHub in Lagos, Nigeria: <https://cchubnigeria.com/>

¹⁵ See on this World Bank programme: <https://www.xl-africa.com/>

¹⁶ See the website of AFD (Agence française de développement): <https://www.afd.fr/fr>

¹⁷ See on the AFD Digital Africa initiative on seed funds for start-ups:

<https://www.afd.fr/en/actualites/digital-africa-seed-funds-start-ups>

¹⁸ See on the mission of „Ampion“: <https://www.ampion.org/about>

3.1 Waste Management in Abidjan, a General View

Economic and demographic growth, and above all the development of urbanization and the lifestyle it brings, are generally considered to be the main factors involved in waste production (UN-HABITAT, 2010). As a result, waste management is a major issue facing all countries and especially cities around the world. Waste management is a public service activity and generally consists of two main stages: the collection, which consists of taking charge of the waste generated in living areas, and the treatment stage, which includes various activities such as sorting, landfilling, recycling, etc. The first stage, collection, is the critical stage for public health and hygiene issues as well as for the efficiency of the waste management process. While in Northern countries the collection rate is around 90% of the waste generated, in Sub-Saharan African regions the average collection rate is, according to the World Bank, 44% (Kaza et al., 2018). While this figure provides a general idea of the failure of waste management services in Africa, it should be emphasized that it represents an estimate in the absence of reliable data and that it is likely to vary positively or negatively across countries, cities, and even within cities. On the other hand, it seems that the already long-standing problem of waste will become more insistent in the decades to come in Africa. Indeed, although it remains the world's least waste-generating region with an average of 0.46 kilograms per capita compared to 1.18 in Europe/Central Asia and 2.21 in North America (Kaza et al., 2018), its high rates of population growth and urbanization suggest that in the future it will produce a significant amount of waste. Thus, according to the World Bank, waste generation in Africa estimated at 174 million tons in 2016 is expected to triple by 2050 (Kaza et al., 2018). Many African countries still do not seem to be able, in the face of such a future challenge, to provide effective responses to the issue of waste (JICA, 2019). Following in this essay the example of the city of Abidjan in the Ivory Coast we can see that, in the face of the many dysfunctions of the public service, various informal activities have developed along the waste management chain. We will first present the specific context of waste management in Abidjan before discussing the practical terms of "Coliba"'s intervention in the plastic waste recycling sector.

In Abidjan, waste management follows a three-stage pattern that is common to all cities in sub-Saharan Africa (Brisoux and Elgorriaga, 2018; Adomon, 2015; Henry, 2009): pre-collection, collection, and landfill. Pre-collection refers to all the procedures for transporting waste from places where it is generated to the various waste bins and grouping stations set up for collection vehicles that then transport it to the landfill. Three points should be emphasized here.

First point: As a configuration of a particular socio-political history (Henry, 2009), the waste management sector in the city of Abidjan presents many dysfunctions. For example, the official collection rate was 65% in 2016 (JICA, 2019).

Another example is the infamous "Probo Koala" affair. In August 2006, after several refusals – including those of the Netherlands, Estonia, and Nigeria – the commercial vessel "Probo Koala" belonging to the transnational firm Trafigura obtained, under opaque conditions, authorization to dump its cargo, 581 tons of toxic waste, in the Akouédo landfill and in several dumping areas in the Abidjan area (Denoiseux, 2010). The dumping of this waste had serious health consequences for the population of Abidjan, with 17 deaths and nearly 43,000 people suffering from poisoning. Although the "Probo Koala" affair subsequently gained momentum with the launch of international investigations that led to a trial and to a compensation for some victims, it has above all appeared as a revelation not only of the state of pronounced degradation of the waste management system but also of the level of incompetence and corruption of public waste managers.

Second point: The pre-collection activity represents the dominant link in the waste management circuit. Originally, it was a minor activity because it was intended for neighbourhoods being inaccessible to vehicles due to the roads' conditions. Thus, it was carried out either by voluntary waste collection by households at places provided, or which was the most common, by pre-collectors going door-to-door and falling under the public service. Following the various dysfunctions of the management services, since the 1990s, pre-collection has been a generalized activity in almost all the city's municipalities. Officially, the pre-collection service is delegated by the communes to private companies. Generally, and unofficially, these service providers tacitly delegate the pre-collection service to informal actors. In practice, apart from a few communes, these are mostly informal activities carried out by unemployed youth or adults who make pre-collection their source of income (Brisoux and Elgorriaga, 2018). Most often equipped with makeshift equipment, such as carts or human-powered wheelbarrows, they engage in door-to-door waste collection. The costs are carried by households based on tacit or verbal contracts. For example, according to Adomon (2015), residents of the commune of Yopougon – a popular municipality in Abidjan – can purchase monthly subscriptions per household from 1,000 to 1,500 CFA francs (equivalent from \$2 to \$3 U.S.) as well as daily rates from 50 to 100 CFA francs (equivalent from 9 to 20 cents U.S.), a fee that is likely to vary depending on geographic location and the amount of waste to be transported (Adomon, 2015). Thus, although there is no legal or official recognition of this, we see a system where informal pre-collectors, in addition to being paid directly by households, potentially benefit from the remuneration, in the form of subcontracting, that they receive from the companies providing the pre-collection.

Third point: The official service does not provide for sorting, recycling, or recovery of waste, which until recently was dumped in the Akouédo landfill, an open-air landfill located on the outskirts of Abidjan. Thus, these activities have been taken over by informal actors. There were 3,000 of them on the site of the

Akouédo dump (JICA, 2019), working under poor sanitary conditions and specializing in the recovery of valuable waste (plastic, iron, cardboard, bottles, glass) that they resell to industrialists or on the markets (Brisoux and Elgorriaga, 2018).

This is, in summary, the context in which “Coliba” as a firm does operate. Let us now turn to what could be called “the digital entrepreneurship factory”, the logic behind the emergence of “Coliba”.

3.2 The Rationales of the “Digital Entrepreneurship Factory” in Africa

The promotion of digital entrepreneurship in Africa appears to be a real inflection within the ICT4D paradigm. However, it is part of a broader socio-economic dynamics and results, in my view, from the articulation of three rationales linked to globalization: the digital rationale, the financial rationale, and the entrepreneurial rationale.

The *digital rationale* is based on the idea that all sectors of activity can and must take advantage of digital technology as a basis for innovation. It can be of transition, in the sense that firms adopt new organizational models by engaging in processes of digitalization of several activities. In recent years, the digital rationale is mainly focused on the creation of digital goods and services. We know that digital firms have a crucial comparative advantage. Unlike traditional sectors, digital products are characterized by atypical cost patterns. Fixed costs are high while variable costs are low. In other words, “it is the design of the product that is expensive for the firm, its production and distribution have low marginal cost” (Plihon, 2003:12). An economy based on information, i.e. the processing, storage and exchange of information, is now superimposed on a knowledge economy (Foray, 2013) focused on the design of new products or processes with high growth potential because it benefits from economies of scale and increasing returns. The platform economy, combining both the knowledge economy with the intensive use of data (Cardon, 2019) and the need to grow in size and market share to take advantage of economies of scale and increasing returns, is in itself emblematic of this new digital rationale. The promotion of digital entrepreneurship in Africa is part of this rationale, the start-up rationale. The African digital enterprise is supposed to be fully integrated into this innovation paradigm: designing innovative digital products or processes with high growth potential.

The *financial rationale* originates from the idea that by developing innovative and efficient digital companies, Africa will be able to attract financial capital and overcome the Lucas paradox, according to which – rather than going to the countries of the South, which are the least endowed with capital –, financial flows are directed primarily to rich countries (Plihon, 2019). Indeed, far from reflecting an efficient allocation of global financial resources as advocated by neoclassical theory, financial globalization instead presents an unequal geographical distribution of capital. Thus, despite the explosion of global financial flows and the dominant

place which finance now occupies in the world economy, Africa still holds a marginal place in terms of foreign direct investment, despite the various institutional reforms implemented since the 1990s to make the continent more attractive. Insofar as this capital is directed primarily towards sectors of activity with high profitability and increasingly towards digital companies, the financial rationale considers digital activity as a criterion of attractiveness for a region lacking foreign investment and the African digital company as an opportunity for financial capital in search of profitability.

Finally, the *entrepreneurial rationale* is part of a global movement of the "re-heroization" (Chapus, Berrou and Onibon Doubogan, 2021) of the entrepreneur. The entrepreneur has always been associated with the movement of Western modernity and capitalism. Reputed as an essential operator of history and economic development, he is found in Karl Marx under the category of the bourgeoisie, as a revolutionary agent and destroyer of traditional feudal structures ([1848] 2014); in Max Weber, under the figure of the Protestant ascetic and the rational entrepreneur ([1905] 1998); and especially in Joseph Schumpeter with his theory of "creative destruction" ([1942] 1990) at work in capitalist economies, a theory linked this time to the figure of the entrepreneur-innovator, driven by the quest for profit to constantly introduce innovations in economic activities. Africa has also known, in the scientific literature, its figures of entrepreneurship under the general features of the actors of the informal economy. This is certainly an entrepreneurship figure which is said to be of a subsistence type, but which is no less recognized for its dynamism, and which has not failed to propose emblematic figures of success such as the *Nana Benz* in Togo¹⁹ or the great *Mouride* merchants of Senegal²⁰. These different figures of entrepreneurship have long been relegated to the background. In the North, they were relegated to the background by large-scale Fordist enterprises and the State interventionism of post-war reconstruction. In the South, the post-colonial developmentalist State left little room for entrepreneurship since it set itself up as an entrepreneur in the alleged or acknowledged absence of a modernizing bourgeoisie. The figure of the entrepreneur began its return to the North with the critique of Fordism and its hierarchical mode of organization (Boltanski and Chiapello, 2011) and especially with the neoliberal revolution of the 1980s (Dardot and Laval, 2009) and its extension to the countries of the South under the "Washington Consensus". This can be seen in the discourse of international financial institutions since the end of the 1990s, particularly those of the World Bank, where the figure of the entrepreneur emerges alongside questions of the fight against poverty and for better governance and/or institutions to gradually impose

¹⁹ See on the Nana Benz businesswomen in Togo: <https://www.togoarchives.com/the-nana-benz-of-togo/>

²⁰ See on the Mourides of Senegal as Islam's mystical entrepreneurs: <https://www.bbc.com/news/world-africa-14344082>

itself "as a relay or partner of the State, or even in some cases as a substitute for the latter" (Chapus et al., 2021:20). As a particular social category, the "African entrepreneur" - like the heroic figure of the Schumpeterian entrepreneur - is now supposed to be an operator of economic development and even of social change. Also, in this new paradigm, he/she enjoys a sympathetic capital that the traditional development actors (States, international financial institutions, NGOs, etc.), which are marked by history and criticism, can no longer claim. The entrepreneurial rationale depicts him/her as the counterpart of the Silicon Valley entrepreneur: young, graduated of major European and American universities, dynamic, and above all – unlike the informal entrepreneur – as a provider of technological innovations adapted to the contexts and challenges of the continent, notably climate change and youth unemployment (Friederici et al., 2020).

The intertwining of these three rationales – digital, financial, and entrepreneurial – informs a set of media and political discourses on digital entrepreneurship in Africa and gives rise to a set of interventions and initiatives whose purpose is to actively produce it, such as the "Venture Bus" initiative of the NGO Ampion.²¹

3.3 "Coliba", a "Success Story" Born from the Meeting of an Intervention and an Aspiration

What is the background of "Coliba"? "Bringing together African entrepreneurs and digital experts from all around the world for a five-day road trip/competition on a bus," this is it how one can define the concept of the "Venture Bus", organized regularly since 2014 in Africa by the German NGO "Ampion". According to its website, "Ampion" describes itself as an organization dedicated to "supporting young Africans in creating innovative start-ups with a social and economic impact in their local communities." Please, note the inflection point in the ICT4D paradigm mentioned above. The design and implementation of projects previously carried out by traditional development actors (financial institutions, NGOs, and philanthropic organizations) are now handed out to local entrepreneurs, even though "Ampion" has originated the initiative. In other words, in this configuration, clearly synonymous with a new phase of the ICT4D paradigm, the intervention consists of generating and assisting a process of innovation by African entrepreneurs. "Ampion" claims – still on its website – its participation in the emergence of more than 80 African start-ups through its hackathon programme. Concretely, the programme takes place aboard a bus crossing the regions of Africa for a few days. The participants selected for the programme receive intensive management

²¹ See on this venture initiative to drive impactful innovation: <https://venture-burn.com/2015/06/ampion-venture-bus-ngos-mission-drive-impactful-innovation-throughout-africa/>

and project design skills and are invited to design digital projects on a topic pre-defined by “Ampion”.

By 2016, while teaching at a French university after completing his PhD in English, the future founder of “Coliba” – with whom I conducted interviews, and some fragments of these interviews will be quoted here – had been thinking about his desire to return to his home country, Ivory Coast, with “the ambition to do something that would have an impact on people’s daily lives”. While looking over what was being done in the field, he heard about “Ampion”’s initiative and decided to apply for the programme:

I went to Abidjan; I looked at what was being done. I knew a little about hackathons and then I jumped on an opportunity. There was a hackathon that was organized by a German NGO. It was a hackathon that allowed setting up projects in sustainable development. I found the idea interesting. We left from Ivory Coast to Nigeria by bus with 60 self-entrepreneurs from various countries. There were Ivorians, Ghanaians, Togolese, and Nigerians. And then I found it great. I participated in this project. That’s how I came up with the design for Coliba, on the bus.

Sustainable development was the topic of that year, around which the participants’ projects had to be designed.

From the Ivory Coast to Nigeria, what jumped out at me was plastic waste. At the time, in 2016, in East Africa, in Kenya, we were witnessing a digital revolution in the finance sector. We had M-Pesa, which had revolutionized finance with digital. So, I said to myself that in West Africa we could digitalize the waste sector.

The “Coliba” project was born from this desire to digitalize plastic waste management in Ivory Coast. The modus operandi developed by its designer is based on three components. A *technological component* based on a web application, an SMS application, and a call centre which was designed to manage the collection of plastic waste. Through these technologies, the people can inform the geographical location of the waste dumps. A *strategic component* that consists of providing market value to used plastic, a product that people generally consider as waste. Thus, to encourage the population to sort and to allow for a better collection of used plastic, the people receive bonus points in a customer account in return for reporting a collection in their place or area of residence. These points can be converted, according to their fidelity to “Coliba”, into various advantages such as air-time or internet credits, shopping vouchers, restaurant tickets, concert tickets, and school kits for people living in poor urban zones. Finally, “Coliba”’s operating mode includes an *analogue component* - in the negative sense of not digital - with the organization of collection by pre-collectors, whose crucial role in “Coliba”’s logistics will be discussed later, and the establishment of a factory equipped with

a sorting and transformation centre for the plastic into pellets, later to be sold to various manufacturers in the sectors of automobile, construction, and textiles. The project, which was the hackathon's prize-winner, subsequently met with considerable enthusiasm among development agencies. This is how the “Coliba” experiment began:

At the end of the project, I got the first prize. The first prize, a check for 10,000 dollars. After I came back to Abidjan, I had the African Development Bank organize an "Innovation Week". I put some layers on my project, I received a first prize and then I went back to Paris, to Bercy, by joining the 'French Tech'. There, I presented my project, and I met my partner. My partner is totally different from me because he is a financier, he went to a business school. He was born in Nigeria, and he grew up in France. He did all his studies in France, and he worked for two years in an open-source company and then we met and there was a good feeling between us. Since he has a slightly different profile from me, we thought that together we would do some enterprising things.

The venture “Coliba” now represents a success story of African entrepreneurship that the media like to echo. It is the provider of a technological innovation in the management of plastic waste, especially for the various unregulated dumping sites, but moreover, it is adapted to the socio-economic characteristics of the population. Indeed, in addition to the incentives to engage the population by providing market value to the plastic user, we have noticed the design of technologies based not only on web application, but also SMS and telephone messaging. This should ensure a better collection of used plastic, especially for people without a smartphone and internet. Also, the company “Coliba” presents at first sight a strong growth potential. According to documents provided by “Coliba”, only 6% of the 220,000 tons of plastic waste produced in the Ivory Coast goes into the recycling circuit, an amount/a share which is common to most sub-Saharan African countries. Unlike the countries of the North, where recycling is now an economic activity, “Coliba” operates in a region where used plastic remains a non-valued waste. This does not exclude, as we shall see, the existence of a recycling sector in the Ivory Coast. For the year 2020, “Coliba” claimed 10,400 tons of recycled plastics. As this figure was only about 4% of the production of used plastics in the country, it represented an increase in the recycling rate of 47% compared to 2019 for the company. The company projects an increase of 54% for 2021. As another element of a "success story", in addition to five new buyers of recycled plastics, “Coliba” claims the status of an inclusive company and as a provider of sustainable employment with notably 80 jobs created in the Ivory Coast, including 75% of women. Finally, for this success story, “Coliba” is led by two young African entrepreneurs, one from Ivory Coast and one from Nigeria, who embody the image of the return of the African diaspora with degrees and ambitious projects for the continent:

We are still in the process of scaling up. We have quite ambitious objectives. We want to be the leaders in recycling in the Ivory Coast. [...] We did not want to be garbage collectors. To pre-collect so the companies come to recover. We said to ourselves, we have this ambition to be African "Suez" or "Veolia". So, we try to be present on the whole value chain. We have set up a recycling factory. [...] We produce semi-finished material, and this semi-finished material is re-used by plastics manufacturers who will use it to make plastic products or packaging, or it will be used in other sectors such as textiles. So, there you have it, we wanted to start on the whole value chain to really have a successful project making sense for Africans and specifically for Ivorians.

The description could stop here and without more details one can participate to the new optimism for digital entrepreneurship in Africa. However, talking about an example of success as a researcher is not to limit oneself to a state of fact which generally consists in noting that a project works because it is adapted to its context and vice versa in a tautological way. Naturally, every project derives its success from its adaptation to its environment. The role of the researcher in this case lies, in my opinion, in an analytical posture and an attempt to clarify the concrete terms of this adaptation.

3.4 Entrepreneurs in the Field

The waste management sector in Abidjan, as mentioned above, is dysfunctional on several respects and shows an objective division of labour. Pre-collection, sorting and recycling activities are dominated by the informal sector, while collection and landfill are the responsibility of official services. The implementation phase of the "Coliba" project has resulted in a series of difficulties encountered in the field and, above all, in a confrontation with the socio-historical configuration of waste management to which they had to adapt.

From the perspective of "Coliba"'s founder, the field experience has involved several initial difficulties, the main one being access to funding. Indeed, apart from the \$10,000 reward obtained as a winner of the "Ampion Venture Bus" programme, "Coliba" started out mainly with its own funds. Thus, for the two leaders, the fact that they had already worked and had accumulated savings appeared to be a starting advantage, especially since the market study, which was a crucial step in the realization of the project, was accompanied by unforeseen costs to produce reliable information and figures on the plastic waste environment in Abidjan. It was argued during the interviews:

There was no data. We had to map everything. The advantage is we worked before. So, we invested, we did market studies, we cross-referenced our figures and then I think we were a little bit lucky because we compared our

figures with studies that were done by big firms here. We relied a little on these data. This reinforced our credibility and allowed us to say we are indeed in a promising market.

With this data, “Coliba”’s leaders succeeded in attracting a Paris-based investment fund, which joined them in 2017, a few months after the start of their activity. However, “Coliba” is now facing another legal difficulty. In the Ivory Coast, there is no specific law or regulatory framework governing the waste sector. As a result, although “Coliba”’s managers have benefited from the Ivorian “guichet unique” or “one-stop shop” mechanism, which facilitates the administrative procedures for setting up a business by allowing any entrepreneur to create a company in three days, “Coliba”’s activity is not legally recognized, which results in a source of uncertainty likely to hinder the smooth running of the company and its future development.

After three years of activity, “Coliba” claims that there were monthly 25,000 active users of its digital device (web application, SMS, messaging), which allows the plant to collect 2,400 tons of used plastics annually. However, this figure represents only 23% of the 10,400 tons of collection achieved overall for the year 2020. In fact, although the digital device is an integral part of “Coliba”’s activity, its modus operandi shows a strong physical presence, including a particular articulation to the socio-historical configuration of waste management in Abidjan and a set of actions carried out in the field to increase the collection rate of used plastic.

Finding an already structured waste sector which is dominated by pre-collectors, “Coliba” adapted to this context and developed a collection strategy based on the mobilization of informal actors: “From the moment you want to structure an ecosystem, you actually overlap. This means that you don’t work perpendicularly with them, you work in the same direction as them while structuring them”. The company thus maintains an objective subcontracting relationship with nearly 6,000 pre-collectors that it says it has identified and that are paid for their services. This relationship is clearly beneficial for both parties. “Coliba” increases its collection rate, and the informal pre-collectors receive additional income in addition to their activity. “Coliba”’s intervention in the field also involves the construction of infrastructure. To compensate for the deficient state of public waste collection infrastructure (garbage bins and grouping centres), the company has opted, based on partnership, for the installation of used plastic collection bins in certain strategic locations of the city, such as schools, businesses, universities, hotels, and gas stations. The objective is to facilitate logistics as well as to encourage sorting at source. Finally, in partnership with philanthropic organizations which are present in the field, “Coliba” regularly conducts sorting awareness campaigns in working-class neighbourhoods, schools, and universities.

As can be seen, from the conception to the realization of the project, “Coliba”’s modus operandi underwent a series of modifications to adapt to the

context. Thus, the innovation did not only consist in the mobilization of digital technology, but also in a dynamic organizational innovation that considered the configuration of the field.

3.5 The “Coliba” Experience in regard of the Globalized Image of Digital Entrepreneurship

Does the success of the “Coliba” project, as it was described above, ultimately reflect the realization of the globalized image of digital entrepreneurship in the Ivory Coast? In other words, does it respond to the three rationales guiding the promotion of digital entrepreneurship in Africa? Let's take these three rationales regarding Coliba's activity. First, the digital rationale, which emphasizes the potential offered by digital technology, particularly the possibility of designing products or services that benefit from economies of scale, increasing returns, or network effects. With a relatively small number of users of its digital platform, “Coliba” appears less as a digital start-up than as a start-up articulating in an original way the potential of digital technology with analogue activities. The innovation, both digital and organizational, far from being radical, adapts dynamically to the context with a strong physical presence on the ground. Moreover, the socio-historical configuration of the waste sector in Abidjan does not allow “Coliba” to benefit from economies of scale or increasing returns for the moment. Indeed, its development seems to be conditioned by its ability to mobilize the various actors in the field, notably informal pre-collectors, on the one hand, and the establishment of a physical infrastructure and logistics base on the other hand; these are activities that require substantial investments. “Coliba” thus belongs to the category of “last-mile platforms” as it was developed analytically by the study of Friederici, Wahome and Graham (2020), to describe most African digital start-ups which are characterized by high marginal costs of activity in contrast to the low marginal costs recognized by the big European digital platforms. The financial rationale is thus countered, because these additional costs that condition the growth of “last-mile platforms” impact their financial profitability, at least in the short term. Finally, as far as the entrepreneurial rationale is concerned, there is no doubt that “Coliba”'s experience resembles in many ways a successful example of entrepreneurship in Africa. The company's leaders are young and have accumulated certain know-how. They have not only taken advantage of the opportunity offered by “Ampion”'s programme but have also managed to overcome the difficulties encountered in the realization of their project. With its activity and its actions in the field, “Coliba” fulfils a social function. However, we must not lose sight of the fact that this social function converges in the interests of the company, which operates only in a recovered segment of waste, namely plastic waste. It is superimposed on an already configured sector that it tries to transform according to its

economic interests. All in all, “Coliba”, a “success story”, is far from having revolutionized the waste sector in Abidjan, which is characterized by numerous deficiencies in the public service and is dominated by informal actors.

4 “Technological Solutionism” vs. “Glocalization”

What lessons can we draw from these two experiences of projects with using digital technology that we have just discussed? We will start with an observation that emerged at the end of the discussion. Both projects took place in sectors of activity currently characterized by a strong presence of informal practices and actors. This is a fundamental fact, common to the countries of the South that development practitioners and entrepreneurs should account for when designing digital projects. A concrete knowledge of the environment, its organizational modalities, and the specific issues that run through it are therefore a prerequisite for the adequate formulation of such a project, which is essential for its success.

This was not the case for the SIS because, as we have shown, at the time of its implementation, neither the productive capacity of the seed industry, nor the existence of a seed market, nor even that of private actors, which appear to be necessary preconditions for justifying the implementation of an information system, were verified. The SIS experience thus reveals one of the drifts of the ICT4D paradigm. It all seems as if we have moved from the idea that the use of digital tools by people leads to an improvement of their living conditions to the idea that the problems faced by people in the South necessarily translate into access to information, making digital technology an indispensable solution. In the words of Tim Unwin, this is a shift from ICT4D/“ICT for Development” to D4ICT/“Development for ICTs” (2009, 2016)²², in other words, moving from “ICTs for Development” to “Development for ICTs”. Finally, the SIS is clearly a “technological solutionism”, a notion forged by Evgeny Morozov (2014) to point out an ideology that consists of “recasting all complex social situations as neatly defined problems with definite, computable solutions or as transparent and self-evident process that can be easily optimized – if only the right algorithms are in place!” (Morozov, E., 2014: 22). As an avatar of technological determinism in the digital age, technological solutionism does not aim so much to explain but rather to shape the social world according to a technicist a priori: “Solutionism presumes rather than investigates the problem that it is trying to solve” (Morozov, E., 2014) and, most of the time, at the cost of denying the history and complexity of the social world as we have just seen with the factually flawed premises that ground the SIS conception.

²² See also the blog from October 24, 2016, 2:37 pm: “Making money from meeting the SDGs? An overarching approach to sustainable development”, available on: <https://unwin.wordpress.com/tag/d4ict/>

The “Coliba” experience, by contrast, shows an original adaptation of digital entrepreneurship to the socio-historical configuration of the waste sector in Abidjan. In this case, the existence of a significant production of plastic waste by the population and the design of digital services (web applications, SMS, messaging) adapted to their socio-economic conditions appear to be prerequisites for the success of the project, but they have not proved sufficient. The success of the project required an analogue (as opposed to digital) investment by the entrepreneurs, notably cooperation with informal actors, incentives for the population, and the construction of physical infrastructure. This is the second lesson we can draw from this comparative study: digital innovation is generally accompanied by organizational innovation and, in the case of countries of the South particularly, by investment in physical infrastructure, which is often lacking. This is undoubtedly the main reason for “Coliba”’s success, which is less a reflection of the effective realization in Côte d’Ivoire of the globalized image of digital entrepreneurship than of its “glocalization”, in other words, a successful adaptation to the local context of digital entrepreneurship. “Glocalization” is a concept coined from the Japanese *Dochakuka*²³, what literally means the adaptation of cultivation techniques to local conditions. In contrast to the idea of universalization of socio-cultural practices and training according to the Western model, the notion of “glocalization” highlights dynamic processes of adaptation and the emergence of hybrid socio-cultural practices concomitant with the process of globalization (Khondker and Schuerkens 2014). This is the case with the “Coliba” project. From conception to realization, the project has undergone a series of adaptive transformations, leading finally to an original form that distances it from the globalized image of the digital start-up, fortunately, since it finally leads to an industrial enterprise that provides jobs.

5 Conclusions and Policy Recommendations

To return finally to the opening debate between the two dominant orders of the discourse around the “digital” in the countries of the South, it should be noted that while the failure of the SIS appears to be the manifestation of a technological determinism that gives credence to the criticism of digital optimism, the success of “Coliba”, which testifies to a glocalization of digital entrepreneurship, adds nuances to the socio-historical determinism. Digital technology is now an integral part of the daily lives of people in the South. It affects all fields of activity and participates in an original way in their transformation. In my view, within the

²³ See on this concept of “Dochakuka” (melding Global into Local) the study: https://www.tandfonline.com/doi/abs/10.1300/J042v21n01_03

framework of fundamental research, the question to opt for or against digital technologies becomes a subsidiary one compared to the issue of describing the concrete forms of its diffusion and appropriation by the population on the one hand, and to propose the means of its effective use for development on the other hand.

In this sense, at the end of this comparative study, a certain number of policy recommendations can be formulated. The failure of the SIS highlights the need for a better cooperation between national and international development actors. In this sense, national public authorities must have a voice in the formulation and choice of international projects and their adequacy with national policies. Digital technology offers a great potential, of course. However, the relevance of projects must be judged in relation to the real needs of the population, which are not at all reduced to access to information and coordination. Hence the need for policymakers to promote applied research programmes to determine both the sectors of activity, likely to be suitable for digitization processes, and the appropriate technological tools for this purpose. In this regard, it is necessary to emphasize the importance of participatory approaches, which are essential for the ownership of projects by the beneficiaries, as well as project monitoring and evaluation activities, a dimension that is often neglected but no less essential in terms of capitalizing on past experiences.

While the various initiatives taken in recent years to promote the emergence of digital entrepreneurship in Africa are to be welcomed, it should be emphasized that it is just as important to promote its development. The “Coliba” experience shows a relative success for the present. Although it has a clear potential of growth, the company still faces two major obstacles: difficulties in accessing financing and problems with the legal framework of its business sector, meaning the existing legal vacuum in the Ivory Coast regarding the status of plastic waste. While the first obstacle seems common to most of African SMEs and the need for policymakers to use legal and regulatory tools to encourage private investment, as especially domestic investments should be emphasized, the second obstacle seems specific. Faced with this situation, national mechanisms being able to ensure public/private cooperation, and mechanisms allowing the expression and consideration of the specific needs expressed by entrepreneurs, are desirable.

References

- Adomon, A. A. (2015): “Les précollecteurs privés informels, une réponse à la crise de collecte des ordures ménagères à Yopougon?”, in: Archives Ouvertes HAL-ENS-LYON; see: <https://hal-ens-lyon.archives-ouvertes.fr/enst-01181270>, accessed March 5, 2021.

- Aker, J. C. (2010): "Information from Markets Near and Far: Mobile Phones and Agricultural Markets in Niger", In: *American Economic Journal: Applied Economics*, 2(3): pages 46-59.
- Becker, L. and N'guessan, Y. (2004): "Le riz dans l'ancienne "boucle du cacao" de Côte d'Ivoire", in: *Autrepart*, 31(3): pages 133-150.
- Boltanski, L. and Chiapello, E. (2011): *Le nouvel esprit du capitalisme*, 1ère édition 1999, Paris, Gallimard.
- Brisoux, L. and Elgorriaga, P. (2018): "Les enjeux de la gestion des déchets à Abidjan: la vitrine de la Côte d'Ivoire face aux défis de l'insalubrité", *Mémoire de Master, Sciences Po, Rennes*.
- Cardon, D. (2019): *Culture numérique*, Paris, Les presses de Sciences Po.
- Carmody, P. (2012): "The Informationalization of Poverty in Africa? Mobile Phones and Economic Structure"; In: *Information Technologies and International Development*, 8: pages 1-17.
- Chapus, Q., Berrou, J. P. and Onibon Doubougnan, Y. (2021): "Le retour du hero? L'entrepreneur, itinéraire d'un concept chez les "développeurs" en Afrique", In : *Revue internationale des études du développement*, 245(1): pages 11-39.
- Chauveau, J. P. (1985): "L'avenir d'une illusion. Histoire de la production et des politiques vivrières en Côte-d'Ivoire", in: *Etudes rurales*, 99(1): pages 281-325.
- Dardot, P. and Laval, C. (2009): *La nouvelle raison du monde: essai sur la société néolibérale*, Paris, La Découverte.
- Denoiseau, D. (2010): "L'exportation de déchets dangereux vers l'Afrique: le cas du Probo Koala", *Revue Courrier hebdomadaire du CRISP/Centre de recherche et d'information socio-politiques*, 2071(26): pages 5-47.
- Donner, J. and Escobari, M. (2009): "A Review of the Research on Mobile Use by Micro and Small Enterprises (MSEs)", pp. 17-26, in: *2009 International Conference on Information and Communication Technologies and Development (ICTD)*, Doha, Qatar.
- Dozon, J. P. (1979): "Impasses et contradictions d'une société de développement: l'exemple de l'opération "riziculture irriguée" en Côte d'Ivoire", in: *Cahiers de l'ORSTOM/Office de la recherche scientifique et Technique d'Outre-Mer, Séries Sciences Humaines*, 16(1-2): pages 37-58.
- Foray, D. (2013): "L'économie de la connaissance", pp. 26-44, in: *Croissance, emploi et développement, les grandes questions économiques et sociales*, edited by Delage, J. P., Paris, La Découverte.
- Friederici, N., Wahome, M. and Graham, M. (2020): *Digital Entrepreneurship in Africa: How a Continent is Escaping Silicon Valley's Long Shadow*, Cambridge, The MIT Press.
- Heeks, R. (2018): *Information and Communication Technology for Development (ICT4D)*, Abingdon, Oxon, New York, Routledge.
- Henry, A. (2009): "Centralisation, décentralisation et accès aux services urbains: le cas de l'enlèvement des ordures ménagères à Abidjan", in: *Belgeo*, (3-4): pages 425-438.

- Huet, J.-M and Richard, S. (2017): *Le digital en Afrique: les cinq sauts numériques*, Paris, Michel Laffont.
- Jensen, R. (2007): "The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector", in: *The Quarterly Journal of Economics*, 122(3): pages 879-924.
- JICA/Japan International Cooperation Agency (2019): *Recueil de données sur la gestion des déchets solides en Afrique*, Data Book, Agence Japonaise de Coopération Internationale, see: https://africancleancities.org/assets/data/JICA_data-book_FR_web_20191224.pdf, accessed April 12, 2021.
- Kaza, S., Yao, L., Bhada-Tata, P., Van Woerden, F., Ionkova, K., Morton, J., Poveda, A. R., Sharraf, M., Malkawi, F., Harinath, A. S., Banna, F., An, G. and Levine, D. (2018): *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*, Washington, D.C., World Bank Group.
- Khonder, H. H. and Schuerkens, U. (2014): "Social Transformation, Development and Globalization", *Sociopedia*, pages 1-14.
- Lançon, F. and Mendez Del Villar, P. (2008): "La flambée des prix mondiaux du riz: crise conjoncturelle ou mutation durable?", in: *Hérodote*, 131(4): pages 156-174.
- Leye, V. (2009): "Information and Communication Technologies for Development: A critical Perspective", in: *Global Governance*, 15(1): pages 29-35.
- Mansell, R. (2006): "Ambiguous Connections: Entitlements and Responsibilities of Global Networking", London, LSE/London School of Economics Research, see: <http://eprints.lse.ac.uk/archive/00000763>, accessed March 15, 2019.
- Marx, K. ([1848] 2014): "Le manifeste du parti communiste", pp. 395-440, in: *Philosophie*, edited by Rubel, M., Paris, Gallimard.
- Mendez Del Villar, P., Bauer, J.-M., Maiga, A. and Louali, I. (2011): *Crise rizicole, évolution des marchés et sécurité alimentaire en Afrique de l'Ouest*, Paris, République Française, Ministère des affaires étrangères et européennes.
- Mettling, B. (2019): *Booming Africa: le temps de l'Afrique digitale*, Paris, Editions Débats publics.
- MINAGRA, Ministère de l'Agriculture and N.B.B Consultant (2002): *La politique rizicole: diagnostic de la filière riz*, Abidjan, République de Côte d'Ivoire, Document de travail.
- Morozov, E. (2014): *To Save Everything, Click Here: The Folly of Technological Solutionism*, New York, Public Affairs.
- Nederveen Pieterse, J. (2010): *Development Theory: Deconstructions/Reconstructions*, 2nd ed., London, SAGE.
- ONDR, Office National du Développement de la Riziculture (2012): *Synthèse de la stratégie nationale revue de développement de la filière Riz (2012-2020)*, Abidjan, République de Côte d'Ivoire, Ministère de l'Agriculture.
- ONDR, Office National du Développement de la Riziculture (2014a): *Mémoire sur la production et le conditionnement des semences certifiées de riz*, Abidjan, République de Côte d'Ivoire, Ministère de l'Agriculture.

- ONDR, Office National du Développement de la Riziculture (2014b): Programme national de développement de la filière semence riz, Abidjan, République de Côte d'Ivoire, Ministère de l'Agriculture.
- Plihon, D. (2003): *Le nouveau capitalisme*, Paris, La Découverte.
- Plihon, D. (2019): "La globalisation financière", pp. 23-41, in: *Les enjeux de la mondialisation*, edited by Bénassy-Quéré, A., Chavagneux, C., Laurent, E., Plihon, D. and Rainelli, M., Paris, La Découverte.
- Shumpeter, J. A. ([1942] 1990): *Capitalisme, socialisme et démocratie*, Paris, Editions Payot et Rivages.
- Thompson, M. A. (2004): "ICT, Power and Developmental Discourse: A Critical Analysis", in: *The Electronic Journal of Information Systems in Developing Countries*, 20(1): pages 1-25.
- UN-HABITAT/ United Nations Human Settlements Programme (2010): *Solid Waste Management in the World's Cities: Water and Sanitation in the World's cities*, edited by United Nations Human Settlements Programme, Washington D.C..
- Unwin, T. (2009): *ICT4D: Information and Communication Technology for Development*, Cambridge, Cambridge University Press.
- Wade, R. H. (2002): "Bridging the Digital Divide: New Route to Development or New Form of Dependency?", in: *Global Governance*, 8(4): pages 443-466.
- Weber, M. ([1905] 1998): *L'éthique protestante et l'esprit du capitalisme*, Paris, Plon.

Relevant Websites for the two projects' stakeholders

The SIS Project:

APRAO: <http://www.fao.org/ag/aprao/en/>

ANADER: <http://www.anader.ci/>

ONDR: <http://www.ondr.ci/>

The Coliba Project:

AMPION: <https://www.ampion.org/>

COLIBA: <https://coliba.ci/>

Unit 3: Digital Transformation in South Africa with Examples from the Free State

Digital Transformation in South Africa with Examples from the Free State - An Introduction¹

K. de Wet² & HMVE Combrink³

1 The Issues

South Africa is known for its high inequality not only in terms of economic factors and wealth distribution, but also for the spillover effects of this high inequality impacting into domains such as education, morbidity and mortality, nutritional outcomes, agricultural productivity, employment, to name but a few areas (Health Systems Trust, 2020; Maluleke, 2021). South Africa has one of the highest Gini coefficients in the world (0.65 in 2017, with an increase of 22.8% between 1980 and 2017), this index being a measure that indicates the income distribution within a country (see: Socio-Economic Survey of South Africa, 2019⁴). These pervasive inequalities, that are all intricately linked, set the scene for the context in which South Africa's Fourth Industrial Revolution (4IR) is taking shape. Albeit a global buzzword, South Africa, as well as the entire African continent, is crafting strategies to respond to the global turn towards harnessing big data, robotics, the Internet of Things (IoT), artificial intelligence (AI), and increasing processes of digitisation and digitalisation that characterise large swathes of the globe at present. South Africa's commitment to this can be witnessed by the creation of its Presidential

¹ The authors are thankful to the suggestions from the two anonymous referees and to the valuable comments from the Chief Editor of the African Development Perspectives Yearbook, Professor Karl Wohlmuth.

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⁴ See on the various chapters of the Survey: <https://cra-sa.com/products/socio-economic-survey/south-africa-survey-2019>

Commission on 4IR (PC4IR)⁵ as well as “The Digital Transformation Strategy for Africa (2020-2030)⁶ from the African Union (AU), among others. According to the Digital Transformation Strategy for Africa one can read: *“Digital Transformation is a driving force for innovative, inclusive and sustainable growth. Innovations and digitalization are stimulating job creation and contributing to addressing poverty, reducing inequality, facilitating the delivery of goods and services, and contributing to the achievement of Agenda 2063 and the Sustainable Development Goals.”*⁷

South Africa is the most industrialised country on the African continent, yet it is argued by some that the previous Industrial Revolutions have only benefited some segments within society (Hlatswayo, 2019). Within South Africa, there are parts that resemble the most developed areas on the globe, whereas other areas and those trapped within face vicious cycles of underdevelopment, poverty, socio-economic marginalisation, and exclusion⁸. The essays that are unpacked in this Unit of the African Development Perspectives Yearbook will highlight the manner in which inequalities are manifest in domains such as agriculture, education, and health care, and by reflecting on potential ways to redress inequalities in these important contexts by harnessing the promises of digital developments. These technological developments could be utilised to attain social good and social relevance by filtering into the everyday uses among ordinary people and systems to enhance certain outcomes. However, the caveat remains that these technological opportunities and advancements could be disadvantageous in as much as it could exacerbate existing and entrenched inequalities, thereby leading to yet another gaping inequality, commonly referred to as the “digital divide” in terms of physical as well as epistemological access to the promises of the digital in all its guises (see: Du Preez/Le Grange, 2020).

The ubiquitous use of the notion of the digital divide has evolved over time and whereas it initially only referred to a gap in terms of access to and usage of technology between groups from different geopolitical, demographic, and socio-economic groups, a distinction is increasingly drawn between other types of digital

⁵ See on the Presidential Commission on 4IR: <https://www.ellipsis.co.za/wp-content/uploads/2020/10/201023-Report-of-the-Presidential-Commission-on-the-Fourth-Industrial-Revolution.pdf>, for the report on recommendations in the South African context.

⁶ See on the Digital Strategy of the African Union: <https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf>

⁷ See on the Digital Strategy of the African Union: <https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf>

⁸ See by Time magazine the blog “South Africa Wealth Gap Unchanged Since Apartheid, Says World Inequality Lab”, August 5, 2021; access for download: <https://time.com/6087699/south-africa-wealth-gap-unchanged-since-apartheid/>, for a succinct explanation of inequality in South Africa over the years.

divides to underscore issues of gender, age, social class, and race (according to Steele, 2019). As can be expected, “the digital divide has an impact on the economy, on various social spheres, society at large, and education” (Steele, 2019). Reference is also made to “second-level digital divide” (Correa, 2008), which highlights the difference between those who are mere knowledge consumers and those who even become knowledge producers. As early as 1994 and then later, some authors (Morrow 1994; Du Preez/Le Grange, 2020) identified the hugely relevant notion of “epistemological access” to focus beyond the issue of physical access only. In fact, a significant majority of those residing within the Global South now does have access to mobile phones and to the Internet, which translates into an increasing inclusion in the digital system (Heeks, 2021). According to Heeks (2021) the increased access to digital infrastructure by the Global South needs to be accompanied with a new paradigm which includes higher levels of access and increasingly sophisticated digital development (Heeks, 2021).

Of South Africa’s 59.67 million inhabitants (in January 2021), there were 38.19 million Internet users at the same period. The amount of Internet users in South Africa increased by approximately 4.5% between 2020 and 2021, and the Internet penetration rate was 64% in January 2021⁹. The South African Department of Communications and Digital Technologies announced in November 2021 that it is looking at a mass internet rollout plan for South Africa. The announcement was made by the current Communications minister Khumbudzo Ntshavheni, in which it was stated during an international meeting between representatives of Brazil, Russia, India, and China and South Africa (BRICS) that South Africa is investigating programmes to fast-track access to internet connectivity for all South Africans by November 2023¹⁰.

South Africa’s National Development Plan 2030, launched in 2012, also emphasises the potential of Information and Communication Technologies (ICTs) to act as critical enablers of economic growth, productivity, and communication¹¹. Digital transformation brought by 4IR technologies in the South African context extends beyond just business. 4IR is driven by people and digitisation infiltrating

⁹ See Datareportal, Digital 2021: South Africa; access for download: <https://datareportal.com/reports/digital-2021-south-africa>

¹⁰ See BusinessTech, 12 November 2021: Plan to give everyone in South Africa access to the internet in 2 years, says minister; access for download: <https://business-tech.co.za/news/broadband/536996/plan-to-give-everyone-in-south-africa-access-to-the-internet-in-2-years-says-minister/>

¹¹ See National Development Plan 2030: Our future – make it work; access for download: https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf

all forms of civil society, and it will continue to shape society in the future because people can connect, socialise, and engage with one another in ways never thought possible¹².

It is therefore imperative that these digital developments should bear long-term advantages, not only in terms of digital uptake, but also with regards to digital immersion and to positive results to lessening widespread inequalities. This includes the absorption of the manifold ICTs promises to lead to more prosperous outcomes in contexts of the Global South. African and South African policies are in place that encapsulate this vision, and it is therefore necessary to implement this vision into practical and practicable outcomes. All the contributions to this edition are written from an interdisciplinary perspective attempting to start a critical engagement with digital transformations and with the immense potential as well as the challenges we face in South Africa.

The essays originate from cooperation emanating from a new initiative that emerged at the end of 2021 at the University of the Free State: *The Interdisciplinary Centre for Digital Futures* (ICDF). The vision of the Centre is to act as a conduit to enhance a responsible digital immersion through the development of expertise in both social scientific and technical competencies of the digital media in all its guises¹³. The ICDF strives to ensure that the deployment and adoption of technological advancements related to the 4IR happen in an ethical, socially responsive, and critical manner. This requires an understanding of digital technologies and its embeddedness within society and its wider environment. It also encompasses the engagement with much-needed change management to understand the challenges of adoption and integration of technologies into societal spaces.

Together with industry, communities, and government, the ICDF wants to spearhead a digital future where the world of “the digital” becomes accessible and useful to a wide range of agents through the local development and the strengthening of our immediate cyberinfrastructure to enable digital research projects. The

¹² See Suryacipta, Integrated Industrial Estate, Industrial Revolution 4.0/Important Things You Need To Know; access for download: https://www.usb.ac.za/usb_news/harnessing-the-power-of-the-4th-industrial-revolution/

¹³ The ICDF is not solely focused on the important processes of mere digitisation but also those that relate to “digitalisation”. “Digitalization” cannot happen without “digitisation” as “digitisation” focuses on the important processes of converting analogue entities to digital ones. “Digitalisation”, however, “requires a much broader adoption of digital technology and cultural change. Digital transformation is more about people than it is about digital technology” (Colline Chapco-Wade-Safina, October 21, 2018, “Digitization, Digitalization, and Digital Transformation: What’s the Difference?”. Access for download: <https://colleenchapcowadesafina.medium.com/digitization-digitalization-and-digital-transformation-whats-the-difference-eff1d002fbdf>). The latter definition therefore aligns most closely with the ICDF’s vision.

ICDF strives to be a collaborative, co-creative space where social scientists, humanities, natural scientists, engineers, and health scientists - as can be witnessed from the contributors to these essays - collaborate and interact with outside partners to provide a unique eco-system, driving the digital future for the benefit of society, economic growth, and prosperity. Its projects will typically be interdisciplinary in nature, combining social, natural, and digital sciences to explore and to find answers to real-world questions.

2 The Contributions

This thematic edition focuses on four essays in key areas that could potentially benefit from sustained and scaled digital enhancements (education, agriculture, health, digital twinning). In terms of education, digital literacy is of paramount importance to lay the foundation for sustained and sustainable future engagements with an increasing digital world. Central to the discussion in all these essays is the deployment of technology. These essays are presented with a specific focus on digital advances in a context of unequal and deficient socioeconomic development, which pose challenges and quandaries for a simple understanding and the implementation of the dictates of the 4IR (see Schwab, 2016). Education, agriculture, and health – the issues we are focusing on - are some of the key spheres of activity and development that constitute the foundation of a prosperous nation. Agriculture is considered in two essays (digital opportunities for small-scale female producers and digital twinning as support tool for soybeans production). The potential digital interventions and solutions suggested within these spheres will be situated within this unique socioeconomic, political, and geographical milieu to critically reflect on how responses to the 4IR could potentially be shaped to be reactive to some of the most pressing needs in South Africa.

The *first essay* on **Basic digital education and the digital divide in South Africa: A Free State perspective** by **H. M. V. E. Combrink, K. de Wet, F de Villiers, S. Brokensha, and E. Kotzé** sets out to describe the much-needed emphasis on basic education in South Africa as a precursor of responding to the 4IR. The 2020/2021 South African national lockdowns in response to the coronavirus disease (COVID-19) have accentuated the existing digital divide and have even intensified the digital divide which is specific to the basic education system. The contrast between schools in context of socio-economic thriving and in poverty-stricken areas was always apparent and this culminated in the fact that basic education stagnated in 2020/21 for the most part in areas with an acute digital scarcity. As outlined by the South African Commission on the Fourth Industrial Revolution (4IR), addressing the digital disparities which are present in South African education is of paramount importance (Report of the SA Presidential Commission, 2020). The Commission identifies that teaching computational thinking and other

related cognitive skills is a better fit than to rush with the deployment of educational technologies. This creates a unique opportunity in which the most suitable technologies can be investigated for this specific context, while establishing long-term relationships with the technological industry. To launch this type of enquiry, a holistic approach is needed to standardise the technology, to provide for the required infrastructure, and to update curricula to ensure that South African basic education does not fall short in terms of participating in the promises of the 4IR. This essay serves to explore the current situation in South Africa's basic education system, with the Free State province as a use case in terms of the digital divide. It aims to emphasise the challenges that lie ahead for the Commission and the whole nation, to materialise the vision of equipping learners with digital skills that benefit the 4IR. This essay will shed light on the complexities which are present within the South African education context and will act as a foundation to explore specific areas of possibility in more detail.

The *second essay* **Opportunities and Challenges of Improved Small-Scale Farming Using Digital Solutions in the Free State Province, South Africa** by **J. Maritz, H. M. V. E. Combrink, K. de Wet, L. Saba, and C. B. Witten** describes the context of South African agriculture by focusing on the issue of small-scale farming. This essay specifically focuses on the Free State province where agriculture and rural livelihood occupy a very central position. The essay suggests some digital technologies to address the needs of specifically small-scale female producers (SSFs). The province has a large rural population of women who do not necessarily have the required skills nor the access to the advances brought about by digital technology in agriculture. As is the case with most of South Africa, the Free State province also has an unbalanced distribution of wealth and poverty, with large numbers of people being marginalised and poor and a situation where food insecurity and its manifold consequences are rife. Female empowerment and economic access for SSFs also suffer in a male-dominated agricultural system, which leaves little capacity for women to seek opportunities to increase both their food security and their earning potential. Women empowerment needs to be intentional in any programme that is focused on enhancing small-scale farmers' skill sets (such as business/financial management and crop/livestock production), not only to enhance their resilience to vulnerability but also to eliminate poverty and its many associated ills.

A variety of technological solutions for small-scale producers exists from various companies, but within central South Africa, infrastructure, digital literacy, training, and basic business skills are scarce to the extent that even the most simplified digital solutions could not make a difference if these deficits were not addressed. In this essay, we propose a critical engagement with the design and redesign of certain technological possibilities to cater for local needs, and the establishment of a much-needed framework to engage with communities continually and sustainably in meaningful ways (through training and support) to empower

people at the periphery, especially women. For the sustainable roll-out of relevant digital technologies in agriculture to succeed, available community engagement, expertise, and infrastructure need to be included to start off any endeavour. Also, the overall aim should focus on sustainable solutions and contextual and participatory methods to respond to the specific challenges which SSFPs face. The authors propose that for embedding modern farm management systems in local contexts, potential technological challenges naturally realise the minimum framework needed for engagement, upskilling, and change management. The latter will be discussed for purposes of synchronisation with available resources and to maximise the effect on the SSFPs.

The *third essay* with the title **Contextual Challenges to develop Precision Medicine through eHealth advances in South Africa** by **HMVE Combrink & K. de Wet** deals with the challenges which are present within the sub-Saharan African countries, and specifically focusses on the South African context in relation to the increasing availability and uptake of the 21st century advances in eHealth, such as Machine Learning (ML) and its incorporation in smart systems. The essay outlines the multifaceted challenges which are present in South Africa – a context which in many ways is similar relative to the realities of other areas in the Global South - in relation to developing and expanding on the possibilities of precision medicine through an array of eHealth interventions and developments that are fast gaining track in 21st century advances in medicine. It focuses on the process to attain precision medicine through the creation and uses of data lakes by underscoring specific impediments rooted in this endeavour. The main challenges include issues such as the availability and the access to big data, the development of interoperable data types and technology, and the concomitant necessity to wield artificial intelligence (AI) through machine learning (ML) processes. However, these main challenges have a range of other related problems that need to be solved from an interdisciplinary perspective as they are not merely technological in nature.

It is evident that there are two major contextual issues at stake when trying to transcend these challenges. First is the ubiquitous problem related to the digital divide despite South Africa's concerted move towards embracing the 4IR technologies. The digital divide relates not only to generalised issues of access but also to equipping people with the prerequisite skillsets to meaningfully engage with digital developments as they are manifest in eHealth. Second, the deployment of this promising eHealth initiative happens in the contexts of weak health systems, as well as a health system in the South African context that is acutely divided by the glaring inequalities between the public and private spheres. Weak health systems and those plagued by inequalities are also often characterised by inadequate governance structures and/or a lack of the proper application of rules and regulations.

This essay therefore summarises relevant literature and arguments currently prevalent in health care and technological developments, specifically those that are directly applicable to eHealth in contexts of precarity and inequality.

The South African health system bears many elements that are indicative of both hope and despair when contemplating the future of precision medicine through the deployment of a range of eHealth advances. The range of eHealth developments needed to reach the potential promises of precision medicine will be unpacked in this essay, bearing in mind the twofold challenges that characterise the South African context. We contend that South Africa, as well as other countries of the Global South that are characterised by inadequate and unequal resource allocation, could simply fall by the wayside when it comes to benefiting from and contributing towards promising technological advances. We conclude by underscoring the necessity to develop new skillsets to equip those working in health care, but also in policy domains as well as in other sectors with the necessary tools to respond to the fast-changing technological environment that is becoming a reality in the 4IR. These necessary skillsets will ensure that some ethical pitfalls could be prevented in the design, deployment, implementation, and evaluation of technology that holds tremendous promise to ameliorate health outcomes and health care in resource-constrained settings through the development of precision medicine. In this context also initiatives in and for the Free State in South Africa are considered.

The fourth and last essay with the title **A Possible Niche Application to Enhance the Uptake of Digital Twins in the South African Agriculture** by **J. Maritz, H. M. V. E. Combrink and K. de Wet** deals with the exciting prospect of developing digital twins especially for the agricultural sector. Digital twin technology refers to an augmentation of a physical process (or asset) in the digital domain via the sufficient recording of data that fully describe the process or object. It is estimated that the global digital twin market will be worth \$48.2 billion by 2026, with most of the market share residing in engineering, health care, and agriculture. The industry value is justified by the advances that digital twin technology brings to large organisations by reducing experimental costs of product development and allowing for an in-depth insight into already existing processes. In addition to the research-driven advances, operational optimisation in terms of the value chain is also enhanced. Digital twin technology also allows for a form of real time reporting to both current and potential investors for the value proposition of a product to be materialised as an iterative process, rather than following the traditional quarterly reports. In this essay, we will introduce the fundamental building blocks and methodologies of digital twins to familiarise the reader with the meaning of these important processes. However, the actualisation of the system and the creation of the buffer layer between the physical system and the twin will also be unpacked by showcasing the relatable case of electric resource management. This will serve to act as a

precursor to similar agricultural twins given the acute impact that unreliable electricity supply has in the entire South African context, not least in agriculture. By merging electric resource management twin with agricultural processes, a niche application is generated that could serve as a golden thread through all types of agriculture in South Africa, with the added inclusion of industry input existing in the food-water-energy nexus. This inclusion also provides the added benefit that optimal resource management of utilities in the agriculture setting is at the fore when considering the development and deployment of digital twinning in the unique South African context. Initiatives in and for the Free State of South Africa are discussed as well.

3 The Strategy

The Fourth Industrial Revolution (4IR) captures the idea of the convergence of emerging technologies and the cumulative impact (both positive and negative) at a global scale (Schwab, 2016). According to Klaus Schwab, the founder of the World Economic Forum (WEF) who initially coined the term 4IR, emphasis should be placed on the primary challenge related to this revolution at present, which is understanding and crafting the trajectory of the 4IR (Schwab, 2016).

In the *first essay*, recommendations for policy mandates in basic education are illustrated. This includes a critical look at the fundamental gaps within the already existing poverty-stricken education system and how these gaps are perpetuating poverty. The primary policy change is a recommendation to include the digital divide as a strategic developmental goal to alleviate poverty by 2060. A further emphasis is placed on the equal uplifting of the public and private sectors of South Africa in terms of digital readiness, by using basic education as an example.

The *second essay* outlines contextual societal challenges in the 4IR context. By using SSFPs in agriculture as an example, a few recommendations are made to improve the situation for the SSFPs by re-conceptualising the conventional Farm Management System (FMS) to respond to both contextual challenges as well as technological advances. This, in turn, harbours potentially widespread advantages. Although this very specific focus might not seem relevant in the broader context of 4IR, this example (and many others like it) outlines the social complexities within the South African context in line with 4IR and serves as well as an example of relevant technological solutions to the immediate contextual challenges in South Africa.

The *third essay* on the health sector and the precision medicine recommends the steps needed to integrate information within a complex system, like healthcare, to improve outcomes. The Fourth Industrial Revolution (4IR) brings with it a certain level of sophistication when it comes to the interpretation of big data, but to leverage from this sophistication, a critical series of agreements need to be reached between industry, government, and the academic sector. Policy coordination at

various levels is needed to use the digital technologies for reforms of the health sector.

The *fourth and final essay* recommends how the digital twin industry in the agriculture context can be developed. Just like the digital twin industry, the Fourth Industrial Revolution (4IR) brings opportunities to domains that we cannot yet fully understand, but this should not deter us from exploring the untapped potential within 4IR to improve processes in society and to create unique value propositions for industry. The digital twin industry can help a lot in modernizing the agriculture sector, but also other sectors can benefit from this tool.

The ensuing essays will highlight – by focusing on specific topics (education, agriculture, and health) - how we suggest some avenues to respond to the most recent and ongoing technological revolution in a relevant and contextually responsive manner. With certain important caveats, these essays suggest that digital transformations, developments, and enhancements hold manifold potential. By contributing to the emergence and dissemination of innovations in education, agriculture, health, and even beyond these domains, digital developments have the potential to act as catalysts to support the African development trajectory. Finally, digital developments and transformations have the potential to facilitate simple and more complex new technological functions related to those involved in a range of formal and informal economic activities.

References

- Correa, T., 2008. Literature Review: Understanding the ‘Second-Level Digital Divide. Unpublished manuscript. Retrieved from: https://www.academia.edu/212163/Literature_Review_Understading_the_second_level_digital_divide_
- Du Preez, P. & Le Grange, L., 2020. “The COVID-19 Pandemic, Online Teaching/Learning, the Digital Divide, and Epistemological Access”.
- Health Systems Trust, 2020. Access for Download: <https://www.hst.org.za/publications/Annual%20Reports/HST%20AR%202019%202020%20FINAL.pdf>
- Heeks, R., 2021, From Digital Divide to Digital Justice in the Global South: Conceptualising Adverse Digital Incorporation, Proceedings of the 1st Virtual Conference on Implications of Information and Digital Technologies for Development. Access: *arXiv preprint arXiv:2108.09783*.
- Hlatswhayo, M., 2019. “Debating the Fourth Industrial Revolution. First Things First”, In: *New Agenda, South African Journal of Social and Economic Policy*, (75, 2019); access for download: <https://www.ajol.info/index.php/na/article/view/192696>
- Maluleke, R., 2021. “Quarterly Labour Force Survey (QLFS) Q2:2021”, Stats South Africa, access for download: http://www.statssa.gov.za/publications/P0211/Presentation%20QLFS%20Q2_2021.pdf

- Morrow, W., 1994. Entitlement and achievement in education. In: *Studies in philosophy and education*, 13(1), pp. 33-47.
- Report of the SA Presidential Commission (PC4IR), 2020. Access for Download: <https://www.ellipsis.co.za/wp-content/uploads/2020/10/201023-Report-of-the-Presidential-Commission-on-the-Fourth-Industrial-Revolution.pdf>.
- Schwab, K., 2016. “The Fourth Industrial Revolution: what it means, how to respond”, *World Economic Forum*. Access for Download: <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>
- Socio-Economic Survey of South Africa, 2019. Centre for Risk Analysis, Johannesburg. Access for Download: <https://cra-sa.com/products/socio-economic-survey/south-africa-survey-2019>
- Steele, C., 2019. “What is the Digital Divide?” Digital Divide Council. Available at: <http://www.digitaldividecouncil.com/what-is-the-digital-divide/>

Basic digital education and the digital divide in South Africa: A Free State perspective¹

HMVE Combrink², K. de Wet³, F de Villiers⁴, S. Brokensha⁵, E. Kotzé⁶

1 Introduction

The Free State province, one of nine provinces in a country that has one of the highest Gini coefficients in the world, is placed in central South Africa (see Kerr 2021 and see also figure 1 below). This means that the discrepancy between those who have access to monetary resources and those who do not tends to be severe, limiting opportunities at the lower end of the economic scale, and maximising potential at the higher end. The Fourth Industrial Revolution (4IR) is a term that was used in 2016, marked by the digital transformation and disruption brought about by digital technologies. This revolution through the increasing use of information

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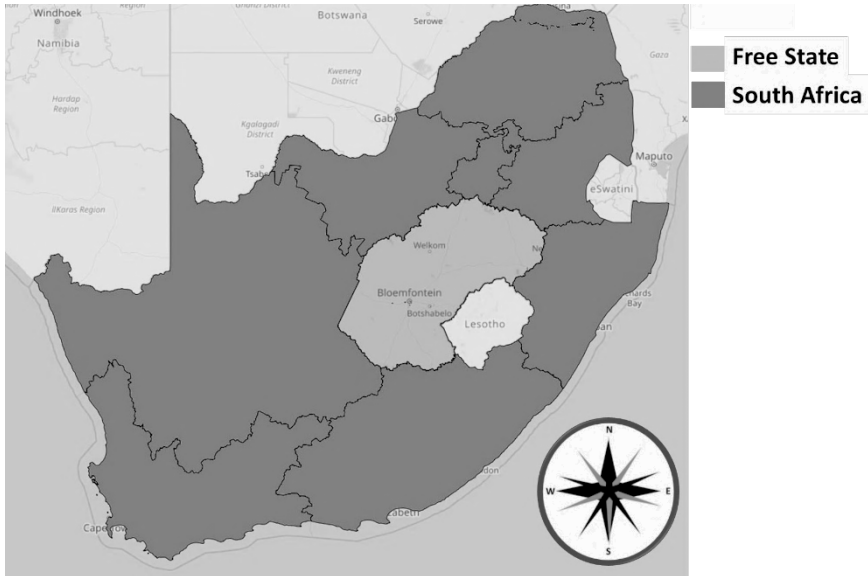
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and communication technologies will inevitably have an impact on jobs as it will lead to the automation of routine tasks at the workplace and will connect people at a scale that has not been seen before (see Schwab 2016).

Figure 1: Free State Province in relation to South Africa



Source: <https://dbedashboard.co.za/Home/>

Since then, several academic discourses have arisen contextualising what the disruption of 4IR means from a variety of perspectives, including the ethical dimension (see Peckham 2021). Higher education faculties and other parts of the education system need to be proactive to the 4IR in South Africa, as a failure to do so will force South Africans to react, and they will then not be able to proactively plan for the changes involved (see Marivate/Aghoghovwia/Ismail/Mahomed-Asmail/and Steenhuisen, 2021). In addition to this, several governments have set in motion policies, engagements with the public and private sector, and have published different preambles to outline the stance a specific sector, government or institution will take in response to the gradual integration of 4IR technology into society.

One such example is the preamble to the 4IR report from South Africa (see: Republic of South Africa, 2018).⁷ The presidency of South Africa wrote a preamble to the report on the 4IR, outlining South Africa's stance on the disruption brought about by 4IR, and what it would take to integrate 4IR into society including: digitisation, digitalisation, the integration of machine learning, and the overall impact of artificial intelligence on society. In this preamble the 2030 vision of the National Development Plan 2030⁸ is elucidated on; the preamble includes how the South African government is going to increase the adoption of 4IR technology and to adapt to the disruptions brought about by this 4IR technology. Basic education and how to address 4IR within this domain are clearly outlined within the objectives and strategies which the South African government intends to deploy. Among these is a reform of the curriculum, the incorporation of 4IR technologies in the school context (like the addition of digital devices to augment learning in and out of the classroom), a retraining related to 4IR into existing curricula, and the incorporation of 4IR-specific fields as additional school subjects, such as data engineering and robotics.

However optimistic this plan may be, there are a few areas for consideration so that this strategy can work. In the next section 2, outlining and contextualising the South African school quintile system will be explained within the context of 4IR technology and the digital divide in the Free State province. Section 3 is on the issues that integrating more technology is not enough to overcome the digital divide in basic education; a Free State perspective is given in this context. Section 4 is on strengthening 4IR adoption for basic education in the Free State. Section 5 is on seamless learning for 4IR adoption in the Free State basic education system. Section 6 presents the opportunities for strategic partnerships related to 4IR technologies in resource-challenged communities in the Free State Province. Finally, section 7 is on Conclusions and Policy Recommendations.

⁷ See on this document from the Presidential Commission on Fourth Industrial Revolution: https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf

⁸ See on the content of the South Africa Vision 2030 of the National Development Plan 2030 "Our future – make it work" (Executive Summary), drafted August 2012: <https://www.gov.za/sites/default/files/Executive%20Summary-NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf>

2 Understanding the South African school quintile system in relation to the digital divide and the Free State province

At the heartbeat of any society lies the strength and rigour dedicated to the basic education system, with South Africa being no different case (see Ulferts/Peterson/Howard, 2021). The South African basic education system has several challenges associated with disproportionate levels of poverty, historic injustices, limited access to technological infrastructure, as well as a limited number of specialised educators across the education system (see Sonkqayi, 2021). These overwhelming challenges are referred to as resource-challenged communities – a term coined by Lazem (see: Lazem, 2019).

To put these challenges into perspective, the South African basic education system follows a specific funding model. Schools in South Africa are subsequently categorised on the premise of each individual school's infrastructure, resources, and human capital needed from the local government to make the education system functional (Manning, 2009). This means that not all schools are fully funded by the South African government, and that there are different levels of financial support from government based on the classification of schools. The classification model follows what is called a quintile system, with five distinct quintiles differentiating the support needed from local government. It is vital for the understanding of 4IR in the basic education system, by contextualising the quintile system in terms of resource-challenged communities, as the South African quintile system can be viewed as a proxy for inequality and infrastructure-related challenges (Gravett/Eadie, 2021). Furthermore, the quintile system is also determined based on the relative wealth in the surrounding areas of the school. The higher the quintile, the more affluent the area surrounding the school, and the less financial support the school gets from the local government (Maistry/Africa, 2020). By and large, South Africa is still a developing country, and there are large discrepancies about the access of digital technology and digital skills for 4IR technology to be completely adopted. For example, most of the quintile 1 – 3 schools, which are considered the poorest schools in South Africa, are within resource-challenged communities where the schools also do not have computers, computer laboratories, or an emphasis on digital technology as part of its teaching and learning model. This means that not only are there deficits in terms of the actual technology in a large portion of South African schools, but these deficits also extend to the skillset available among the educators themselves to teach these subjects. In contrast to this, quintile 4 and 5 schools have a stronger emphasis on 4IR technology, and to a large extent embrace 4IR technologies within the learning environment. This can be observed by the adoption of online learning, and by hybrid

learning models that were implemented by quintile 4 and 5 schools in the South African context during the 2020/2021 lockdowns resulting from the COVID-19 regulations, even though there were still observable challenges in the adoption of these technologies and skills even by affluent schools (du Plessis, 2020). Unfortunately, quintile 1 – 3 schools could not go the online route in 2020/2021 because the schools and the learners, in large, do not have access to the required technology to have made this transition successful (Chisango/Marongwe, 2021). In addition to this, understanding the economic drivers related to the quintile system motivates a further consideration as to why 4IR technology is difficult to adopt across the entire South African education sector, especially in resource-challenged communities surrounding quintile 1 – 3 schools. Unfortunately, this arrangement creates a divide from which the South African education system can be categorised into a public, semi-public, and a private sector stream (see: le R Booysen, 2003). Classifying the school system according to this distribution accentuates the stark differences prevalent within the poverty-stricken side of the education system and the scale of the divide in the public sector.

As it stands in the Free State Province, more than 80% of schools form part of the public sector. Additionally, there are differences in the poverty indices between each South African region that further illustrates this divide being present in this context⁹. A further 84.5% of the schools in the Free State fall under either one of the quintiles 1 – 3 school classifications (Parker/Short, 2009). Quintile 1 – 3 schools require the most financial support for 4IR integration as these schools lack the fundamental infrastructure and community support (i.e., higher school fees cannot be expected, and other sources of external funding are not available) to get funds into the school setting. This lack of external funding for quintile 1 – 3 schools means that other education needs will inevitably be prioritised before the incorporation of digital technology¹⁰. Quintile 4 schools are found on the pivot of the scale between resource-challenged community members that cannot support school fees and community members that can afford school fees (adjusted to meet the needs of the school – albeit relatively insignificant). For quintiles 1 – 3,

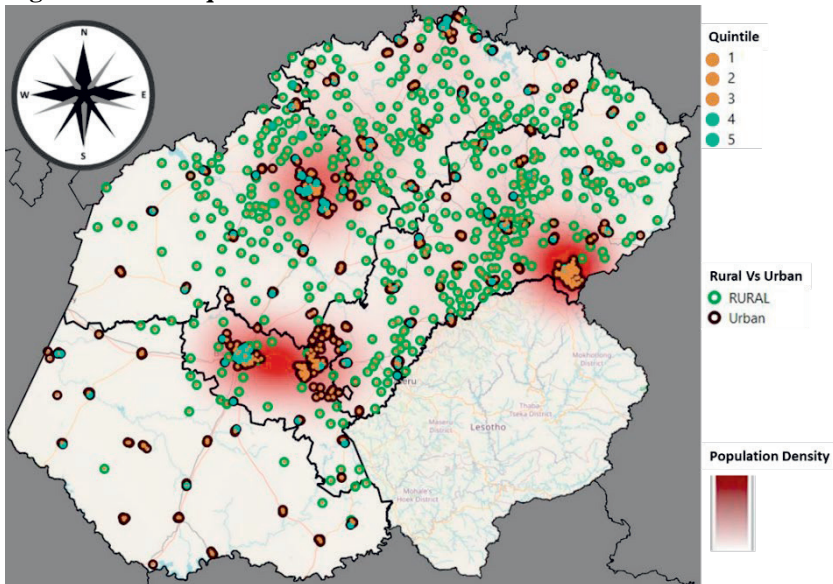
⁹ See on the “National Norms And Standards For School Funding”, Proposals for amendments, November 2004, Department of Education, Pretoria; download for access: <https://www.education.gov.za/Portals/0/Documents/Legislation/Call%20for%20Comments/NATIONAL%20NORMS%20AND%20STANDARDS%20FOR%20SCHOOL%20FUNDING.pdf?ver=2008-03-05-104405-000>

¹⁰ Department Of Education, Free State, Vote NO. 6, Annual Report, 2019/20 Financial Year; access: <http://www.education.fs.gov.za/wp-content/uploads/2021/03/EDUCATION-ANNUAL-REPORT-2019-20.pdf>

the state pays the salaries of the teachers, and the paygrade and packages are determined by the government which is universal for all its staff on the same employment level. Quintile 4 and 5 schools rely on a hybrid model, whereby there is some subsidy from local government, but the schools are dependent on “third stream funds” in the form of school fees and external donations. In the Free State context, the situation is grim because most of the schools in this province are not only classified as poor, or are in poor communities, but are also located in semi-urban or rural areas. This means that access to resources might be limited like public transport (the availability of functional roads might be non-existent, and learners need to walk for long distances to make it to the school) or the poor or non-existent internet connectivity (Green, 2020, and see also figure 2 below).

It stands to reason that quintile 1 – 3 schools are reliant on government support and quintiles 4 and 5 schools follow a more financially sustainable school model based on private income apart from state assistance.

Figure 2: School quintile distribution in the Free State



Source: Combrink, 2022

Because of this, quintile 4 and 5 schools have what is known as a school governing body, which functions to provide strategic inputs on the implementation of teach-

ing and learning, outside the scope of the state. It also means that if a school governing body wants to invest in education material or infrastructure for the enrichment of the learners in a specific school, then they can incorporate systemic changes without the approval of the state – if it falls within the parameters of government policy.

Although the distribution between quintiles in terms of the number of learners is relatively even (with a similar number of learners per quintile), the economic impacts of the differences between the quintiles are not. For example, it will require fewer resources to incorporate 4IR technology between quintile 4 and 5 schools than in quintile 1 – 3 schools because the areas around quintile 4 and 5 schools are more economically active and have the infrastructure to support 4IR technology, while quintile 1 – 3 schools do not. Furthermore, quintile 4 and 5 schools have the authority, through a school governing body, to implement 4IR technology if the school budget allows it – while quintile 1 – 3 schools are completely reliant on government budgets and state-led decisions. These inherent differences between the different quintiles have a direct impact related to the rate of change within different schools with respect to internet connectivity, number of internet capable devices, and the type of technology that is used across different schools. To put this into perspective in the Free State context, if more than 80% of the schools are within the quintile 1 – 3 classification system, and more than 80% of the schools in the Free State are part of the already thinly spread public budget – then how will the adoption of 4IR technology be possible if all these other systemic issues are prevalent as well as exacerbated by the repercussions associated with COVID-19?

In contrast to quintiles 4 and 5 schools, 45% of quintile 1 – 3 learners have parents/guardians who are part of the general labour force, and 50% of quintile 1 – 3 learners have parents/guardians who are currently unemployed; and a large portion of these areas do not have the required state infrastructure to support stable, large scale internet connectivity (Timmis/De Wet/Naidoo/Trahar/Lucas/Mgqwashu/Muhuro/Wisker, 2021). Another problem resides within the social dynamics of the parent/guardian system in child-headed households. Child-headed households are households where the guardian is a minor (under the age of 18 years) looking after other minors, normally upwards of three to five individuals, and sometimes some of them are even under the age of two years old (Hall/Sambu, 2019). This phenomenon of child-headed households is becoming more prevalent as the burden of HIV/AIDS and TB is still a major public healthcare problem in the Free State province. According to Leatham (2008), the numbers of child-headed households were becoming nationally and internationally noticeable, and as time progressed, this problem will remain acute in the face

of the severe HIV/AIDS and TB epidemic in the Free State province (Mofolo/Heunis/Kigozi, 2021). An additional exacerbation of this problem is vested in the number of people in the Free State province defaulting on their life-saving anti-retroviral treatment of HIV/AIDS because of the 2020/2021 COVID-19 lockdowns (see Bayani/Krubiner/Barasa/Biribawa/Broadbent/Casas/Chalkidou/Combrink/Denis/Kaakyo, 2021).

These differences further accentuate that the escape from poverty through education remains problematic given that learners who undergo basic education follow an education journey which is based firmly on their current socio-economic status (Akoojee/McGrath, 2005). It is for this reason that the education system in the Free State province cannot be viewed as a homogeneous sector. Furthermore, this quintile classification should be taken into consideration to illustrate the stark differences present within the education system in this province (and beyond within the wider South African context). Despite the challenges associated with infrastructure and monetary means among the various quintiles, there are also further challenges associated with the digital divide and the digital fluency in the basic education system.

The digital divide in this context is defined as the divide in the adoption, use and utilisation of 4IR technologies, software, and devices capable of digital technologies being used in teaching and learning inside and outside of the school setting. The digital divide and the digital literacy between the different quintile systems is something that has been widely cited in South African literature because it is a serious concern for the future of South African education (Durodolu/Mojapelo, 2020). As a result, the South African government incorporated this deficit as part of the 2030 National Development Plan¹¹. Unfortunately, just incorporating 4IR technology into an environment deprived of digital literacy is not enough to solve the problem. In the next section, an outline will be given explaining that although there are stark differences in the infrastructure-related issues between the different school quintiles in the Free State, digital inequality will persist if critical reflective skills are not taught, even if 4IR technology was provided to quintile 1 – 3 schools.

¹¹ Republic of South Africa, National Development Plan 2030; access: <https://www.gov.za/sites/default/files/Executive%20Summary%20Summary-NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf>

3 The Limits of the Simple Integration of Technology in the Free State perspective - How to overcome the Digital Divide in the Basic Education System?

South Africa's National Development Plan 2030 recognises that the country's skills deficit has exacerbated inequalities predominantly in rural and township areas (Matli/Ngoepe, 2020). Developing basic digital education is one critical means to narrow this gap, but what this education should encompass needs to be carefully interrogated. A useful point of departure is to consider Ng's digital literacy model (Ng, 2012) which points to three critical dimensions of learning, namely, the technical, the cognitive, and the socio-emotional dimensions. The technical domain requires that learners become proficient in operating digital technologies for learning (Anthonysamy, 2020). This necessitates being able to open a file, browse the Internet, save a document, and the like. The ability to search for and assess digital information as well as to communicate novel ideas by employing critical thinking skills describes the cognitive view of learning. This view also advocates the development of multi-literacy skills, which may be defined as the skills needed to decode meaning across different forms of communication that may be text-based, visual, or oral, for example. The socio-emotional view encourages the development of the communication and social skills required to enact tasks such as socialising on the Internet in a responsible way or distinguishing between authentic and 'fake' news (Maureen/van der Meij/de Jong, 2020).

The last two views are particularly important because they dovetail with an emergent view that calls for a more holistic approach to multiple literacies (Njenga, 2018). This holistic approach includes the engagement with culture, institutions, different societies within a country, the associated resource-challenged communities, and political boundaries surrounding 4IR adoption. Such an approach also concedes that digital literacy must be embedded within a given socio-economic context – that the users of digital technologies must have the autonomy to decide on the extent of use of these technologies in society, and that these needs should be defined based on local context and measured against the implicit and explicit consequences of these technologies within society (Njenga, 2018).

Without this embeddedness, digital literacy may paradoxically widen the digital divide which operates at two levels: the first level constitutes the lack of or the unequal access to technology (Lutz, 2019), while the second reflects inequalities in terms of skills and uses owing to users' socio-economic circumstances (Hargittai, 2002). Both these two forms of digital literacy deficits are present within the Free State education system because of the high percentage of quintile 1 – 3

schools in the province and because of the high number of poor communities within the area surrounding the schools in the province. It acknowledges the fact that digital exclusion is not simply a matter of lack of access to material resources (Lembani/Gunter/Breines/Dalu, 2020). Acknowledging this level of digital inequality is critical, given that there is a tendency to adopt a techno-centric approach to technology, trusting that the digital divide can be solved through higher availability to 4IR technology. The pertinent question here is “what's the point of infrastructure without the skills to use it?” Kassongo/Tucker/Pather, 2018). As clearly indicated, most of the Free State province's schools falls within the quintile 1 – 3 classification system, and unfortunately, this also means that 4IR adoption will be challenging if fundamental technological and digital literacy gaps are not addressed in the Free State context.

An example of the consequences of the fundamental technological and digital literacy gaps being prevalent in basic education can be seen in a study conducted within the University of the Free State in 2020, specifically focussing on challenges which first year students experienced when transitioning from basic education into the university environment (Combrink/Oosthuizen, 2020). According to the study by Combrink & Oosthuizen (2020), having access to internet-capable devices, being able to navigate the online learning platform, access to a stable internet connection, and for a first-year university student to appropriately use internet-capable software were among the biggest challenges which the students faced during the 2020 lockdowns. They further reported that some of the challenges which the students faced included that some did not know how to optimally navigate the online space; some were not sure how to identify where to get academic support; and some were uncertain as to the most effective ways of studying. Although these skills (how to ask for assistance and how to study effectively) are not directly linked to the fundamental technological and digital literacy gaps, they have a significant impact on how effectively students navigate themselves through their first year at the university by using technology. In addition to this, the study also showed that there were other factors, such as time management, goal setting, and the ability to adjust to a new environment, that have an impact on the student's own ability to transition into university. This last part is contextually important as technology alone will not solve some of the fundamental concerns identified, but at the very least if these fundamental technological and digital literacy gaps are addressed at a basic education level prior to the students entering the university, then the burden might be lessened. They concluded in their study that online learning should be scaled for all learners, but that it should include mechanisms that assess the challenges which students face. Lastly, they put an emphasis on the instructors at the University of the Free State to be sensitive to the challenges

which these students face as these are significant and pertinent throughout the student cohort.

A recent study by Dube (2020) describes both levels of inequality in the context of online learning. The study found, among other things, that rural learners in South Africa lack access to digital devices, as internet data are too expensive for them, and that most teachers are not equipped with the skills needed to utilise online learning apps. One of Dube's stark conclusions is that online learning is not plausible in resource-challenged communities, and that it will favour learners in privileged quintile 4 and 5 schools, so that there is an increase of the digital divide (Dube, 2020). Dube further supports the notion that 4IR technology in terms of its adoption into the South African education system will continue to benefit quintile 4 and 5 schools, leaving behind quintile 1 - 3 schools being the result of the abovementioned challenges.

What these studies outlined is that integrating 4IR and digital content into the Free State province education system should fundamentally include teachings about the use of these platforms to augment learning within the current education system, while at the same time focus should be on enhancing learning and raising competencies that include concepts of digital literacy. Designing curriculum around these concepts requires strategic inputs from leading technology companies and needs a well-coordinated facilitation process and strategy between the private and public sectors of South Africa's basic education landscape. This request means that the South African government needs to increase not only the infrastructure in these schools but has also to scaffold teachings and content within the current curriculum; for that to function, the teachers themselves need to be trained in 4IR technology to allow for 4IR adoption in a safe and responsible manner.

There are no quick fixes to the quagmire in which South Africa's basic education finds itself in relation to the digital divide within the quintile system. However, this does not imply that we cannot (or should not) think about the additional challenges that are ushered in by technological developments that are potentially creating an ever-greater digital divide between schools, teachers, and learners. Some of these additional challenges include the current reading, numerical literacy, and writing capability within learners from quintile 1 - 3 schools across the rural, semi-urban and urban demographics. Currently, there is a standardised curriculum from which schools teach for each grade. However, the education outcomes and the assessment of outcomes from national benchmark tests, grade 10 qualifying examinations, and grade 12 school exit examinations portray how different these outcomes are between quintile 1 - 3 schools and the quintile 4 and 5 schools. In 2020, the average English, mathematics, and physical science marks

of grade 12 learners from quintile 1 – 3 schools were significantly lower than those from quintile 4 and 5 schools (Fair/Stott, 2021). Despite the challenges contextualised in the previous two sections, there is hope and there are strides made in the Free State context to either strengthen digital adoption in the Free State basic education system, or to address the inequalities created by the basic education system in the Free State. Both strategies may be relevant. In the next section, strengthening 4IR adoption in the basic education system will be outlined from different perspectives.

4 Strengthening appropriate 4IR adoption for basic education in the Free State

Incorporating digital technology involved a certain skillset, above and beyond the current skills taught within the current education system. If the current education system is not strengthened, those who will truly benefit will be reserved to learners from quintile 4 and 5 schools, further perpetuating the digital divide and the gap in digital fluency between less economically active communities and more economically active communities (Matli/Ngoepe, 2020). As stated before, this strengthening will only occur within 20% of the schools in the Free State province as most of the schools and learners in the province form part of an under-resourced environment. If this continues, the spill-over effect will inevitably increase poverty, and as time continues, will increase the Gini coefficient within South Africa, further widening the gap between those who have wealth and those who do not. Basic education should therefore be strengthened, to see improved results in skills such as reading with comprehension, and command of mathematics and informed reasoning. These are competences which should strengthen learning outside the digital domain and within the digital domain. To do so will require an in-depth engagement on all levels of society, including the required research and development within the Free State tertiary education sector for the purpose of enhancing basic education.

This includes investigating digital technological advances, the adoption of digital fluency within the context of illiteracy and studying if competencies such as literacy and numerical ability can be enhanced with the use of 4IR technology. Furthermore, understanding how the deployment of these technologies impacts learning, the education system and ultimately the society should be topical and fundamental in this type of research so that the appropriate adjustments can be made to the system. This process must be iterative, systemic, and evidence-based for it to make a meaningful and lasting impact. Some of these responses relate to

the initiatives that institutions of higher learning have embarked on within the Free State to combat this problem. One example within the context of the University of the Free State is the introduction of a student programme that assesses how to teach the skills which a student needs to successfully transition into the university environment in the form of a first-year seminar (Strydom/Mentz, 2008). This first-year seminar is mandatory for all first-year students at the University of the Free State and includes concepts that address a variety of academic competencies which a first-year student needs to be successful in their studies (Combrink/Oosthuizen, 2020). These academic skills are taught in a timeous manner (within the first semester) to enable students to apply these competencies to their other academic subjects at university. Part of the motivation behind this scaled intervention is it to address the observed needs which institutions have assessed of its students who come from under-resourced school environments, in terms of core academic and digital competencies required of the students to be successful at the university. In addition to this, government and state support are also needed as industry and the academic institutions cannot drive these initiatives alone, as the issues are fundamentally caused by state-led education institutions which are perpetuating the gaps observed at tertiary levels in the Free State. Luckily, the South African response to 4IR does provide some clarity about the trajectory which the state is taking. The preamble on the 2030 vision published by the South African government in response to the 4IR outlines the proposed steps needed to strengthen 4IR deployment in South Africa (Matli/Ngoepe, 2020).

An important reference in the preamble to what is currently being taught within basic education across all the school quintiles is the focus on skills which are related to critical thinking and problem solving, creativity and innovation, ability for collaboration and teamwork, as well as the ability to communicate using digital platforms. The problem is that for quintile 1 – 3 schools, without the required infrastructure to practically showcase this, digital education is purely theoretical, and so learners need to imagine what some of these technologies mean without having access to the devices to use, so that they cannot learn directly from these technologies by using them. One answer to this problem was proposed with the introduction of cloud computing solutions for public quintile 1 – 3 schools in the Free State context (Muriithi/Masinde, 2016). This solution focusses on enabling more cloud-based resources and tools with fewer electronic devices, so that learners in these poverty-stricken communities in the Free State may benefit from exposure to such technologies throughout their basic education journey. As promising as this solution is, it still falls short of the internet connectivity challenges

within the Free State¹². Although there are areas with low internet connectivity, there was an increase of the number of internet-capable devices and users from 2020 to 2021 showing that progress is imminent. Consequently, given cloud-based solutions for quintile 1 – 3 schools in the Free State, there are potential solutions that can help to overcome fundamental technological and digital literacy gaps – albeit not perfect. If technological solutions such as cloud-based computing for quintile 1 – 3 schools are expanded on, then teaching fundamental technological and digital literacy competencies will be possible in these areas. Furthermore, the extent to which this content may be taught can extend beyond just theoretically teaching these concepts. This includes enabling a space in classrooms for showcasing and practicing concepts using 4IR, to prove that it is possible even within poor communities.

Another factor that needs to be mentioned is the role of the environment outside the education system and the ways in which it influences the learners' digital literacy. In other words, if the education system is strengthened for 4IR technology to thrive and digital literacy to be at a standard that is acceptable, the surrounding resource-challenged communities need to be also uplifted so that the gap between the schooling and the surrounding communities is less severe (Grobler, 2021). This means that the strengthening of the education system should have a trickle-down effect to its immediate surroundings. Another solution to strengthening the education system is to consolidate learning across different educational technologies and contexts through seamless learning. In the next section, seamless learning as a strategy for 4IR adoption in the Free State basic education system will be outlined.

5 Seamless learning for 4IR adoption in the Free State basic education system

One opportunity to enhance basic digital education in South Africa is through the implementation of seamless learning. The term “seamless learning” is described and explained by a host of scholars, elaborating on the concept as the continuity or extension of learning across a variety of contexts and across different devices. Given the abovementioned sections, this implies that content should be available in paper, digital, and cloud-based applications for learners and educators to access.

¹² Digital 2021: South Africa, Datareportal, 11 February 2021, Simon Kemp; access: <https://datareportal.com/reports/digital-2021-south-africa>

Seamless learning does not just suggest of moving to a digitalization of content; it implies that there is digital scaffolding of content across different platforms so that when a learner engages with content based on their preference or access to available devices, then the subject matter should be ubiquitous and similar, despite the platform used where the information is accessed. Another way to view seamless learning is to have an “omni-platform” approach, whereby content and experiences are shared between interoperable devices, technologies, online platforms, and between different users simultaneously.

An additional concept to seamless learning implies that learners are engaged by being active while maintaining creativity in a collaborative space across different learning scenarios and between different devices (Chan/Roschelle/Hsi/Kinshuk/Sharples, 2006). Thus, the student should be able to access multiple devices, to connect individually or socially, and formally or informally in a context of their choice to learning material, in a learning environment with other learners and educators (Chan/Roschelle/Hsi/Kinshuk/Sharples, 2006). In the seamless learning environment, context plays an important role because the real world is experienced through continuous engagement (Westera, 2011). The process of learners who apply knowledge and learning is seen as the contextualisation of knowledge as a social, co-constructed process (Scardamalia/Bereiter, 2006).

The idea of seamless learning has the added advantage that it can be incorporated into the basic education system; but for this to happen, a few strategies should be understood before seamless learning can be implemented. One of these concepts relates to the stratification of the learning experience from the learning environment. Although teachers and educators may include learning experiences in an online space by adding content online for the learners to access, in the context of seamless learning the learning environment and the experiences are still separate (Wong/Looi, 2011). This means that - by adding content in the online environment or by simply adding content and 4IR technologies to an existing school subject – one cannot reach seamless learning (Vaughan/Reali/Stenborn/Van Vuuren/MacDonald, 2017). Seamless learning involves both, the technological component as well as for the student to engage with the environment, which requires a competent level of digital fluency. In addition to this, for this fluency to be fully accepted, a culture of digital adoption is needed. Digital adoption in this context refers to learners engaging with 4IR technology outside of the school space (see table 1 below).

Table 1: Seamless learning vs. digitising content

Seamless learning	Digitising content
All relevant learning material can be found in different formats (paper-based, digital, audio only, etc.), and accessed across various platforms	Paper-based material is captured online and shared on a specific platform
Learner has preference where to access the learning material	Learners are told where to find the material
Educators monitor peer interactions	All learning interactions are between the learners and the educator only
Collaboratively engaging with the content can take place any time of the day	Collaboratively engaging with the content only takes place during classroom hours
Promotes collaborative learning	Promotes individual learning

Source: Authors

The positive aspects of seamless learning are, amongst others, that it provides flexible learning opportunities. It is a student-centred approach; there can be real-time interaction; they can connect with anyone, anywhere (the global perspective), and they gain practical experience. Students take responsibility for their learning by engaging in different individual and collaborative assessment and learning activities, through active, responsive, and meaningful engagement (Vaughan/Reali/Stenborn/Van Vuuren/MacDonald, 2017). Concepts of seamless learning are addressed within the 2030 preamble, but without the required implementation framework.

The implementation framework of seamless learning is divided into three processes, namely 1) the decision-making process, 2) the change process, as well as the 3) design and implementation process (Hambrock/De Villiers/Rusman/Maccallum/Arrifin, 2020).

Regarding the decision-making process, costs, efforts, accessibility, affordability of technology, teachers' and learners' competencies and attitudes, and curriculum integration are important aspects to consider. Factors of the change process entail a change of models, methods, approaches, roles, responsibilities and evaluation and assessment strategies, and clear guidelines for all the relevant stakeholders need to be in place prior to the implementation (Hambrock/De Villiers/Rusman/Maccallum/Arrifin, 2020). The design and implementation process entails a process-oriented design of interdisciplinary and transboundary activities.

In an abstract sense, transboundary activities are referring to a series of concepts whereby traditional boundaries related to content access are now accessible. In practical terms, this refers to a learner being able to use their phones as a device to both, to entertain themselves and to learn the required content where traditionally learning and entertainment were separated. Guidance and support are needed to lead the learners to autonomy in the learning process, which must have clear learning objectives and needs to be based on the experiential design of activities within different environments and settings, using technology. Social learning participation and involvement of various social practices are important, and formative and summative assessment, evaluation and testing must be in place (Hambrock/De Villiers/Rusman/Maccallum/Arrifin, 2020). Change management cannot be underestimated as teachers may be afraid of adopting technologies to augment and to disrupt the way they teach content, and they ultimately transfer knowledge (Hambrock/De Villiers/Rusman/Maccallum/Arrifin, 2020). Thus, teachers must first have and understand what seamless learning entails and get for this the necessary training (see table 2 below).

Table 2: Application of seamless learning for learners and teachers

Learners	Teachers
Learning can take place on different digital devices	A stronger emphasis is placed on scaffolding content and preparation of learning material and assessments
Communication platforms allow for the sharing of ideas and collaboration inside and outside the classroom	The skills required to mediate conversations on collaborative platforms need to be taught to all teachers
Learning takes place inside and outside the classroom	A stronger emphasis is on scaffolding learning pathways so that independent learning can take place
Learners have the preferred way over how they learn content	The content presented to learners need to be ubiquitous across all learning platforms (the same information must be presented there)

Source: Authors

A further need will be to create this level of digital adoption in areas surrounding quintile 1 – 3 schools, as both the access to infrastructure and to the required skills may not be present within these communities. As mentioned before, for holistic

digital literacy to be enhanced, current gaps in the implementation of the curriculum of basic education in the Free State need to be addressed (Vaughan/Reali/Stenborn/Van Vuuren/MacDonald, 2017). Innovative teaching strategies will be vital as there are stark differences in the available skillset and infrastructure to include 4IR technologies within a seamless learning environment for learners. These challenges are also met with the prevalent digital divide seen in the Free State province (Gillwald/Moyo/Stork, 2012).

For a full immersion and adoption of 4IR technologies in the Free State, a concerted effort is needed to upskill civil society across all sectors and not just those who are economically active. Furthermore, resources, technologies, support services, online environments, video conferencing, and tutorial support are hindrances in the process of current implementation (Basitere/Ivala, 2017; Prinsloo/Van Rooyen, 2007). Seamless learning, as a viable strategy, is resource-intensive and will require not only the supporting infrastructure but also an upskilling of the educators present in the current South African basic education system, especially in quintile 1 – 3 schools (Basitere/Ivala, 2017). However insurmountable these challenges may seem, therein lies an opportunity for the establishment of new economic partnerships with local and international stakeholders to respond to these challenges. There is also a strategic shift to have continuous inputs from industry to form part of educational policies and practices. This too has its shortcomings but, at the core of the strategy, all relevant stakeholders in the Free State should be involved to address the demands posed by the changing environment of work and skillsets. In the next section, the dynamic partnerships that need to exist to strengthen the various levels of the education system and industry will be explored.

6 Opportunities for strategic partnerships for 4IR technologies in resource-challenged communities in the Free State

With each of the abovementioned challenges that the education system faces, there are opportunities to uplift communities by integrating 4IR technologies into resource-challenged communities. For this integration to happen, there must be three things in place, namely: awareness, supply, and demand. The awareness will remain systemic as policies, governing entities, government support, and community-based needs are still being defined in the 4IR context. For there to be a full understanding of the impact of the disruption brought about by 4IR technologies in resource-challenged communities, there needs to be significant research and

investigations conducted in the Free State. Research into a variety of digital domains related to education are being conducted – but there is still room to explore the labyrinth of complexities in this sector. This will take time as skills and expertise need to be developed within society to meet the demands of 4IR technology integration and 4IR harm mitigation. The emphasis is on the positive transformation of the education sector, but it must be understood that for the education system to be strengthened, resource-challenged communities surrounding certain parts of the education system also require sustained and sustainable interventions. The only way for society to embrace 4IR technology is if the benefits by far outweigh the disadvantages. Currently, all the potential harms and disadvantages are not known yet, and the impact of 4IR technology on the environment around resource-challenged communities is not yet recognised nor understood.

Citizens in resource-challenged communities need to be better-off with the adoption of 4IR technology than without it. For supply and demand to occur the terms and conditions of the role of government and industry need to be well defined and understood. The supply will initially come from the importing of goods and devices from other international industry partners, but as time continues, the supply needs to come from a hybrid between international and local, with Free State technology companies at the forefront. This is important for the Free State economy as an over-reliance on the importation of hardware will create an economic dependency that may not be sustainable in the long run. Partnerships across governments, academic institutions, and industry will assist in overcoming the digital divide and the digital literacy gaps which are currently existing in the education system in the Free State and in South Africa (see table 3 below).

A further emphasis should also be placed on the software and programming skills required to innovate 4IR technology in the Free State province. As it currently stands, there are deficits in both the manufacturing and software engineering skills required for 4IR technology deployment within the Free State economy. In the short term, there are uncountable opportunities for international entrepreneurs and international investors to work toward improving the awareness and supply constraints currently present within this economy. The demand will follow if, and when, the value proposition of 4IR technology integration into society is realised. These processes are systemic, require a variety of stakeholders, and can only occur over a long period of time. For the full adoption of 4IR technologies in sectors of society where the digital divide is prominent, research and development driven by the academic institutions in the Free State should take place to map the current situation and to outline the areas for improvement. Research into the digital divide should include seamless learning, the technological deficits which are

present within the Free State education system, the impact of 4IR on technologically sparse communities, and the questions how institutions and the society will adopt these technologies. Included in this research should be the strategic addition of very specific 4IR gaps, and an impact assessment of what might happen should the 4IR technologies not be adopted, and should the digital divide not be addressed.

Table 3: Partnerships and opportunities to overcome the digital divide and the digital literacy gaps

Industry	Opportunity
Mobile service providers	Expanding the internet penetration in the Free State
Higher Education	Updating the current education curriculum to accommodate for 4IR teaching and training, 4IR research, and providing academic support to students from disadvantaged backgrounds
Local/foreign tech companies	Cloud-based solutions for low-resourced schools and affordable devices that are internet-capable
ICT providers and start-ups	Creating interoperable education platforms for the public sector to enhance seamless learning
NGOs	Empowering and training citizens around quintile 1 – 3 schools in 4IR and digital literacy
Financial auditing firms	Aligning the governance of resources for the education system by adapting the auditing systems to adopt 4IR technologies

Source: Authors

This research and development should be funded by industry and government institutions, as this work will have a much larger impact on society in the medium to long term. At present, COVID-19 brought with it economic constraints that put a tremendous amount of pressure on governments and industry, but if the areas outlined in this essay are not explored, then the outcomes might be significantly more dire than the current situation.

7 Conclusions and Policy Recommendations

We come back to the pertinent question asked earlier, “what is the point of infrastructure without the skills to use it?” (see: Kassongo/Tucker/Pather, 2018). We

can aim to equip all Free State learners with devices to link to the Internet and to engage in virtual learning. However, if part of this strategy does not include the development of online citizens who can make sense and interpret what they are doing, such a material deployment will have no consequences and might rather exacerbate deficient learning in some schools where teachers might put the onus on “technology” to do the teaching.

A concise and succinct cost to benefit model needs to be developed for government, industry, and people within resource-challenged communities so that the impact of the disruptions may be known from the onset. The type of 4IR technology transformation that is needed to uplift resource-challenged communities should be viewed in terms of long-term impact, and not short-term adoption. The long-term impact can only be materialised if there is buy-in and investment from government and industry. For this level of buy-in to take place, the overcoming of the digital divide needs to be written in as a sustainable development goal (SDG). The level of 4IR technological integration within resource-challenged communities has the potential to create demand if the value proposition proves to alleviate poverty.

Furthermore, 4IR technological adoption and beneficial consequences (impact) thereof will be more rapid around the more affluent areas in South Africa, and less prevalent around quintile 1 – 3 schools. This unfortunate reality is the spill-over effect of poverty and inequality – which will continue if the surrounding areas around quintile 1 – 3 schools are not immersed with 4IR technology. As with other revolutions, the gradual yet substantial transformation brought about by the 4IR technologies is a revolution in which we find ourselves currently, and this transformation process should be critically considered. Countries of the Global South, such as South Africa, need to proactively incorporate 4IR technology throughout society, especially within the education system. This critical state of mind should harbour a true understanding of the digital world and its uses before it can be critiqued authoritatively. For 4IR technology to have a lasting impact in the Free State context, it is recommended that 4IR technologies are adopted as basic education needs for all the different quintiles, at the same time. For this to happen, the overcoming of the digital divide in terms of both infrastructure and digital literacy needs to be mandated as a sustainable development goal (SDG). Furthermore, for this to happen, mechanisms from government need to be enabled to uplift the digital illiteracy within quintile 1 - 3 schools and thereby also improve local communities. This can only happen through dynamic partnerships which include the state, the industry, and international partnerships. Evidence suggests that failure to do so will result in the inevitable widening of the poverty gap, which is

present within South Africa, a perspective which will result in a higher Gini coefficient and will lead to increased levels of poverty.

References

- Akojee, S. and McGrath, S. (2005). Post-basic education and training and poverty reduction in South Africa: progress to 2004 and vision to 2014. *Draft, Post-Basic Education and Working Paper Series*, 2.
- Anthonsamy, L. (2020). Digital literacy deficiencies in digital learning among undergraduates. In: S. Noviaristanti, H. Hanafi, & D. Trihanondo, *Understanding digital industry* (pp. 133-136). London, UK: Taylor & Francis Group.
- Basitere, M., & Ivala, E. N. (2017). Implementation of blended learning: the experiences of students in chemical engineering extended curriculum program physics course. *Conference proceeding of the international conference on e-learning*, pages 23-30.
- Bayani, D. B., Krubiner, C., Barasa, E., Biribawa, C., Broadbent, A., Casas, L., Chalkidou, K., Chi, Y. L., Combrink, H., Denis, O. O. and Kaakyo, M. (2021). The Indirect Health Effects of COVID-19: Emerging Findings from Kenya, the Philippines, South Africa, and Uganda.
- Blaschke, L. (2014). *Using social media to engage and develop the online learner in self-determined learning*. Retrieved from Research in Learning Technology: doi:10.3402/rlt.v22.21635. ISSN 2156-7077
- Chan, T., Roschelle, J., Hsi, S., Kinshuk, K., & Sharples, M. (2006). One-to-one technology-enhanced learning: an opportunity for global research collaboration in research and practice in technology enhanced learning. In: *World scientific publishing*, 1(1): pages 3-29.
- Combrink, H. M. V. E. and Oosthuizen, L. L. (2020), "First-Year Student Transition at the University of the Free State during COVID-19: Challenges and Insights". In: *Journal of Student Affairs in Africa* 8, no. 2: pages 31-44.
- Combrink, HMVE (2022): School quintile distribution in the Free State by population density. University of the Free State. Figure. <https://doi.org/10.38140/ufs.19137089.v1>
- Chisango, G. and Marongwe, N. (2021). The digital divide at three disadvantaged secondary schools in Gauteng, South Africa. In: *Journal of Education (University of KwaZulu-Natal)*, (82), pp.149-165.
- du Plessis, P. (2020). Implications of Covid-19 on the management of school financial resources in quintile 5 public schools. In: *South African Journal of Education*, 40(4).
- Dube, B. (2020). Rural online learning in the context of COVID 19 in South Africa: Evoking an inclusive education approach. *Multidisciplinary Journal of Educational Research*, 10(2),135-157.

- Durodolu, O. O. and Mojapelo, S. M., 2020. Contextualisation of the information literacy environment in the South African education sector. In: *Electronic Journal of e-Learning*, 18(1), pp. 57-68.
- Englander, E., Donnerstein, E., Kowalski, R., Lin, C., & Parti, K. (2017). Defining cyberbullying. In: *Pediatrics 140 (supplement 2)*, s148-s151. doi:10.1542/peds.2016-1758u.
- Fair, D. L. and Stott, A. E. (2021). A Longitudinal Case Study of Mathematics and Mathematical Literacy Achievement of Boys at a High Quintile School in South Africa. In: *African Journal of Research in Mathematics, Science and Technology Education*, pp.1-11.
- Gillwald, Allison/Mpho Moyo/Christoph Stork, Understanding what is happening in ICT in South Africa, A supply- and demand-side analysis of the ICT sector, Evidence for ICT Policy Action, Policy Paper 7, 2012, Research ICT Africa. Net, IDRC/CRDI; for download: https://media.africaportal.org/documents/Policy_Paper_7_-_Understanding_what_is_happening_in_ICT_in_South_Africa.pdf
- Gravett, S. and Eadie, S. (2021). The Sandbox project: Developing competencies for a changing world in South African schools. In: *Embedding Social Justice in Teacher Education and Development in Africa* (pp. 163-178). Routledge.
- Green, F. (2020). Schoolwork in lockdown: new evidence on the epidemic of educational poverty. *Centre for Learning and Life Chances in Knowledge Economies and Societies (LLAKES), University College London (UCL), Research Paper*, 67.
- Grobler, A. (2021). Plans and interventions of South African Grade 1 educators during the 2020 lockdown period. In: *Research in Social Sciences and Technology*, 6(3), pp.163-178.
- Hall, K. and Sambu, W. (2019). Demography of South Africa's children. In: *South African child gauge, Children's Institute, Cape Town*, pp.216-220.
- Hambrock, H., De Villiers, F., Rusman, E., Maccallum, K., & Arrifin, S. (2020). Seamless learning in higher education: Perspective of international educators on its curriculum and implementation potential, pressbook available, access: <https://seamless-learning.pressbooks.com/>.
- Hargittai, E. (2002). *Second-level digital divide: Differences in people's online skills*. Retrieved from First Monday: <http://firstmonday.org/article/view/942/864>
- ISTE/International Society for Technology in Education. (2007). *National educational technology standards for students*. ISTE (International Society for Technology in Education).
- Jenkins, H. (2006). *Convergence Culture: Where old and new media collide*. New York: New York University Press.
- Jenkins, H. (2010). Transmedia Story Telling and Entertainment: An annotated syllabus. In: *Journal of Media & Cultural Studies*, 24(6), pages 943-958. Access doi: <https://doi.org/10.1080/10304312.2010.510599>

- Kassongo, R., Tucker, W., & Pather, S. (2018). Government facilitated access to ICTs: adoption, use and impact on the well-being of indigent South Africans. *IST-Africa week conference (IST-Africa/Programme for Innovation, Science and Technology adoption, policy, and research in 18 African countries)*. IEEE/Institute of Electrical and Electronics Engineers, (pp. 1-10).
- Kementerian, P. M. (2015). *National Education Blueprint Higher Education*. Retrieved from Malaysia Education Blueprint 2015-2025: <http://mohe.gov.my/muat-turun/awam/penerbitan/pppm-2015-2025-pt/5-malaysia-education-blueprint-2015-2025-higher-education> (24.09.2020).
- Kerr, A. (2021). *Measuring earnings inequality in South Africa using household survey and administrative tax microdata* (No. wp-2021-82). United Nations University - World Institute for Development Economics Research (UNU-WIDER).
- Lazem, S. (2019). On designing blended learning environments for resources challenged communities, accessed: <https://doi.org/10.3991/ijet.v14i12.10320> (03.11.2019).
- le R Booysen, F., (2003). Urban–rural inequalities in health care delivery in South Africa. *Development Southern Africa*, 20(5), pp. 659-673.
- Leatham, C. P. (2008). *The lived experiences of adolescent learners from child-headed families in the Northern Free State*. University of Johannesburg (South Africa).
- Lembani, R., Gunter, A., Breines, M., & Dalu, M. (2020). The same course, different access: the digital divide between urban and rural distance education students in South Africa. In: *Journal of Geography in Higher Education*, 44(1): pages 70-78.
- Lutz, C. (2019). Digital inequalities in the age of artificial intelligence and big data. In: *Human behaviour and emerging technologies*, 1(2): pages 141-148.
- Maistry, S. M. and Africa, I. E. (2020). Neoliberal stratification: The confounding effect of the school poverty quintile ranking system in South Africa. In: *South African Journal of Education*, 40(4).
- Manning, A. D., 2009. *The management of school financial policy and internal financial controls in designated section 21 schools in the Motheo Education District, Free State* (Doctoral dissertation, University of the Free State).
- Marivate, V., Aghoghovwia, P., Ismail, Y., Mahomed-Asmail, F., and Steenhuisen, S. L. (2021). The Fourth Industrial Revolution - what does it mean to our future faculty? In: *South African Journal of Science*, 117(5-6), pp.1-3.
- Matli, W., & Ngoepe, M. (2020). Capitalizing on digital literacy skills for capacity development of people who are not in education, employment, or training in South Africa. In: *African Journal of science, technology, innovation, and development*, 12(20): pages 129-139.
- Maureen, I., Van der Meij, H., & de Jong, T. (2020). Enhancing storytelling activities to support early(digital) literacy development in early childhood education. In: *International journal of early childhood*, 52(2): pages 55-76.

- Ministerie van Onderwijs, & Cultuur en Wetenschap. (2019). *Strategische agenda hoger onderwijs en onderzoek*. Retrieved from Houdbaar voor de toekomst (Fit for the future), <https://www.rijksoverheid.nl/documenten/rapporten/2019/12/02/bijlage-1-strategische-agenda-hoge>
- Mofolo, N., Heunis, C. and Kigozi, G. N. (2021). Corrigendum: Towards national health insurance: Alignment of strategic human resources in South Africa. In: *African Journal of Primary Health Care & Family Medicine*, 13(1).
- Muriithi, G. M. and Masinde, M. (2016), May. Cloud SAMS: Cloud computing solution for public schools within South Africa's 'second economy'. In *2016 IST-Africa Week Conference* (pp. 1-15). IEEE.
- Ng, W. (2012). Can we teach Digital Natives Digital Literacy? In: *Computers and education*, 59(3): pages 1065-1078.
- Njenga, J. (2018). Digital literacy - the quest of an inclusive definition. In: *Reading and Writing*, 9(1): pages 1-7.
- Peckham, J.B. (2021). The ethical implications of 4IR. In: *Journal of Ethics in Entrepreneurship and Technology*.
- RoSA/Republic of South Africa (2018). Presidential Commission on the Fourth Industrial Revolution: Nominations invited, access: https://www.gov.za/sites/default/files/gcis_document/201812/42078gen764.pdf
- RoSA/Republic of South Africa (2012), National Development Plan 2030, Executive Summary, August 2012; Access: <https://www.gov.za/sites/default/files/Executive%20Summary-NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf>, and access to the full report: https://www.gov.za/sites/default/files/gcis_document/201409/ndp-2030-our-future-make-it-workr.pdf
- Riconscente, M., Mislevy, R., & Corrigan, S. (2015). Evidence centered design. In S. Lane, M. Raymond, & T. Haladyna, *Test development*. Routledge, access: <https://www.routledgehandbooks.com/doi/10.4324/9780203102961ch3> (04.05.2020).
- Scardamalia, M., & Bereiter, C. (2006). Knowledge building: theory, pedagogy, and technology. In: R. Sawyer, *The Cambridge Handbook of the Learning Science* (pp. 97-115). Cambridge: Cambridge University Press.
- Schwab, K. (2016), January. The Fourth Industrial Revolution: what it means, how to respond. In: *WEF/World Economic Forum* (Vol. 14, No. 1).
- Sonkqayi, G. (2021). The State of South African Education: A Critical Exploration of Distributive and Epistemic Injustices. In: *The Thinker*, 88(3), pp.30-40
- Strydom, J. F. and Mentz, M. (2008). Should orientation for higher education teaching and learning be better? In: *South African Journal of Higher Education*, 22(5), pp.1088-1096.

- Timmis, S., De Wet, T., Naidoo, K., Trahar, S., Lucas, L., Mqgwashu, E. M., Muhuro, P. and Wisker, G. (2021). *Rural Transitions to Higher Education in South Africa: Decolonial Perspectives*. Routledge.
- Tshabalala, M., Ndeya-Ndereya, C., & Van der Merwe, C. (2014). Implementing blended learning at a developing university: obstacles in the way. In: *The electronic Journal of e-learning*, 12(1): pages 101-110.
- Ulferts, G. W., Peterson, E. A. and Howard, T. L. (2021). Human Resource Planning in Education. In: *Journal of Organizational Psychology*, 27(1).
- UNESCO. (2011). *UNESCO Mobile Learning Week Report*. Retrieved from United Nations Educational, Scientific, and Cultural Organisation (UNESCO); access: <http://www.unesco.org/new/fileadmin/multimedia/hq/ed/ict/pdf/unesco%20mlw%20report%20final%2019jan.pdf> (04.11.2019).
- Vaughan, N., Reali, A., Stenborn, Van Vuuren, M., & MacDonald, D. (2017). Blended learning from design to evaluation international case studies of evidence-based practice. In: *Online learning*, 21(3): pages 103-114.
- Westera, W. (2011). On the changing nature of learning context anticipating the virtual extensions of the world. In: *Educational technology and society*, 14(2): pages 201-212.
- Wong, L. H., & Looi, C. K. (2011). What seams do we remove in mobile assisted seamless learning? A critical review of the literature. In: *Computers and Education*, 57(4): pages 2364-2381.

Opportunities and Challenges of Improved Small-Scale Farming Using Digital Solutions in the Free State Province, South Africa¹

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1 Introduction: Context of Small-Scale Producers in the Free State Province

In this essay the opportunities and the challenges of improved small-scale farming using digital solutions in the Free State Province, South Africa are analysed. In this section 1 there is an Introduction, focussing on the context of Small-Scale Producers in the Free State Province. Section 2 presents the potential technological interventions to enhance small-scale farming in the era of digitalisation, while section 3 is on the modern farm management systems when adapted to small-scale female producers (SSFPS). Section 4 is on overcoming potential challenges when introducing modern farm management systems to local SSFPs, and section 5 has the conclusions and the policy recommendations, when looking at the way forward.

The provincial region that covers central South Africa is called the Free State, a landlocked region with an estimated population size of 2.9 million people (see Socio-Economic Survey of South Africa, 2019). The Free State province comprises of more than a quarter of the country's arable land and has the highest

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number of commercial farms in South Africa (STATS SA, 2020). The province has a population density of 22.8 people per km², with a combination of subsistence/communal, emerging, commercial, and mega farmers that all contribute to the economy (Food For Mzansi, 2019)⁷. In fact, according to the organisation Free State Agriculture⁸, small-scale farmers are much needed to keep the rural economies alive and healthy (Food For Mzansi, 2019). The following box 1 includes an overview of what small-scale farming entails:

Box 1: Small-Scale Farming in South Africa:

It is estimated that there are approximately 4 million small-holder farmers in South Africa. Small-holder farms can be defined as farms “with a low asset base and operating in less than two hectares of cropland” (World Bank, 2003). A small producer or small-scale producer is “a producer who is not structurally dependent on permanent hired labour and who manages their production activity mainly with a family workforce”⁹ Approximately 75% of all farming in South Africa is conducted by small-holder farmers, and this small-scale farming is also the primary source of food in rural areas.¹⁰

Although women constitute 40% to 50% of the agricultural workforce in the Global South, they account for less than 20% of landowners globally (Devex Partnerships, 2021)¹¹. Another source indicates that approximately 70% of small-scale farmers are women, but that in sub-Saharan Africa, only 17% of landowners are female (Solidaridad, 2019)¹². Women involved in farming also often face challenges, such as access to agricultural inputs, to relevant expertise, to finance opportunities, and to overall decision-making power (Devex Partnerships, 2021). In any developmental programme focused on agriculture, a gender-intentional

⁷ See Food For Mzansi, 2019, Small-scale farmers keep rural economies alive, says “Free State Agriculture”, 7th May 2019; access: <https://www.foodformzansi.co.za/small-farmers-keep-rural-economies-alive-says-free-state-agriculture/>

⁸ See the homepage of Free State Agriculture: <https://www.facebook.com/VrystaatLandbou/>

⁹ See Flocert Glossary, Small producers/small-scale producers; for download: <https://www.flocert.net/glossary/small-producers-small-scale-producers/>

¹⁰ Aguera et al., 2020

¹¹ See Devex Partnerships, 2021, How gender equity can boost agricultural business and food production, 2 December 2021, accessed: <https://www.devex.com/news/sponsored/how-gender-equity-can-boost-agricultural-business-and-food-production-102163>

¹² See Solidaridad, 2019, Linking Women Farmers To High-Value Markets In South Africa, 22 August 2019, accessed: <https://www.solidaridadnetwork.org/story/linking-women-farmers-to-high-value-markets-in-south-africa/>

angle needs to be included to ensure the empowerment of women (Devex Partnerships, 2021), given the widespread potential benefits of involving them (citation below from Solidaridad, 2019): “Female farmers accounted for around one third of the country’s [South Africa’s] 847,000 new farm jobs in the first quarter of 2018, according to Statistics South Africa. Women’s incomes also have a bigger impact on food security with studies showing that every Rand in income earned by women has the same impact as R11 earned by men”.

In the Free State, there is an abundance of small-scale producers, but male farmers traditionally dominate this sector (Socio-economic Survey of South Africa, 2019). Despite increased processes of democratisation in terms of access to land and financial means and assistance, small-scale female producers (SSFP) have been disadvantaged because of some entrenched patriarchal cultural notions still dominant in this largely male-dominated agricultural landscape (Ngwexana, 2018). There is therefore very little representation of female farmers in the Free State context.

From a developmental perspective, the upskilling of semi-skilled farmers (focusing especially on women) with educational packages or software and training will potentially improve performance and data availability manifold. This in turn has the potential to greatly enhance or shape decision-making skills if adopted and used optimally. This could lead to addressing a further burden, which is food insecurity and nutritional education. In terms of food insecurity, including women to increase production is important. Women as SSFP, who are often the custodians of the household, could contribute to overcome the scourge of food insecurity through becoming more actively involved in food production. The pervasive contextual factor of female headed households where a single parent is responsible for feeding dependents is an immense burden on these women to not only provide shelter and food, but also to ensure that the nutritional quality of the produce is of such a nature to lead to optimal growth not only for themselves but also for children in their care (Dunga, 2020).

Between 2006 and 2015, income from the labour market activities (receiving a form of salary) has been the leading source of household income in South Africa, accounting for over 70% of total income. Given the rising unemployment rate, Statistics South Africa (STATS SA, 2020) reported that labour market income was the main driver of income inequality in South Africa, contributing with 74,2% towards overall income inequality in the country in 2015. Nevertheless, social grants and remittances have played a crucial role in reducing the income inequality gap between the bottom and top deciles (STATS SA, 2020).

This dependency on employment income has far-reaching impacts for food and nutrition security as millions of South Africans depend on purchasing food (and not producing it). Statistics South Africa (STATS SA, 2019) further reports that individuals living in male-headed households had a bigger impact on influencing overall economic inequality as compared to those living in female-

headed households and that economic inequality decreased for Indians/Asians and whites, while it remained rather constant for coloureds, but increased for black Africans. As a predominantly rural province with many black female-headed households, the Free State province carries a high burden of social grant-dependent households, a high rate of unemployment, and a high level of food insecurity (Dunga, 2020). During the COVID-19 lockdown restrictions reported hunger and shortages of food affected two out of five households in the country (Van den Bergh et al., 2021).

It has been shown that a strategy to relieve hunger and food shortages is based on homestead food production, especially through the empowerment of SSFP. One such example was a programme called Enhanced Homestead Food Production (EHFP) programme, a two-year programme that provided women with small productive assets (such as seeds, seedlings, saplings, and small tools) in addition to teaching them about optimal agriculture, health, hygiene, and nutritional practices showed positive results in vegetable production and consumption, in improved maternal and child nutrition, and in increased income. Specifically, women (mostly mothers) in participating communities owned more agricultural assets and small animals, produced more nutritious food, gained more health and nutrition knowledge, and consumed more nutritious food. In addition, their children were more likely to meet their minimum dietary diversity requirements compared to those living in villages that did not participate in this programme (Covic/Hendriks, 2016). Opportunities to improve livelihoods and nutrition have been proven through homestead food production both as an entry point for interventions such as first, skills development and health and second, nutrition education and micro-finance. The box 2 below elaborates on homestead food production:

Box 2: Homestead Food Production in South Africa

The South African government under the auspices of the Department of Agriculture, Forestry and Fisheries has implemented some policies related to land, food, and agriculture to increase food production, to reduce food insecurity, hunger, and malnutrition, and to improve the income and livelihood status of households. Some of these policies include the Agriculture and Land Reform Policy (ALRP), the Comprehensive Agricultural Support Programme (CASP), and the South Africa Integrated Food Security Strategy (SAIFSS). Within SAIFSS, an important initiative was introduced to develop homestead food production programmes. These programmes encourage households and individuals to utilise the plots available to them to produce vegetables, especially to be consumed by households themselves, although there is also the possibility to sell the surplus yield to generate some income (Gathena et al., 2013).

Food and nutrition security are central to the achievement of the Sustainable Development Goals (SDGs) adopted by 193 countries around the world in 2015, including South Africa (see Vinuesa et al. 2020). SDG 2 (Zero Hunger) is directly relevant, but food and nutrition security is also dependent on the achievement of many other SDGs, including SDG 1 (Ending Poverty), SDG 3 (Good Health & Well-Being), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities & Communities), and SDG 12 (Responsible Consumption & Production)¹³. The United Nations declared 2015-2025 the “Decade for Nutrition”, putting food and nutrition central to the global development agenda. With the impact of the COVID-19 pandemic, it is anticipated that the pandemic and the ensuing economic downturn will have a more pronounced negative impact on the global food and nutrition security. To this end, it is imperative that all poverty reduction and development efforts support the food and nutrition agenda to secure household level food and nutrition security, and hence the focus on SSFP in this essay.

To bolster small-scale farming activities that would, likely, contribute to food availability and to its many potential spin-offs, such as enhanced nutritional outcomes, we argue that a conventional digital farm management system (FMS) and its applicability to SSFP could be considered the cornerstone of sustainable, profitable, and efficient farming to contribute to the alleviation of the problems highlighted. However, the FMS needs to meet the requirements and abilities of SSFP to be usable, sustainable, and to lead to improved overall results.

This essay therefore argues that traditional FMSs need to be scaled down to render these more usable and user-friendly to SSFP to ensure sustainable homestead food production (and potential concomitant spin-offs). The vision developed in this essay is that SSFPs are not only prioritised by government policies, but that the University of the Free State (UFS) is in an ideal position to implement this endeavour. With dynamic departments such as Agricultural Economics, Agricultural Engineering, Soil Crop and Climate Sciences, Animal Sciences, Sustainable Food Systems and Development, as well as with existing projects focusing on emerging and small-scale farmers and women empowerment and two experimental farms to provide practical training to these cohorts,¹⁴ the feasibility of developing such a framework is secured.

¹³ See UN General Assembly, 2015; accessed: <https://sdgs.un.org/2030agenda>

¹⁴ See UFS (University of the Free State), Faculty of Natural and Agricultural Sciences; for download: <https://www.ufs.ac.za/natagri/faculty-of-natural-and-agricultural-sciences-home/general/departments-and-divisions>

2 Potential technological interventions to enhance small-scale farming in the era of digitalisation

Provided the availability of a wide array of systematic data as well as the existence of appropriate technology (hardware and software), many constraints that small-scale farmers face, in their daily work, could potentially be addressed. However, these solutions are too often used in fragmented ways. Moreover, not all service providers - or farmers - have equal opportunities to access the data and these promising technologies. Big data brings with it the promise to combine these fragmented data, resources, and service providers to support the larger farmer ecosystem (Gray et al., 2018). Given the growing importance and use of mobile telephones even in remote rural areas, the context is conducive to strengthen farmer ecosystems through optimising this technology.

One possible way to prevent a fragmented approach of harnessing digital advances in agriculture is to invest in bundled technological solutions (van der Walt, 2021). This refers to an interoperable management system that contains different technological solutions all in one centralised application. In the context in which SSFP find themselves in South Africa, a bundled solution should incorporate different implicit and explicit components related not only to agriculture and business (which are vital components for the user), but also relevant information regarding food security, nutrition, educational empowerment, and the relevant training to navigate such systems (in the form of user-friendly and targeted, relevant online tutorials). In fact, given the heterogeneity of the designations “small-scale farmer” and “small-scale farm”, we will find entities that harbour both – those with profit potential as well as those that do not necessarily have this potential. The International Food Policy Research Institute (IFPRI) distinguishes between these two categories according to the types of constraints they face (IFPRI 2013). Those with profit potential will more likely face “soft constraints such as limited capital, markets, information, infrastructure, and friendly technologies”. Those without profit potential, on the other hand, face “soft and hard constraints such as poor soil, low rainfall and high temperatures, remote locations and high population density”. Whereas those farms with profit potential would be targeted with “strategies such as extension services, agriculture financing, etc., those without profit potential need alternative strategies such as social safety net support, nutrition-focused crop production for household consumption, and education/training for non-farm employment, among others” (Gray et al., 2018). It is important to notice that SSFP could potentially fall within both categories, as some government and private initiatives are focused on female agricultural empowerment (Solidaridad, 2019).

This requires a rethinking and redesign of processes that are all interconnected with the user, and in the context of the SSFP should contain information fine-tuned for this specific demographic. Taking an ecosystem approach to data is

necessary since it enables addressing the comprehensive needs of those who should benefit from these initiatives. These are the small-scale farmers, thereby using the ecosystem approach for including them during all the levels of intervention. The digital space is primarily data-driven and requires computational prowess to ensure that technologies created are used effectively by those who need them most (Sarker, 2021).

The main challenge is it to ensure that any digital intervention happens in tandem with the agri-food value chain system, and this must be highly advantageous to both producers and consumers. This should also be coupled with the nutritional and socio-economic needs that have an impact on the SSFP. The net benefit for investors within the digital space is to empower small-scale farmers with user-friendly applications that might in turn benefit not only individuals and communities but also the agricultural sector. This will shape how farmers farm and how financial institutions engage with models that rely on a new-age reliability index, which are impacted by digital interventions and may channel credit to spaces that were previously ignored.

3 Modern Farm Management Systems adapted to Small-Scale Female Producers (SSFP)

Previous sections considered the homestead food production as a possible solution to food shortages and malnutrition, especially in the South African context.¹⁵ This section highlights the modern digital farm management system (FMS) and its potential applicability to SSFP. Modern FMSs are considered the cornerstone of sustainable, profitable, and efficient farming (Singh/Khilari/Nair, 2022).

Modern FMSs are based on the ability to draw insight from data generated by the complete farming ecosystem. The latter paradigm could be in the form of yield forecasts, farming risk mitigation, improved operation efficiency, visible marketing, optimisation of irrigation strategies, improved weather forecasts, and improved profitability. As an example of this modern data-based paradigm, consider a local SSFP that relies on irrigation (as main natural resource) for crop production, which will depend on the ability to schedule optimal irrigation strategies. A farm management system (FMS) that depends on irrigation will have the ability to gather (to study) local weather data and to apply irrigation control based on crop requirements. In essence, such a system facilitates the process of generating insights from real observations towards applying some beneficial interventions to existing farm processes (Ahmed/Nabi, 2021). If the latter FMS is driven by data which are generated by sensors, it evolves towards a digital FMS.

¹⁵ See on the definition of homestead food production:
https://akvopedia.org/wiki/Homestead_Food_Production

The digital FMS exists in a paradigm of sophisticated modern technology and reliable communications to support the recording of yield data and to track the progress of applied interventions. Within this sophisticated modern paradigm, digital literacy is assumed to be fluent (farmer's ability to navigate within the digital paradigm), and basic data analytic methodologies are assumed to exist (to make sense of the farming data and the ability to apply interventions to farming operations that will have beneficial consequences). Modern FMSs are driven by:

- 1) A plethora of electronic sensors that record and transmit farming data (see Saiz-Rubio/Rovira-Más, 2020).
- 2) Insights that are drawn from the farming data, also known as Decision Support Systems, or DSS (see Saiz-Rubio/Rovira-Más, 2020).
- 3) Core interventions are drawn from the DSS and applied to farm processes, so to improve profitability (see Zhai et al. 2020, and Castrignanò et al. 2020).

However, as can be assumed from the attributes above, the modern FMS is not the topic of this essay, but an invariantly transformed, simplified, and scaled down version of it, that could be applied to local SSFP in the Free State region to maximise support supplied by targeted intervention programmes, while simultaneously overcoming the initial dilemmas of restricted device connectivity and of the uptake of technology.

Introducing SSFP to modern FMSs and digital skills are currently driven by sporadic and non-sustainable interventions that are targeting local farmers. However, the National Digital And Future Skills Strategy South Africa (South Africa, 2020)¹⁶ suggests a more systematic approach for developing digital skills in a holistic manner. The latter strategy outlines seven progressive strategic elements of which the first two initial steps resonate with the main argument proposed by this essay. Initially the strategy's focus is on digital foundations starting at school level (see Essay 1 to this Unit for a comprehensive outline of the South African and Free State education context), after which the focus evolves to implementing support structures when effecting the obtained initial digital skills. In conjunction with the national digital development strategy is the need for improving ICT infrastructure within the South African agriculture sector.

In conclusion, digital FMSs are the steppingstone towards improved yield and sustainable homestead food production and could be of value especially for SSFP in the Free State region, especially beyond the stages of initial technological uptake and fundamental digital skill development, as supported by government

¹⁶ See South Africa. 2020. National Digital And Future Skills Strategy South Africa. Available at: https://www.gov.za/sites/default/files/gcis_document/202009/43730gen513.pdf

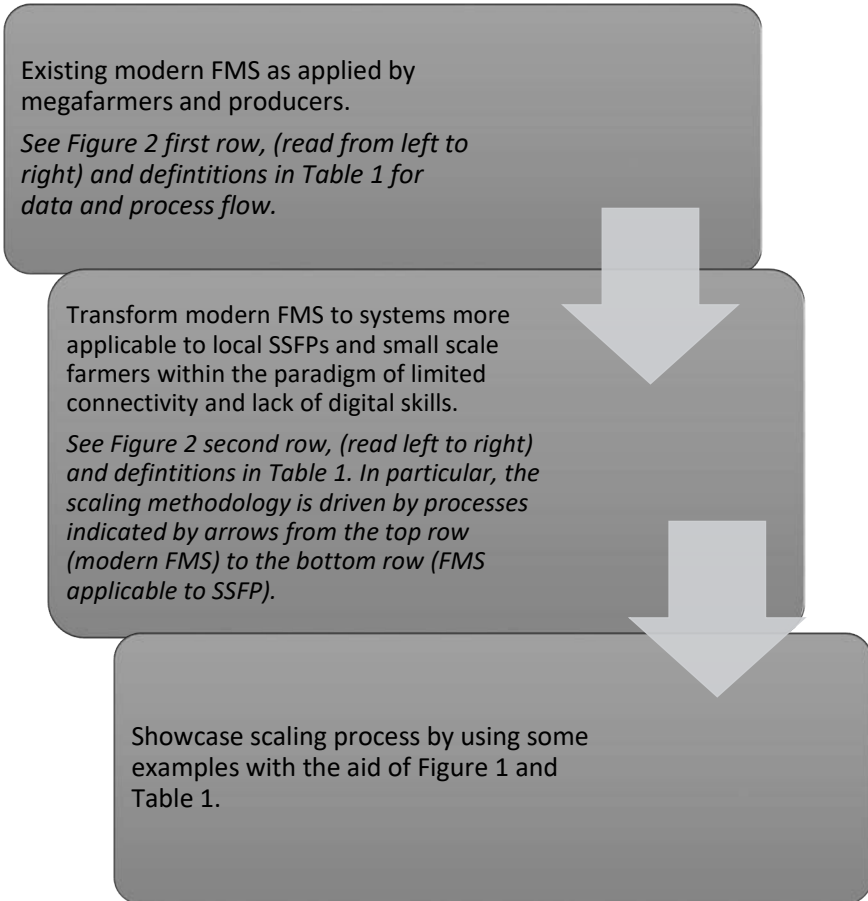
strategies and policies. The next section outlines a novel framework to overcome the initial challenges when introducing modern FMSs to SSFP or small-scale farmers in general. Ample opportunity for interventions exists within the proposed framework.

4 Overcoming potential challenges when introducing modern farm management systems to local SSFP

Within the modern FMS paradigm as discussed in the previous section, several limitations exist that could severely influence the method of social engagement to initiate technology uptake (in the form of a digital FMS) when considering SSFP in the Free State region. Attempting to converge towards a happy medium to engage SSFP in the Free State region, a methodology is described in this section that utilises the core concepts outlined by modern FMS so to systematically establish the more appropriate framework applicable to SSFP within the paradigm of limited skillsets, technology, and connectivity.

The proposed scaling methodology is visually summarised in Figure 1, rigorously unpacked in Figure 2, and supported by Table 1 by including an overview of all the applicable definitions and metrics when considering the scaling methodology. Furthermore, this section concludes with a hypothetical example of the proposed FMS scaling process as applied to local SSFP.

Figure 1: Executive summary of the proposed scaling process of modern FMSs towards systems more applicable to local SSFPs



Source: Authors

Table 1 below serves the purpose of listing all the relevant acronyms, descriptions of processes, and associated motivations related to the scaling process (from modern FMS to FMS applicable to local SSFP crippled by the lack of digital skills). Table 1 is synchronised with the processes found in figures 1 and 2 and is meant to be studied in conjunction with figures 1 and 2, as representing the

information in another context becomes not only cumbersome, but also difficult to keep track of.

Table 1: Definition and motivation atlas to support the systematic scaling of modern digital FMSs to be more applicable to SSFPs in the Free State region

Identifier	Description	Motivation and Notes
FMS	Farm Management System	The consolidated digital platform hosting all the digital applications within one management system
DC	Digital Citizen	A key stakeholder for the routine use, and the uptake, of a digital system like a FMS
DA	Data Analytics	In reference to the use of data and analysis to drive evidence-based decision-making for a specific process
AES	Agricultural Engineering Skills	Skills needed to transform inferences towards actuation in the agriculture context
SCP	Small Scale Producer	In reference to agriculture producers that are not part of the large commercial value chain
LTD	Low Tech Data	A primary target for the uptake of digital FMSs to improve processes and practices
DDSS	Digital Decision Support System	A digital system that enables evidence-based decisions, based on inferences found in the data and displayed on a digital platform
SADDSS	Socially Aligned Digital Decision Support System	Enables technology uptake via trust and relatable actions
MR	Mechanisation Restrictions	Core restrictor of actuation of interventions
A	Process converting farm ecosystem to data	Via array of sensors
B	Process converting data to DDSS	Via cloud computing or third-party interventions

C	Process converting DDSS to actual intervention	Via the implementation of agricultural skills
H	Process converting SCP's data to LTD	Focus is on simplistic farming data and introductory principles of DC
I	Process converting LTD to socially aligned DDSS (from the perspective of SSFP in the Free State region)	SSFP's farming intuition is proved via DA on available farming data, while exploring the implications of DC
J	Process converting insights drawn from socially aligned DDSS towards actual interventions	Focus is to assist with introductory AES to move farming data toward beneficial interventions
D	Scaling down large producers to SCP	Scale down the principles found in large scale operations towards SCP ¹⁷
E	Process that imposes LTD methodologies	Scale and identify towards LTD ¹⁸
F	Process of transforming towards a socially aligned DDSS	Align DDSS towards SADDSS ¹⁹
G	Process that imposes the observations of MR in South Africa	Explore the effect of mechanisation restrictions on the modern actuation paradigm ²⁰
T_1	Level indicating a farm management system (FMS) more suited for SSFPs in the Free State region	Level indicating a farm management system (FMS) more suited for SSFPs in the Free State region
T_2	Level indicating a farm management system (FMS) more suited for SSFPs in the Free State	Level indicating a farm management system (FMS) more suited for SSFPs in the Free State region, with added

¹⁷ See von Loeper/Musango/Brent/Drumie, 2016

¹⁸ See Alant/Bakare, 2021

¹⁹ See Khoza/Senyolo/Mmbengwa/Soundy, 2019

²⁰ See Bastian/Swanepoel, 2019

	region, with added device connectivity	ICT infrastructure and capabilities
T_3	Level indicating a farm management system (FMS) more suited for SSFPs in the Free State region, with further emphasis on electrical resource management within failing municipalities	Level indicating a farm management system (FMS) more suited for SSFPs in the Free State region, with further emphasis on electrical resource management

Source: Authors

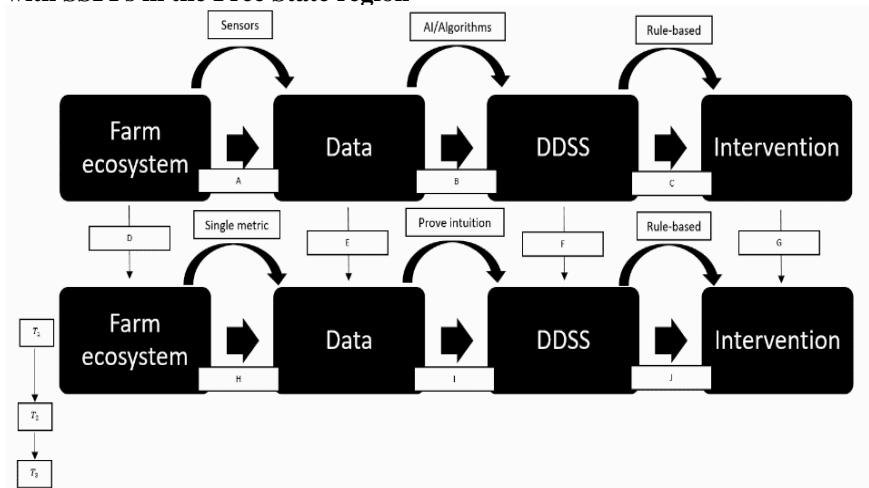
The proposed FMS scaling process, as outlined below in Figure 2, is governed by:

- 1) Building blocks (farm ecosystem, data, DDSS, interventions drawn for data insights) that are considered fundamental elements of any FMS and need to retain its basic structure or impact even after scaling toward a system more applicable to local SSFPs.
- 2) Processes (A, B, C, H, I, and J) that facilitate the movement of data from farm ecosystems to the implementation of interventions (or actuation) are showcased as a movement with arrows from left to right in Figure 2.
- 3) Processes (D, E, F, and G) that facilitate the scaling of the building blocks from status quo (i. e., the modern) FMSs (first row of figure 2) to more applicable FMSs orientated towards SSFPs in the Free State region (second row Figure 2).

Moreover, typical timeline attributes are governed by the following:

- 1) Within modern FMSs, communication and transmission rates of data are considered near real-time,
- 2) Within the more applicable SSFPs-orientated FMSs, communication and transmission rates could be considered to be based on connectivity,
- 3) Interventions (from decision to actuation) within modern FMSs typically occur in near real-time,
- 4) Interventions (from decision to actuation) within the more applicable SSFP-orientated FMSs will range from days to weeks based on connectivity and programme specific phases.

Figure 2: Outlining the scaling methodology that scales the modern FMS, existing in the “Agriculture 5.0” paradigm, towards FMSs that are aligned with SSFPs in the Free State region



Source: Authors

The core beneficial attributes of the scaling process (see figure 2 and table 1) of a typical status quo FMS towards a happy medium that is more relevant to local SSFPs ensure that partial connectivity restrictions are elevated, technological uptake is improved, and the possibility of institutional support towards SSFPs is maximised during the first stages of interaction. Also, the ability of the scaled FMSs to slowly progress (in a linear fashion) towards near real-time data communications, decisions and actuation will increase SSFP engagement and promote sustainable interventions. A primary emphasis in this model is to contain a healthy farm ecosystem, driven by ICT and connectivity. Once these have been established, a connection to the correct sensors and the collection of the relevant data are vital for the success of the digital decision support system, the rules associated with them, and ultimately, the primary interventions that will be created resulting from this.

To illustrate how local SSFP will exist and progress in levels T1, T2 and T3 (see figure 2), a hypothetical example of SSFP, focussing on a small crop setup (of less than one hectare), that supports households directly with some portion being sold to neighbouring households, is considered. If the latter hypothetical scenario exists in level T1 (also known as the scaled FMS applicable to the local SSFP paradigm), together with the assumed necessary institutional support and programmes,

planned predefined interventions and the initial low-tech solutions, the following digital progression will occur in level T1:

- 1) Low tech (with low power consumption) farming sensors (such as for measuring humidity or nutrient levels) send data to smartphones using Bluetooth. This setup is predefined (or programmed) by an intervention programme and requires no Wi-Fi connection. DC principles (see table 1) are introduced in its most basic essence during this phase via some informative platforms on the smartphone. This attribute mitigates the impact of no internet connection.
- 2) Farming data is automatically transferred to SADDSS (see table 1) based on predefined intervention programmes on SSFP's mobile device, to reconfirm what is already known and outlined by SSFP's intuition and abilities (perhaps based on prior training). SADDSS could be visually illustrated using simplistic economic graphs and projections. DC and basic DA principles (see table 1) are introduced in its most basic form during this phase; this could be in the form of reviewing the process of generating insights from data by use of infographics on smartphone.
- 3) Insights drawn from SADDSS (steps 1 - 2 above) are implemented by focussing on AES (see table 1) while considering the local restrictions of modern mechanisation. Possible application routes of AES requirements are predefined by intervention programmes.

If the digital progression, that exists in paradigm T1, proves to be successful via the observations of increased uptake of hard/soft skills, further expansions could be considered (towards paradigm T2; see figure 2). The latter could be in the form of introducing more applicable sensors, and the utilisation of smartphones with external access to cloud-based platforms that will enable further real-time interventions and support as outlined above by the existing intervention programmes. Advance digital skill development is required when SSFP operate in level T2.

If level T2 proves valuable for maximising the impact of institutional interventions on local SSFP with efficient uptake of skills and methodologies, paradigm T3 could be gradually integrated by continuing to apply principles found in level T2, in parallel with analysing the SSFP's most risky resource, that is the farming ecosystem's electrical energy consumption. If the outcomes of T1 and T2 are successful, SSFP will be equipped to focus on the electrical energy consumption metric of the farming ecosystem as a response to the FMS and the knowledge inferred. The latter expansion introduces the principle of sustainability to local SSFP-specific FMS, via a crisp focus on resource management, within a context of failing electrical infrastructures and ill-managed municipalities, and it further supports the scaling methodology.

Activities within level T3 could be supported and assessed by predefined programmes and interventions.

This section explored the main technological challenge encountered when attempting to apply modern FMSs to local SSFPs, that is the requirement to scale status quo/modern FMSs (see: section 3) toward systems that could improve farming operations while facing limited connectivity and lack of initial digital skills. To reiterate the main contribution of this essay and especially of this section 4, overcoming the initial technological uptake complexities when introducing modern FMSs to local SSFPs could be realised by gradually scaling the core components of modern FMSs to maximise technology uptake and by systematically integrating the key driver for sustainable homestead food production and farming activities. This could also lead to increased levels of profit potential associated with SSFPs in a resource-constrained setting, such as the Free State province. Furthermore, by relaxing the near-real time connectivity requirements of modern FMSs towards a scaled system applicable to local SSFPs, that are sensitive to connectivity, will ensure steady technological uptake and monitoring of response time for interventions.

5 Conclusions and Policy Recommendations: Envisioning the way forward

As previously mentioned, the region has diverse agricultural practices that comprise both summer and winter crops, deciduous fruits, and livestock farming. The Free State province ranks highly as a major contributor of different commercial crops produced in the sector on a national scale (Ferrer, S., 2013). Owing to the success of a well-documented commercial setup, the Free State province as well as the expertise vested at the University of the Free State has the knowledge and expertise base for setting a precedent in leading the transformation of local small-scale farmers, especially when SSFP are the primary agenda (responding to the SDGs). Considering the problems associated with small-scale farming, which may include inadequate resources available, poor infrastructure, inconsistent knowledge support, and a lack of educational empowerment, it is easy to overlook the social inequalities in a context where fundamental human rights exist.

The main goal or driver for digitalisation is to mainstream small-scale farming by addressing negative constraints (soft and hard challenges) which are impacting on the development and possible shift from small-scale to commercial farming or to render small-scale farming sufficient and more lucrative to those individuals practicing it. More dramatically, it could potentially transform this “survivalist sector” into a viable micro-enterprise one as envisioned by existing national and international policies and agendas that focus on agricultural development, food

security, and the empowerment of women. These objectives are therefore squarely in line with our suggested re-conceptualising of the modern FMS, which is firmly rooted in empowerment, training, and development of long-term solutions geared toward enabling SSFPs to provide for their households and the larger communities in which they find themselves.

The way forward proposed in this essay is firmly based on integrating the systematically scaled down FMS (as outlined in Section 4) into local SSFP's farming operations. This is for an engagement that could serve as a golden thread when maximising the predefined interventions offered by the entity through providing the service and overcoming the initial technology uptake due to the lack of DC principles and digital infrastructure. Furthermore, an important use case exists to do social good by improving the livelihood, training, and upskilling of the SSFP to become more economically active and to be positioned to provide for their households and immediate communities. It is estimated that equal access to resources and opportunities for men and women would increase global food production from 2.5% to 4% (Devex Partnerships, 2021). This means that the incorporation of access could potentially raise yields on farms by approximately one-third and alleviating hunger of approximately 150 million people (see: Devex Partnerships, 2021). The scaled-down, responsive FMS, applicable to local SSFP, accounts for region-specific factors that were introduced during the scaling process. Furthermore, the proposed neutral ground case was enhanced (from level T1 to levels T2 and T3) by introducing improved device connectivity (not just Bluetooth but WI-FI as well) and incorporating sustainable resource management. An intuitive example was proposed to illustrate the scaled FMS for engagement of SSFP having only small crops primarily for homestead food production.

We therefore recommend that FMS's scaling should shift the focus to individual users managing an agricultural process at a local level. We propose this so that the impact on the FMSs can reach a part of the society; the FMSs would directly benefit from the technology use and could potentially even tap into a global market where they would be able to sell their produce. The ability to make evidence-based decisions in this context is vital as there will always be a "finger on the pulse" when it comes to the SSFPs, and thus mitigating the risks for SSFPs to lose their ability to influence their business.

Finally, and most importantly, by using a variety of existing technologies, and with the aid of industry, academics, and society, SSFP can be empowered to become more economically active, to provide for their communities, and to assist vastly in empowering the nutritional health as well as education of their immediate environments.

References

- Aguera, Pablo, et al. (2020). Paving the way towards digitalising agriculture in South Africa.
- Ahmed, L. and Nabi, F., 2021. Data-Driven Smart Farming. In: *Agriculture 5.0: Artificial Intelligence, IoT, and Machine Learning* (pp. 157-174). CRC Press.
- Alant, Busisiwe & Bakare, Olusegun. (2021). A case study of the relationship between smallholder farmers' ICT literacy levels and demographic data with regard of their use and adoption of ICT for weather forecasting. In: *Heliyon*. 7.; access: <https://pubmed.ncbi.nlm.nih.gov/33748475/>; March 12, 7(3): e06403. Doi: 10.1016/j.heliyon.2021.e06403. eCollection 2021 Mar.
- Bastian, R. & Swanepoel, Jan & J. A. Van. (2019). Effectiveness Of The Implementation Of The Mechanisation Programme For Emerging Farmers In The Overberg And Eden Districts Of The Western Cape. In: *South African Journal of Agricultural Extension (SAJAE)*. 47. Access: 10.17159/2413-3221/2019/v47n2a503.
- Brent, Alan & Silinga, Cebo & Sanetra, Nadia. (2016). Guideline for energy management in the South African wine industry. In: *Journal of Energy in Southern Africa*. 27. 53. Access: 10.17159/2413-3051/2016/v27i4a1458.
- Castrignanò, Annamaria & Buttafuoco, Gabriele & Khosla, Raj & Mouazen, Abdul & Moshou, Dimitrios & Naud, Olivier. (2020). Agricultural Internet of Things and decision support for precision smart farming. Access: 10.1016/C2018-0-00051-1.
- Covic, N. & Hendricks, S. L. (ed). 2016. Achieving a nutrition revolution for Africa: The road to healthier diets and optimal nutrition. IFPRI: Washington, D.C.
- Digital Farmer Profiles: Reimagining Smallholder Agriculture, USAID
- Dunga, H. M., 2020. An empirical analysis on determinants of food security among female-headed households in South Africa. In: *International Journal of Social Sciences and Humanity Studies*, 12(1), pp. 66-81.
- Ferrer, S. (2013). Report 6: Demographics of farms, farm workers and farm dwellers in South Africa, unpublished report for an ILO study on farm workers.
- Gray, B., Babcock, L., Tobias, L., McCord, M., Herrera, A., Osei, C., Cadavid, R., 2018,
- Huang, W. H.-Y. & D. Soman (2013). Gamification of education. *Report Series*: In: *Behavioural Economics in Action*, 29, 12.
- Kapp, K. M. (2012). The gamification of learning and instruction: game-based methods and strategies for training and education. John Wiley & Sons.
- Khoza, T. M. & Senyolo, Grany & Mmbengwa, Victor & Soundy, P. (2019). Socio-economic factors influencing smallholder farmers' decision to participate in agro-processing industry in Gauteng province, South Africa. In: *Cogent Social Sciences*. 5. Access: 10.1080/23311886.2019.1664193.
- May, J., Witten, C. B. & Lake, L. (ed). 2020. *South African Child Gauge 2020*. Cape Town Children's Institute, University of Cape Town.

- Ngwexana, T., 2018. Access to land and productive resources among female farmers in Stellenbosch: Implications for women's empowerment and household food. University of the Western Cape (UWC), South Africa
- Nixon, R. 2015. Slow Violence, Gender, and the Environmentalism of the Poor 515; In: Postcolonial Studies: An Anthology, edited by Pramod K. Nayar, Wiley-Blackwell
- Sarker, I. H., 2021. Data Science and Analytics: An Overview from Data-Driven Smart Computing, Decision-Making, and Applications Perspective. In: SN Computer Science, 2, 377, July 2021; Access: <https://link.springer.com/article/10.1007/s42979-021-00765-8>
- Singh, C., Khilari, S. H. and Nair, A. N., 2022. Farming-as-a-Service (FAAS) for a Sustainable Agricultural Ecosystem in India: Design of an Innovative Farm Management System 4.0. In: Digital Transformation and Internationalization Strategies in Organizations (pp. 85-123). IGI Global.
- Saiz-Rubio, Veronica & Rovira-Más, Francisco. (2020). From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management. *Agronomy*. 10. Access: 10.3390/agronomy10020207.
- Seeliger, Leanne & de Clercq, Willem & Hoffman, Willem & Cullis, James & Horn, Annabel & de Witt, Marlene. (2018). Applying the water-energy-food nexus to farm profitability in the Middle Breede Catchment, South Africa. In: *South African Journal of Science*. 114. Access: 10.17159/sajs.2018/5062.
- South Africa. Government Document. 2020. National Digital And Future Skills Strategy South Africa; available at: https://www.gov.za/sites/default/files/gcis_document/202009/43730gen513.pdf
- Statistics South Africa [STATS SA]. (2019). Inequality Trends in South Africa: A multidimensional diagnostic of inequality, Statistics South Africa: Pretoria.
- Statistics South Africa [STATS SA] (2020). Census of commercial agriculture, 2017 Financial and production statistics. Report no. 11-02-01 (2017) 104, pp., ISBN 978-0-621-48283-6. Published by Statistics South Africa, Pretoria.
- Statistics South Africa [STATS SA]. (2021). More people participate in the South African labour market in the 4th quarter of 2020, Statistics South Africa: Pretoria.
- Takavarasha Jr., Sam & Cilliers, Liezel & Chinyamurindi, Willie. (2018). Navigating the unbeaten track from digital literacy to digital citizenship: A case of university students in South Africa's Eastern Cape province. In: *Reading & Writing*. 9. Access: 10.4102/rw.v9i1.187.
- Tsangas, Michail & Gavriel, Ifigeneia & Doula, Maria & Xeni, Flouris & Zorpas, Antonis. (2020). Life Cycle Analysis in the Framework of Agricultural Strategic Development Planning in the Balkan Region. In: *Sustainability*. 12. Access: 10.3390/su12051813.
- United Nations General Assembly. 2015. Transforming our World: The 2030 Agenda for Sustainable Development, 21 October 2015, United Nations: New York.
- Van den Berg, S., Patel, L. & Bridgman, S. 2021. Hunger in South Africa during 2020: Results from Wave 3 of NIDS-CRAM, (University of Stellenbosch); Access: <https://cramsurvey.org/wp-content/uploads/2021/02/10.-Van-der-Berg-S.-Patel-L.->

- Bridgman-G.-2021-Hunger-in-South-Africa-during-2020-Results-from-Wave-3-of-NIDS-CRAM-1.pdf.
- Von Loeper, Wolfgang & Musango, Josephine & Brent, Alan & Drimie, Scott. (2016). Analysing challenges facing smallholder farmers and conservation agriculture in South Africa: A system dynamics approach. In: *South African Journal of Economic and Management Sciences*. 19. 747. Access: 10.4102/sajems.v19i5.1588.
- Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D., Tegmark, M. and Nerini, F. F., 2020. The role of artificial intelligence in achieving the Sustainable Development Goals. In: *Nature communications*, 11(1), pp. 1-10.
- Van der Walt, J., 2021. Africa's women farmers need better access to information. In: *Farmer's Weekly*, 2021(21008), pp. 32-34.
- World Bank, 2003. World Bank Rural Development Strategy, and for access: <https://openknowledge.worldbank.org/handle/10986/14084>
- Zhai, Zhaoyu & Martínez, José & Beltran, Victoria & Lucas Martínez, Néstor. (2020). Decision support systems for agriculture 4.0: Survey and challenges. In: *Computers and Electronics in Agriculture*. 170. 105256. Access: 10.1016/j.compag.2020.105256.

Contextual Challenges to develop Precision Medicine through eHealth advances in South Africa¹

HMVE Combrink² & K. de Wet³

1 Introduction - Two divergent health systems in South Africa

The eHealth initiatives could be classified as forming part of the much-vaunted Fourth Industrial Revolution (4IR). 4IR is transforming all sectors and spheres of society, with a combination of interoperability, artificial intelligence (AI), software engineering, and digital science (Pacheco/Nascimento/Weber, 2018). It is stated that eHealth is often defined as “healthcare services provided electronically via the internet” (Eysenbach, 2001) – which includes the Internet of Things (IoT), sophisticated software engineering apps run on cloud servers, the use of Artificial Intelligence (AI) through the deployment of Machine Learning (ML) algorithms embedded in apps, or smart systems that enable technologies to learn from users and their behaviour over time to better execute specific functions. Although

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eHealth encompasses this wide array of possibilities, in this essay we are specifically focused on concepts in eHealth that rely on digitizing⁴ a traditionally paper-based field to yield big datasets that have the potential, through AI and ML, to develop and to refine medical practice, precision medicine, and responsive treatment using technology. “Precision medicine”, sometimes also referred to as “personalised medicine” is focused on developing “which approaches will be effective for which patients based on genetic, environmental, and lifestyle factors”⁵.

The processes of digitization and of rendering digital datasets interoperable (and therefore usable) are unfortunately challenging in resource-constrained contexts, such as in the South African health care context, since hospitals, laboratories and supporting facilities, like clinics, tend to operate in silos and data are therefore not readily shared. Central to the concept of interoperability between systems is the existence - as yet elusive - of a basic digital architecture to support a continuous data flow between different technologies and data types into one consolidated database, otherwise known as data lakes.

The challenges associated with attaining this promising ability of digitization to yield big data, with creating processes of interoperability, and with the sharing of these data are further amplified by the stratification of a very unequal public and private health care system in the South African context. Private health care is operated by a host of different well-endowed and sophisticated stakeholders (private hospital groups), whereas the public health care system consists of facility-based health care services in the public space serving the great majority of South Africans. There is not an entrenched culture of data sharing between these monoliths of health care provisioning where vast amounts of data are generated daily (Schmidt/Colvin/Hohlfeld, 2018). In fact, data sharing is not ubiquitous even among departments or facilities working at a similar facility (Mgozi/Weeks, 2015).

Approximately 8.5% of South Africa’s gross domestic product (GDP) spending is on health care (Bvuchete/Grobbelaar/Van Eeden, 2015). This amounts to the equivalent of R 332 billion per year that is spent in this domain. However, half of this amount is spent in the private sector, which greatly caters for a minority and wealthier socio-economic class (Barber/Kumar/Roubal/Colombo/Lorenzoni, 2015). It is estimated that 84% of the South African population are being catered

⁴ See the introduction to this Unit for the two concepts “digitization” and “digitalization”. Although we explicitly refer to processes of digitization here, it obviously also encompasses the more important issues of digitalization and digital transformation as these three concepts are all needed to lead to a sustainable uptake.

⁵ See in: MedlinePlus; access: <https://medlineplus.gov/genetics/understanding/precision-medicine/precisionvspersonalized/>

for by the public health care sector, which also represents the population that carries a disproportionate weight of the burdens of disease (Rispel, 2016). This inevitably results in the skewed access to health care, where those who can afford private health care are serviced by high quality standards of care, while those who cannot afford this luxury have to contend with care that is often of lower quality, given the manifold difficulties that overwhelm the public health care system. These challenges are, among others, deficiencies in human resources for health, overcrowding, frequent mismanagement, and other associated ills (Maphumulo/Bhengu, 2019).

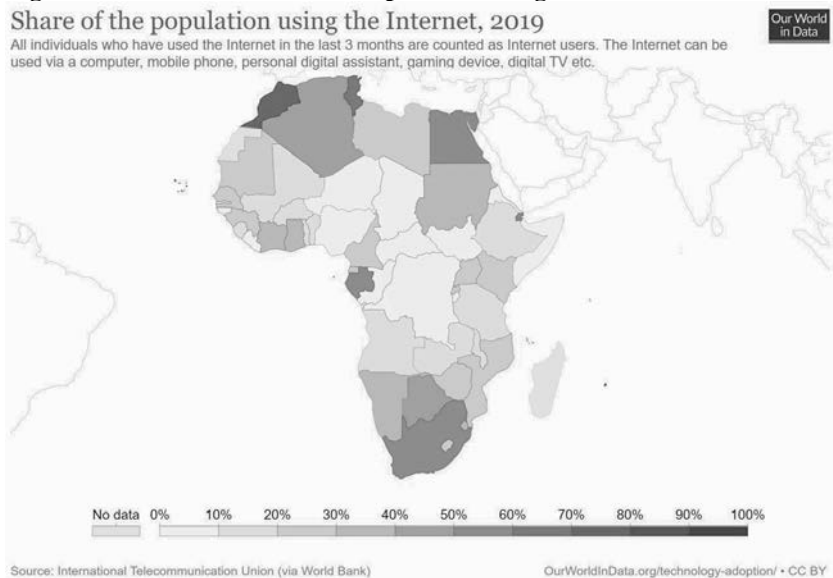
Government hospitals and clinics, working under these conditions, often render unreliable services and often do not have adequate specialist services (see: Africa WHORO for Health Systems in Africa, 2012). This unintentionally creates a situation in South Africa where the most successful and digitally advanced health care systems are used and developed in the private health care context, leaving other areas, such as smaller communities and towns (often rural areas), as well as the wider public health care system excluded from the promises of digital developments in health care. The majority of South Africans still resides in peri-urban and rural areas, which questions the fairness of the medical and technological advances made in urban and well-endowed health care facilities. Unfortunately, if these differences are not addressed, a plethora of unfavourable outcomes will continue to manifest in the unequal burden of disease, health outcomes, and access to quality care for all South Africans. Establishing an eHealth intervention in the form of functioning data lakes is one of the potential solutions to systemically upgrade as well as to integrate the private and public health care systems among urban, peri-urban, and rural population groups. Data lakes may also equalise the two divergent health systems currently in operation in South Africa for them to synergistically cooperate towards attaining better health outcomes through the development and refinement of precision medicine. This does imply that more than just government support and buy-in is needed, and that innovative sectors and unique value propositions need to be established to grow the interoperability of the health care system in its entirety.

Section 1 has introduced to the two diverging health systems of South Africa and has emphasized the role of digitalization for their convergence. In the next section 2, an outline of the digital divide in Africa and of South Africa during the 4IR will be given. Section 3 discusses the issue of Interoperability and the developments in the Interoperable Framework in South Africa, while section 4 goes beyond Interoperability to look at the context of the fourth Industrial Revolution (4IR). Section 5 is on the future of eHealth in resource-constrained contexts, and section 6 has the Conclusions and Policy Recommendations.

2 The Digital Divide in Africa and South Africa during the Fourth Industrial Revolution (4IR)

According to the United Nations (Ekwebelem/Ofielu/Nnorom-Dike/Iweha/Ekwebelem/Obi/Ugbede-Ojo, 2021), sub-Saharan Africa consists of 46 countries on the African continent. Among these, South Africa is regarded as one of the most varied cultural regions in the world (Sharma/Shah/Karar, 2020). However, despite its diversity, South Africa has also been labelled one of the most technologically deprived regions on the planet (You/Dal Bianco/Amankwah-Amoah, 2020). This can be seen by the high Gini-coefficient for most of sub-Saharan Africa, including South Africa, which indicates widespread levels of dire inequality (Asongu/Odhi-ambo, 2020). The economic halt of Africa's digital advancement could be ascribed to the number of internet users as a relative percentage of the population with access to and use of the internet across a variety of devices (figure 1).

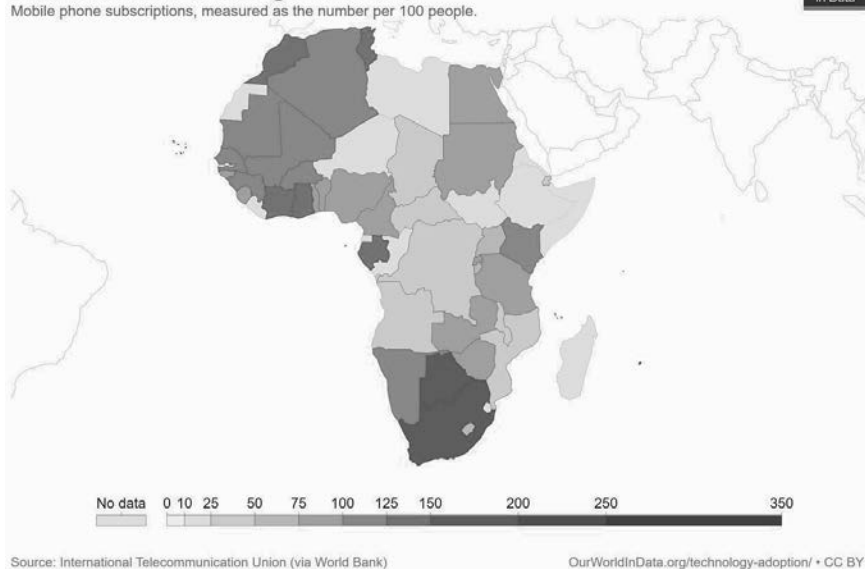
Figure 1: Share of the African Population using the Internet



Source: Our World In Data/Internet; for access: <https://ourworldindata.org/internet>; Data available at: <https://data.worldbank.org/>

It must be noted that, despite the number of general devices (desktop computers, portable tablets, etc.), connectivity to the internet is low in Africa. However, the number of mobile internet users in Africa is high (see figure 2).

Figure 2: Mobile cellular subscriptions per 100 people across Africa
 Mobile cellular subscriptions, 2019



Source: Our World In Data/Internet; for access: <https://ourworldindata.org/internet>; Data available at: <https://data.worldbank.org/>

Moreover, a variety of contextual challenges are present within most African health systems where pressing and basic health care needs often compete with other, equally valid needs. As a result, these basic health care needs are systematically not met in many instances (Ramlagan/Shean/Parker/Trollip/Davids/Reddy, 2021).

The immense potential of eHealth must be met with serious consideration of the responsibilities that will accompany its deployment and successful, sustainable uptake, as well as by paying attention to issues of equality. At the core of this are the policies that govern how technology is considered within the context of the health care system. This specific argument becomes exponentially more complex when sophisticated systems, such as eHealth advances, and such as data lakes, are introduced (see: Bakibinga-Gaswaga, E./Bakibinga, S./Bakibinga, D. B. M., and Bakibinga, P., 2020). For 4IR to be fully realised in South Africa, digital literacy as well as digital fluency need to permeate this important trend-setting sector, especially also in terms of the financial and economic value associated with wielding these skills effectively (Lyons/Kass-Hanna/Liu/Greenlee/Zeng, 2020).

There is therefore an increasing need for the widespread availability of relevant expertise as the sharing of data. It is of an unprecedented scale in the South African context and requires new analytical tools, as well as the formulation of

specific and relevant experimental questions. Extensive functional illiteracy in many areas of sub-Saharan Africa also exacerbates digital illiteracy (see: Bakibinga-Gaswaga, E. et al., 2020). Furthermore, schools that incorporate blended learning and provide their learners with the required digital skills are primarily independent from government institutions (see the essay on basic education in this South Africa Digitalization Unit), and these schools encompass a negligible percentage of the general population. This means that the central policies that govern these systemic transitions are at a loss to materialise at scale, which might have unfavourable outcomes as to its sustainable impact on the overall society.

Another hurdle, especially in resource-constrained settings with overburdened health systems, is the significant computing power that is required for the analysis of such large and complicated data sets. Practical challenges, such as a lack of interoperability and standardisation within existing systems, digital record keeping, and data labelling, are barriers to optimal uptake and eventual success. In addition, machine learning (ML) approaches have been criticised on several levels. Its dependency on large amounts of training data could be problematic in some settings (especially where paper-based records are the norm). Inconsistencies in the availability and quality of data could also restrict the potential of ML, especially in contexts marked by this pronounced lack of digital literacy and access, the low skillsets, and the weak health systems.

Ignoring contextual and practical challenges in the South African context, as well as in similar settings across the globe, could result in detrimental and unintended consequences. So much so that it has been suggested by some that in resource-constrained settings, the technology-centric approach to treating diseases like cancer threatens “to do more harm than good” (see: Sullivan/Pramesh/Booth, 2017, page 3). In terms of the spectrum encompassing the burden of cancer in Africa, Boehm et al. (2021)⁶ indicate that less than one-quarter of the people currently benefit from precision medicine. These remarks are truly a cause for concern, and efforts should be made to understand the most pressing impediments to gain substantially more benefit from eHealth advances, such as the potential inherent in wielding big data to advance precision medicine. The issue of interoperability is a challenging barrier once digitization is achieved. Interoperability and responses to this important process will be unpacked in the ensuing sections to grapple with the complexity of this inevitable process in the creation of data lakes.

⁶ See Boehm/Garnett/Adams/Francies/Golub/Hahn/Iorio/McFarland/Parts/Vasquez, 2021

3 Interoperability and Developments in the Interoperable Framework in South Africa

It has been shown that the use of artificial intelligence (AI) to analyse and to identify patterns in large and complex datasets has led to much faster and more accurate outcomes than were previously possible (see Schwalbe/Wahl, 2020). An indispensable ingredient for using artificial intelligence (AI) and machine learning (ML) is the availability of big data, which requires the application of dedicated analytical and statistical approaches in order to move from mere bio-information to substantial advancements in actual patient care, which is what precision medicine entails (see Reddy/Allan/Coghlan/Cooper, 2020).

As a glimmer of hope, within the context of the South African health care system, there has been a strategic shift towards the interoperability of systems between clinics, facilities, hospitals, and the overarching institutional administrative domain. Interoperability refers to a data and information flow between different systems and facilities so that what occurs in one system can reflect on another one. This specific information flow infers that the digital components in health need the operation of mechanisms that enable both, making possible the information flow and ensuring the security of the information. The latter aspect is vital for South Africa's POPIA (Protection of Personal Information Act)⁷ and GDPR (General Data Protection Regulation)⁸ compliance.

In the South African healthcare system, there are many additional third-party institutions that potentially need to access the information and data that exist (Carapinha, 2017). This includes the two-way traffic of sharing and obtaining information between these outside partners and the health care space, which include laboratory services, pharmaceutical services, academic institutions, service providers, and the clients themselves, among many others. Overall, the health care sector deals with sensitive information as well as a lot of information from a range of sources regarding a specific client. Not only does this information need to be stored in a safe place, but it also needs to be retrievable by clinical staff who work with the client, academic staff who perform research, institutions that need to monitor and evaluate clinical outcomes, and those that need to audit the data – to name but a few key stakeholders (see Mhlanga/Garidzirai, 2020). This increases the complexity which is present to create functioning data lakes within the health care system and underscores the potential challenges associated with this endeavour. To achieve the goal of interoperability, a consolidated framework and strategy needs to be in place.

⁷ See on the Act: <https://popia.co.za/>

⁸ See on a comparison of Act and Regulation: <https://www.popiact-compliance.co.za/gdpr-information>

For South Africa, a few policy documents have been circulated from government intended to guide the adoption and incorporation of interoperability, such as the health normative standards framework (HNSF). The HNSF forms the basis for interoperability of the healthcare system in South Africa (see Wolmarans/Solomon/Tanna/Venter/Parsons/Chetty/Dombo, 2014). This strategy outlines how institutions in the public health care space can share information on a system-to-system basis. In addition to this, the 2012 – 2017 eHealth strategy of South Africa was succeeded by the national digital health strategy for South Africa 2019 – 2024 (see Kante/ Ndayizigamiye, 2021). The 2012 – 2017 eHealth strategy focussed on defining the standards for information sharing. These standards were benchmarked against international frameworks and were derived from the HL7 V3 Reference Information Model (RIM) (see Dolin/Rogers/Jaffe, 2013). The RIM is a framework from which technical competencies and standards are defined in a healthcare context – and includes the technical details of what software engineers, information managers, and those concerned for information and communication technology compliance should entail in the healthcare space when an innovation is incorporated for the purpose of assisting, improving, or replacing any service at any level of healthcare.

This framework proposes coding standards and information technology requirements for the implementation of sharing information between different institutions when using application programming interfaces (APIs) (see Muñoz/Trigo/Martínez/Muñoz/Escayola/García, 2011). This specific model is intended to promote open-source development and draws on the intention of interoperability within the native environment. Finally, these interoperability outlines were also benchmarked from the framework titled “Integrating the Health Enterprise” (IHE) (see Barbarito/Pincioli/Mason/Marceglia/Mazzola/Bonacina, 2012). To adopt these frameworks and to augment the South African integrated health care strategy, the 2019 – 2024 digital health strategy includes the vision of “better health for all South Africans enabled by person-centred Digital Health”. This strategy contains the interoperability development principles to ensure the universal adoption and understanding of the plan. Central to this plan is the incremental approach proposed by the South African government whereby the integration of systems will be based on a series of small gains over time, rather than coming forth as a single intervention that will integrate the system. This approach is justified by the challenges being present in the South African health care system, including a lack of infrastructure, poor network connectivity, deficits regarding the required digital skills to navigate an eHealth environment, problems with integrating the required training of the “tools of the trade” (to get the skills and the equipment needed to do the job properly) within academic institutions, and upskilling the existing staff members in the current health care system.

Unfortunately, adequate costing of all the afore-mentioned challenges, and addressing these, have not been detailed and only approximate estimates are given.

A vital component of the strategy is that initiatives related to the implementation of the HNSF need to be managed through governance structures in the National Department of Health (NDoH). This means that all developments in relation to this strategy will fall under the umbrella of a national South African coordination framework: one which would require already established entities and companies of proactively working with and on solutions related to eHealth. In the next section we will outline the context of 4IR beyond interoperability and provide insight into the additional perceptions related to interoperability, and what is needed beyond this.

4 Beyond interoperability – The Context of the Fourth Industrial Revolution (4IR)

Attaining interoperability will be no mean feat. However, the challenges associated with eHealth advances, such as the development of data lakes to enable AI and ML to ultimately attain precision medicine, cannot happen if inherent limitations or requirements are not explicitly addressed. A new engagement with ethical decision-making is needed to respond to the manifold challenges highlighted until now, as well as to accurately, and in a non-biased manner, estimate and evaluate the costs and benefits (see Jones-Bonofiglio/Nortjé, 2020). An emphasis also needs to be placed on comparability and reproducibility, and therefore not only on mere maximisation of performance (Langeni, 2020). This will ensure sustainable and widespread use of AI and ML to the benefit of large, global patient cohorts (see Beam/Manrai/Ghassemi, 2020). The eHealth expertise is a new skill, as well as a way of doing and thinking that will become indispensable if eHealth is to succeed on a wide scale. This professional and public change management should ultimately equip medical staff as well as patients to communicate and be versed in the new AI-embedded landscape. The question of responsibility, when it comes to AI and ML, is still debated and problematic (Heinrichs/Eickhoff, 2020). Issues of liability will have to be given serious consideration in the event of medical errors that might occur in the process of deploying AI and ML – and this is obviously not a problem merely confined to the Global South (Rajkomar/Dean/Kohane, 2019). The issue of data use, consent, and privacy to assure patients that their information will not be used for maleficent purposes equally generates problematic debates as there is a growing lack of trust among the public as to the true intentions of harvesting big data in so many spheres of life (see Gutzwiller/Reeder, 2020). The issue of cybersecurity links up with the preceding point as data leaks and a lack of control of data access could potentially lead to information ending up in the wrong hands (see Sarker/Kayes/Badsha/Alqahtani/Watters/Ng, 2020). Developments in eHealth, through AI and ML, should not amplify socio-economic inequality and thereby entrench health-related disparities.

The immense potential of the creation and use of data lakes by harnessing AI and ML in health care will be wasted if all these global and contextual factors are not considered for its successful and sustainable deployment and to ensure that it will translate into widespread improvements in morbidity and mortality outcomes. It is for this reason that policy changes related to 4IR should seriously engage with contextual factors from interdisciplinary perspectives that would extend not only from medical sciences *per se* but to other domains, including data science, ethics, social sciences, and humanities to name but a few.

5 The future of eHealth and big data in resource-constrained contexts

The range of eHealth advances is still poorly scaled and fragmented in resource-constrained contexts, and these contexts could therefore easily become the new experimental domains in the global race for technological dominance. Some have referred to this process as “digital colonialism” (Chen/Lin/Li/Ma, 2020, and Bihane, 2020). These technological advances in health are growing apace on a global scale, which means that it will either go the route of engulfing those areas left behind, or these areas could somehow join the new race to stake their claim with regards to processes that they are best positioned to command. The eHealth advances are a potentially lucrative activity that lure a wide array of stakeholders to enter this burgeoning market. South Africa is an ideal petri-dish for low-tech digital interventions, mostly associated with eHealth initiatives, although results thereof are often disappointing (Kip/Sievernink/Germert-Pijnen/Bouman/Kelders, 2020). Even more sophisticated eHealth developments in AI, such as ML and smart systems, are taking root within the African continent, with dedicated groups, such as Data Science Africa⁹ that was created in 2013 and the Deep Learning Indaba¹⁰ that started in 2017, to drive this movement (see Marwala, 2021, but also Adebé/Aruleba/Bihane/Kingsley/Obaido/Remy/Sadagopan, 2021).

However, as described in the preceding pages, the South African context is challenging to design, deployment, implementation, and evaluation of eHealth developments, which include low- and high-tech interventions. Poor governance structures and ethical decision-making processes are also areas of concern as these inevitable technological developments become more widely used and entrenched on the African continent (see Simen-Kapeu/Reserva/Ekpini, 2021). On the other hand, South Africa and other parts in the Global South cannot be left behind in the fast-paced expansion of health care progress. These rapid international developments need to be home-grown to respond to the unique challenges that hamper

⁹ See for Data Science Africa: <http://www.datascienceafrica.org/>

¹⁰ See: <https://deeplearningindaba.com/2021/>

health-related improvements on the African continent. Fourth Industrial Revolution (4IR) and concomitant eHealth interventions will remain a pipe dream if health care inequalities persist. A case in point is that low-income countries spent an average of US\$ 41 per person on health care in 2017, compared with US\$ 2,937 in high-income countries. This translates into a difference of more than 70 times (WHO, 2019). High-income countries account for about 80% of global health spending (WHO, 2019). Therefore, there is a dire need to address the digital divide as well as health system divides (that too often lead to the entrenchment of weak health systems) to respond to the challenges and opportunities presented by eHealth.

Within the Interdisciplinary Centre for Digital Futures (ICDF), developments to build data lakes in healthcare specific to the Free State are underway. As is the challenge with defining boundaries of complex problems, so too will defining the role of Universities, Governments, and Industry be challenging within this new domain. It is for this reason that active research within the ICDF and in centres like this is paramount to addressing the plethora of challenges that exist within this prominent domain. To grapple with the multifaceted problems that characterise eHealth, an interdisciplinary approach will be needed to respond to these issues in a resolute and defensible manner. Centres such as the ICDF within the University of the Free State are both geographically and economically positioned to have a far-reaching impact on the healthcare system in the Free State because it engages with research and training in this new domain. Although the ICDF is currently working with facilities in the Free State, expansion to other regions in South Africa is underway. Skills and systems deficits will have to be addressed through dedicated curriculum changes that incorporate perspectives from non-cognate disciplines to cater for new skill sets that are required in the context of the 4IR, especially as it relates to analysing and interpreting big data for optimal use and value. In South Africa, there is an explicit recognition of the disruptive (and potentially advantageous) forces that big data usage and analysis ushers in. This is acknowledged through the “National Research Big Data Strategy for South Africa”¹¹, developed by the Department of Science and Technology of South Africa. Such initiatives indicate that concerted and orchestrated efforts are in place to enhance processes of data sharing and open access among a host of private and public entities (government departments, private hospitals, academic institutions). In fact, ensuring that Big Data and its concomitant analytics work towards obtaining development goals requires the “social construction of its usage through carefully designed policy strategies” (Hilbert, 2016). Increasing evidence from other parts of the Global South as well as from South Africa attests to the possibilities of

¹¹ See on the Research Big Data Strategy for South Africa: <https://stip.oecd.org/stip/interactive-dashboards/policy-initiatives/2021%2Fdata%2FpolicyInitiatives%2F26333>

harnessing big data to bring about positive outcomes, responding to the attainment of the Sustainable Development Goals (SDGs) (see Arfanuzzaman, 2021). It has also been proven that the efficient use of big data by conducting standard analyses of variations have the potential to detect anomalies with regards to the underuse, overuse, or misuse of medical care (Wennberg, 2011), which is important in contexts of constrained resources and unequal health-related resource allocations.

We are now at a stage where the initial euphoria and novelty of digital health interventions must be tempered and that it is time to provide evidence-based improvements in health, so to reduce health inequalities. Increasingly, this important corpus of knowledge is being constructed and refined. Emphasis and sensitisation are growing to enhance data-sharing practices among public and private actors, and even among countries, which will only increase the potential of big data analytics. Certain initiatives allow the transparent use of a wide variety of datasets.¹² It is only through these measures that sustainable uptake and implementation of digital developments in health will have a viable outcome in South Africa and other areas characterised as the Global South.

6 Conclusions and Policy Recommendations

Healthcare in South Africa still has a way to go to achieve sustainable data sharing practices, to digitise available data, and to attain full interoperability, although there are strategies in place to ensure that these processes do materialise. The prospect of creating data lakes brings with it much promise not just in terms of compliance to data governance acts, but also in terms of advancing research, clinical care, and the overall improvement of clinical outcomes through the provision of more targeted medicine that would manifest itself resulting from the developments in AI. Countries in the Global South, such as South Africa, are burdened with a host of diseases due to the poor living conditions, specific climate conditions, and other poverty and inequality-related problems. South Africa is, what is often referred to as a quadruple burden of diseases, first, characterised by the combined scourges of HIV and AIDS and tuberculosis; second, it also has unacceptably high neo-natal and child morbidity and mortality rates; third, we are witnessing an increasing prevalence in non-communicable diseases; and last, the ubiquity of violence and traumata. It is therefore imperative to understand the interplay between the environment and its impact on

¹² These are initiatives from the World Bank (data.worldbank.org), the Open Government Partnership (<https://www.opengovpartnership.org/about/>) and from open access endeavours from the Global South (datos.gob.cl in Chile, bahrain.bh/wps/portal/data in Bahrain, www.opendata.go.ke in Kenya, dadosabertos.pe.gov.br in Brazil, and data.buenosaires.gob.ar in Argentina).

health to manage the entire health care system to the benefit of all. Contributing towards this goal to gain insights for better patient management also provides the opportunity for a great deal of national and international investment, and for responding to increasing requirements for innovations that can assist the interoperability framework's overall vision. To achieve this goal, interdisciplinary, international, and cross-sectoral collaboration is vital, together with fluid partnerships between key stakeholders in the global and local health care context.

References

- Abebe, R., Aruleba, K., Birhane, A., Kingsley, S., Obaido, G., Remy, S. L. and Sadagopan, S., 2021, March. Narratives and counternarratives on data sharing in Africa. In: *Proceedings of the 2021 ACM (Association for Computing Machinery) conference on fairness, accountability, and transparency* (pp. 329-341).
- Adeboye, N. O., Popoola, P. O. and Ogunnusi, O. N., 2020. Data science skills: Building partnership for efficient school curriculum delivery in Africa. In: *Statistical Journal of the IAOS*, 36(S1), pp. 49-62.
- Africa WHORO for Health systems in Africa, 2012. Community perceptions and perspectives: the report of a multi-country study. *World Health Organization Regional Office (WHORO) for Africa*.
- Arfanuzzaman, M., 2021. Harnessing artificial intelligence and big data for SDGs and prosperous urban future in South Asia. In: *Environmental & Sustainability Indicators*; access for download: <https://doi.org/10.1016/j.indic.2021.100127>
- Asongu, S. A. and Odhiambo, N. M., 2020. Inequality and gender inclusion: Minimum ICT policy thresholds for promoting female employment in Sub-Saharan Africa. In: *Telecommunications Policy*, 44(4), p. 101900.
- Ayentimi, D. T. and Burgess, J., 2019. Is the fourth industrial revolution relevant to sub-Saharan Africa?. In: *Technology analysis & strategic management*, 31(6), pp. 641-652.
- Ayodele, T. O., 2010. Types of machine learning algorithms. In: *New advances in machine learning*, 3, pp.19-48.
- Bakibinga-Gaswaga, E., Bakibinga, S., Bakibinga, D. B. M. and Bakibinga, P., 2020. Digital technologies in the COVID-19 responses in sub-Saharan Africa: policies, problems and promises. In: *The Pan African Medical Journal*, 35(Suppl. 2).
- Barbarito, F., Pincioli, F., Mason, J., Marceglia, S., Mazzola, L. and Bonacina, S., 2012. Implementing standards for the interoperability among healthcare providers in the public regionalized Healthcare Information System of the Lombardy Region. In: *Journal of biomedical informatics*, 45(4), pp.736-745.

- Barber, S. L., Kumar, A., Roubal, T., Colombo, F., and Lorenzoni, L., 2018. Harnessing the private health sector by using prices as a policy instrument: lessons learned from South Africa. In: *Health Policy*, 122(5), pp. 558-564.
- Beam, A. L., Manrai, A. K. and Ghassemi, M., 2020. Challenges to the reproducibility of machine learning models in health care. In: *Jama*, 323(4), pp. 305-306.
- Birhane, A., 2020. Algorithmic colonization of Africa. In: *SCRIPTed*, 17, p. 389.
- Boehm, J. S., Garnett, M. J., Adams, D. J., Francies, H. E., Golub, T. R., Hahn, W. C., Iorio, F., McFarland, J. M., Parts, L. and Vazquez, F., 2021. Cancer research needs a better map. Access for download: <https://www.nature.com/articles/d41586-021-00182-0> (accessed 11 February 2021)
- Bvuchete, M., Grobelaar, S. S. and Van Eeden, J., 2018, April. A case of healthcare supply chain visibility in South Africa. In: *2018 3rd Biennial South African Biomedical Engineering Conference (SAIBMEC)* (pp. 1-5). IEEE.
- Carapinha, J. L., 2017. A comparative review of the pharmacoeconomic guidelines in South Africa. In: *Journal of medical economics*, 20(1), pp. 37-44.
- Dolin, R. H., Rogers, B. and Jaffe, C., 2015. Health level seven interoperability strategy: big data, incrementally structured. In: *Methods of information in medicine*, 54(01), pp. 75-82.
- Ekwebelem, O. C., Ofielu, E. S., Nnorom-Dike, O. V., Iweha, C., Ekwebelem, N. C., Obi, B. C. and Ugbede-Ojo, S. E., 2021. Threats of COVID-19 to achieving United Nations sustainable development goals in Africa. In: *The American Journal of Tropical Medicine and Hygiene*, 104(2), p. 457.
- Eysenbach, G., 2001. What is e-health? In: *Journal of medical Internet research*, 3(2), p. e20.
- Gutzwiller, R. S. and Reeder, J., 2020. Dancing with algorithms: Interaction creates greater preference and trust in machine-learned behavior. In: *Human factors*, p. 0018720820903893.
- Heinrichs, B. and Eickhoff, S. B., 2020. Your evidence? Machine learning algorithms for medical diagnosis and prediction. In: *Human brain mapping*, 41(6), pp. 1435-1444.
- Hilbert, M., 2016. Big Data for Development. A Review of Promises and Challenges. In: *Development Policy Review*, 34(1): pages 135-174.
- Huang, Q., Xia, X. and Lo, D., 2017, September. Supervised vs. unsupervised models: A holistic look at effort-aware just-in-time defect prediction. In: *2017 IEEE International Conference on Software Maintenance and Evolution (ICSME)* (pp. 159-170). IEEE.
- Jones-Bonfiglio, K. and Nortjé, N., 2020. A policy and decision-making framework for South African doctors during the COVID-19 pandemic. In: *South African Medical Journal*, 110(7), pp. 613-616.

- Kante, M. and Ndayizigamiye, P., 2021. Internet of medical things, policies, and geriatrics: An analysis of the national digital health strategy for South Africa 2019–2024 from the policy framework perspective. In: *Scientific African*, Volume 12, July 2021, e00759. Access: <https://www.sciencedirect.com/science/article/pii/S2468227621000636>
- Kip, H., Sieverink, F., van Gemert-Pijnen, L. J., Bouman, Y. H. and Kelders, S. M., 2020. Integrating people, context, and technology in the implementation of a web-based intervention in forensic mental health care: mixed-methods study. In: *Journal of Medical Internet Research*, 22(5), May 2020, e16906. Access: <https://www.jmir.org/2020/5/e16906/>
- Langeni, Q., 2020. *Barriers to Closing the Skills Shortage in South Africa: A Policy Delphi* (Doctoral dissertation, University of Phoenix).
- Lyons, A., Kass-Hanna, J., Liu, F., Greenlee, A. and Zeng, L., 2020. Building financial resilience through financial and digital literacy in South Asia and Sub-Saharan Africa. Available at SSRN 3496562.
- Maphumulo, W. T. and Bhengu, B. R., 2019. Challenges of quality improvement in the healthcare of South Africa post-apartheid: A critical review. In: *Curationis*, 42(1), pp. 1-9.
- Marwala, T., 2021. The Fourth Industrial Revolution in Higher Education. In: *The Responsive University and the Crisis in South Africa* (pp. 300-311). Brill.
- Mgozi, T. and Weeks, R., 2015, December. The impact of cloud computing on the transformation of the healthcare system in South Africa. In: *2015 ITU Kaleidoscope: Trust in the Information Society (K-2015)* (pp. 1-7). IEEE.
- Mhlanga, D. and Garidzirai, R., 2020. The influence of racial differences in the demand for healthcare in South Africa: A case of public healthcare. In: *International Journal of Environmental Research and Public Health*, 17(14), p. 5043.
- Muñoz, P., Trigo, J. D., Martínez, I., Muñoz, A., Escayola, J. and García, J., 2011. The ISO/EN 13606 standard for the interoperable exchange of electronic health records. In: *Journal of Healthcare Engineering*, 2(1), pp. 1-24.
- Pacheco, R. C., Nascimento, E. R. and Weber, R. O., 2018. Digital science: cyberinfrastructure, e-Science, and citizen science. In: *Knowledge Management in Digital Change* (pp. 377-388). Springer, Cham.
- Rajkomar, A., Dean, J., and Kohane, I., 2019. Machine learning in medicine. In: *New England Journal of Medicine*, 380(14), pp. 1347-1358.
- Ramlagan, S., Shean, Y. L., Parker, S., Trollip, K., Davids, A., and Reddy, S. P., 2021. Pushing the Boundaries: Adapting research methodology to document the COVID-19 pandemic from a socio-behavioural perspective in a low/middle level income country: the case of South Africa. In: *International Journal of Social Research Methodology*, pp. 1-7.

- Reddy, S., Allan, S., Coghlan, S., and Cooper, P., 2020. A governance model for the application of AI in health care. In: *Journal of the American Medical Informatics Association*, 27(3), pp. 491-497.
- Rispel, L., 2016. Faultlines in delivering good health care to poor people in South Africa. In: *The Conversation*. For Download: <http://theconversation.com/faultlines-in-delivering-good-health-care-to-poor-people-in-south-africa-48329>. (Accessed 6 June 2021).
- Sarker, I. H., Kayes, A. S. M., Badsha, S., Alqahtani, H., Watters, P., and Ng, A., 2020. Cybersecurity data science: an overview from machine learning perspective. In: *Journal of Big Data*, 7(1), pp. 1-29.
- Schmidt, B. M., Colvin, C. J., Hohlfeld, A., and Leon, N., 2020. Definitions, components, and processes of data harmonisation in healthcare: a scoping review. In: *BMC Medical Informatics and Decision Making*, 20(1), pp. 1-19.
- Schwalbe, N. and Wahl, B., 2020. Artificial intelligence and the future of global health. In: *The Lancet*, 395(10236), pp. 1579-1586.
- Sharma, K., Shah, J. and Karar, S., 2020. Qualitative Approach to Understanding Barriers to Delivering Difficult News in Sub Saharan Africa. In: *Open Access Journal of Surgery*, 12(1), p. 001.
- Simen-Kapeu, A., Reserva, M. E. and Ekpini, R. E., 2021. Galvanizing action on primary health care: analyzing bottlenecks and strategies to strengthen community health systems in West and Central Africa. In: *Global Health: Science and Practice*, 9(Supplement 1), pp. S47-S64.
- Sullivan, R., Pramesh, C. S., Booth, C. M., 2017 “Cancer patients need better care, not just more technology”, In: *Nature*, 549: 7672, available online at: <https://www.nature.com/news/cancer-patients-need-better-care-not-just-more-technology-1.22644> (accessed 11 February 2021)
- Sutherland, E., 2020. The fourth industrial revolution—The case of South Africa. In: *Politikon*, 47(2), pp. 233-252.
- Wennberg, J. E. 2011. Time to Tackle Unwarranted Variations in Practice, *BMJ*. 26 March 2011, Volume 342: d1513. For Access: <https://www.bmj.com/bmj/section-pdf/186247?path=/bmj/342/7799/Analysis.full.pdf>
- WHO/World Health Organization, 2019. *Global Spending on Health: A World in Transition*, Geneva, for download: https://www.who.int/health_financing/documents/health-expenditure-report-2019.pdf?ua=1 (accessed 24 March 2021).
- Wolmarans, M., Solomon, W., Tanna, G., Venter, J., Parsons, A., Chetty, M. and Dombo, M., 2014. eHealth Programme reference implementation in primary health care facilities. In: *South African health review*, 2014(1), pp. 35-43.
- You, K., Dal Bianco, S., and Amankwah-Amoah, J., 2020. Closing technological gaps to alleviate poverty: evidence from 17 sub-saharan african countries. In: *Technological Forecasting and Social Change*, volume 157, p. 120055.

A Possible Niche Application to Enhance the Uptake of Digital Twins in the South African Agriculture¹

J. Maritz², HMVE Combrink³, K. de Wet⁴

1 Introduction

Digital twin technology is changing the way in which research and development as well as monitoring and evaluation take place within entities and across various sectors of the economy, especially in agriculture. Digital twin technology refers to an augmentation of a physical process (or asset) in the digital domain via the sufficient recording of data that fully describes the process or object. The digital twinning paradigm implies a transformation of the most basic data from analogue (static, inaccurate, and most of the time non-recordable) to a digital form through the process of digitisation and acting in a systematic manner, to augment dimensions of value to the process or asset governed by the user (see Cimino/Negri/Fumagalli, 2019). Some of these value-adding processes relate to the ability to manipulate the digital twin and to alter properties within the digital twin before any “real-world” changes take place. This allows industry, farmers, and researchers to stress test concepts on digital platforms, rather than to model and to prototype something in a physical space. Digital twins are therefore used to reflect uncertainty in real-world scenarios and are used for specific purposes. The output of a digital twin is seen “within the context of dozens – or perhaps millions – of other data points and outputs” (Smith, 2020).

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Visual interfaces on any device will allow the end-user to see the information sought about the status of a specific enquiry; either the history of something, the predicted future, or the ability to manipulate systems remotely. Prediction is also a valuable possibility of digital twin usage by doing risk-free scenario testing on the digital twin, rather than on their physical counterpart. This opens the way for a further opportunity to explore resource management as a critical and needed component of these technologies.

There are strategic moves in South Africa that will strengthen the development of technologies and their application, as the 4IR technologies become even more ubiquitously practiced. South Africa is embracing the challenges posed by the 4IR, as can be witnessed by the emergence of the Presidential Commission on 4IR (PC4IR, 2019), and the concomitant strategies to include the country into these global technological advances⁵. According to this report, “4IR strategies place emphasis on leveraging and harnessing capabilities in the private sector to find scalable and profitable solutions that simultaneously unlock social and economic value. Most strategies, particularly those of emerging economies, make explicit reference to human capital development, both as it pertains to future labour force entrants and the requirement to reskill those transitioning into emerging jobs of the future” (PC4IR, 2019: page 2).

Digital Twinning is one such domain of the future that will require increasing investments in expertise. Digital twin technology is becoming an important paradigm in industry, and it was estimated that, by 2021, approximately half of large industrial companies will be making use of some form of digital twin technology, which would apparently lead to a 10% improvement in operational effectiveness (Petty, 2017).

Digital twinning works hand in hand with the growing industry of the Internet of Things (IoT) and with increases in the use of the latter, and especially the agriculture sector will lead to a growth of digital twin use cases. This means that market opportunities in both these spheres (physical and digital) will potentially have a synergistic effect on each other and create a host of new industry possibilities. However, for these initiatives to really take off and to grow in a context such as South Africa, we argue that they need to respond to a pressing need. We therefore propose the merging of the electric resource management digital twin with agricultural processes to create a niche application of digital twinning that will have the potential to serve as a basis for further investment, both nationally and internationally,

⁵ See: Presidential Commission on the 4th Industrial Revolution (PC4IR), published in Government Gazette No. 42388 on 9 April 2019, both long and short versions of the Report of the Presidential Commission on the 4th Industrial Revolution (PC4IR); for download: https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf

so that the digital twin industry can gain momentum in South Africa. The latter proposal will be anchored in the paradigm of soybean production in South Africa (specifically in the Free State), in a general way, by utilising the known key drivers of such a unique ecosystem (see section 2). The novelty of our proposal is in using the relatable and sensitive electrical driver as seed initiative towards the implementation of a full digital twin and the initial training thereof. The potential benefits, the investment opportunities as well as the challenges, will be explained to contextualise this emerging market in the South African context.

The text is structured as follows. After this Introduction in section 1 there is in section 2 a case study on the small-scale soya bean producer in the Free State of South Africa who can connect the soybeans production with digital twin technology via a seed initiative. Section 3 presents a review of emerging markets and opportunities created in the context of digital twinning technologies, while section 4 briefs on beneficial national and international investment opportunities resulting from the digital twinning technology. Section 5 is on conclusions and policy recommendations.

2 Case Study: Connecting the Soybeans Production in South Africa with Digital Twin Technology via a Seed initiative

The South African soybean value chain consists of suppliers, producers, aggregators and traders, processors, feed manufacturers, and meat industries (Dlamini, 2014). In 2014 the Free State province accounted for 12% of the national crop output, short of two other South African provinces, namely KwaZulu-Natal and Mpumalanga accounting for 21% and 43% respectively. Since 2014, the Free State province has increased its soybean production and it is considered as a critical province for emerging soybean production. To ensure that increased soybean production could take place, we suggest the introduction of the electricity twin (the entity resembling electric resource usage) given the fact that the South African power grid is under severe pressure and is driven by ongoing load shedding practices (in 2020, the total number of hours of load shedding amounted to 859) (see: Calitz/Wright, 2021). This paper focuses on producers (specifically the small-scale producers) of the soybean value chain, with an emphasis on the Free State province, which needs to fulfil this mandate under ongoing pressurized power grid constraints.

To put the main novelty and strategy of this essay into perspective – let us consider a hypothetical agricultural example in the form of a small-scale farmer who has a one-hectare (10,000 m²)-size soya bean crop and a small grazing area which is demarcated for livestock. In addition to this, the following permutations are in place:

- 1) The farmer does not only own the one-hectare-sized soya bean crop (the physical asset) but has also its digital twin of all key drivers. The digital twin characterises and records the ecosystem of information that represents all

the inner workings of the crop, with its environment and the reaction to external inputs; and

- 2) The farmer also owns the livestock and its digital footprint which contains critical information related to the ecology which is affecting the livestock – all of which are aimed toward improved yield and livestock sustainability.

Accessing and being in the position to optimally use the above-mentioned digital twins and transferring the data towards deeper insights and beneficial interventions relies on certain competencies, such as digital literacy, digital fluency, and operating as a digital citizen to overcome digital challenges (see Blijnaut, 2009)⁶.

Direct ownership of digital twins and of digital twin technologies are inherent upon the proprietorship of processes, of the asset or the living ecosystem (in the case of agriculture). This in turn is complicated by the process of “materialising” the full digital twin in a digital domain and could also be costly; it also requires domain-specific knowledge. Transferring the crop to the digital paradigm is also dependent on a certain level of familiarity with the soybean crop and its value chain. The utopian case described above, within the South African soybean producer context, is crippled by the following:

- 1) The lack of infrastructure that includes the digital paradigm,
- 2) The lack of a consistent electrical supply, and the
- 3) Unfamiliarity with the crop itself.

Therefore, the impact of existing energy resources (and the risk management thereof) could be considered as a key seed initiative (and impediment) in the South African context behind realising digital twins of assets and processes of complex agricultural systems (see Pylaniadis/Osinga/Athanasiadis, 2021).

To support this specific seed initiative, unidirectional causality does exist – running from energy consumption towards economic growth – that will be amplified for the most energy-intensive agriculture processes in South Africa, namely irrigation-driven production (see REEEP 2016, and references therein).⁷ This is evident in South Africa and in other developing countries such as India and Egypt (Adhegaonkar, 2015). The challenges associated with the key drivers linked to providing consistent energy resources will be introduced as possible opportunistic seed initiative to support digital twin implementation in the context of South African agriculture.

⁶ The essay on digitization of Education in this Unit 3 explains these notions in great detail. However, it does not fall within the ambit of this specific essay to expand on these concepts anew.

⁷ See on Renewable Energy and Energy Efficiency Partnership (REEEP), International Secretariat: Vienna, Austria: <https://www.reeep.org/>

Within the paradigm of digital electric resource management, the emphasis is placed on the monitoring/evaluation and quantifying the electric resource consumed by some process, ecosystem, or instrument (see Agostinelli/Cumo/Guidi/Tomazzoli, 2021)⁸. The digital electric resource management paradigm exists within and is amplified by a centralized supply system exhibiting unreliable electrical supply due to failing infrastructure, increasing operational costs and scheduled power outages/load shedding. Overcoming unreliable supply, via alternative energy resources, is capital-intensive and requires technical support with added long term maintenance obligations.

Connecting small-scale/prospective soybean producers to the digital paradigm will be solidified by firstly focusing on their ecosystem's electrical twin (as argued above), through which the needed initial skills will be obtained, and some digital infrastructure will be created. The fundamental building blocks and methodologies of digital twins have already been introduced, but the realisation of the system and the buffer layer between the physical system and the twin will be outlined in this section by showcasing the relatable case of electric resource management, which will serve to act as a precursor twin to similar agricultural twins. To further introduce the reader to the process of digital twinning in general, figure 1 outlines a stepwise twinning procedure of typical agricultural systems. Figure 1 represents digital twinning (and its value chain) in its most general structure.

As outlined in Figure 1, the soybean-related process (or electric consumer) is digitised by using remote Internet of Things (IoT) sensors and meters that can generate accurate, well-structured, and cyber-secure data recordings in near real time (resembled by transformation A in figure 1). When all the critical metrics are digitised that allow the operator to digitally reconstruct the physical process or the electric consumer, the digital twin starts to exist and to coincide, typically, with large volumes of time series data (and added metadata), and with no clear strategy or initial intervention being available so far. Complex twin data can be transferred to a DDSS⁹ by implementing two schemes (resembled by transformation B in figure 1):

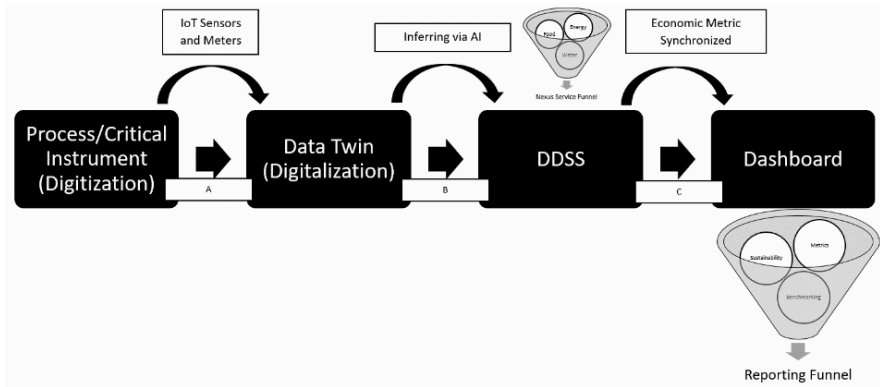
- 1) Inferring strategies, anomalies, models, and predictive capabilities using Artificial Intelligence-based schemes that focus on classification and prediction (see Rathore/Mazhar/Shah/Shukla/Bentafat/Bakiras, 2021); and
- 2) Performing in-loop simulations, which are “digital stress tests” and a form of scenario planning, using the availability of historic data, without

⁸ See Agostinelli et al. 2021 for download: https://econpapers.repec.org/article/gamjers/v_3a14_3ay_3a2021_3ai_3a8_3ap_3a2338-_3ad_3a539867.htm

⁹ Digital Decision Support System (DDSS): A digital system that enables evidence-based decisions based on inferences found in the data and displayed on digital platforms.

implementing input variations on physical counterparts (Dufour/Soghomonian/Zareh/Li, 2018).

Figure 1: Outlining the methodology of digital twinning and the entry-points of service levels with reporting service break-out points.



Source: Authors

When a DDSS is inferred or modelled, i. e. when it is generating the layer that contains structured data that could make sense to the user, certain process-sensitive metrics could be extracted and broadcasted to dashboards or real-time reporting break-out points. The DDSS serves as entry point for services (such as energy-, water- and food-related paradigms and professional consultations) to augment the structured data by using it as input to their predefined models. The dashboards serve as entry points for real-time reporting services that could relate to autonomous benchmarking within policies and frameworks across a variety of organisations (resembled by transformation C in figure 1). The underlying “data warehouse infrastructure” provides the baseline for information integration into other complex twins existing in the same organisation. Examples of such digital twins within the resource management paradigm (still part of the agricultural twinning process) are: Smart grids (twinning the

physical electrical networks¹⁰); Microgrids (twinning electrical networks that operate in a self-sufficient manner¹¹), and Digital Twins (of existing smart farms¹²). By shifting the initial focus towards only twinning the electrical consumption associated with the soybean producers, a niche application is generated that could serve as a “golden thread” to introduce the benefits of twinning to the soybean producers of South Africa, with the added inclusion of industry input existing in the food-water-energy nexus. This inclusion also provides the added benefit that optimal resource management of utilities in the agriculture-setting is at the fore. To fully realise the above-mentioned niche application of digital twins, the general case study portrayed earlier is used to showcase this specific niche. One of the critical electrical resource consumers when cultivating soybeans is irrigation – which evidently couples to production yield and sustainability . Creating a digital twin of the latter mentioned agricultural electrical consumer then generates figure 2 (below). Figure 2 is identical to figure 1, but the emphasis is on the key electrical resource consumer for soybean producers, that is, irrigation.

The digital twin illustrated in figure 2 is amplified and niched when considering the looming reality of an unreliable electrical resource that South Africa is currently facing. Since irrigation is mainly considered as a form of electrical resource consumption, digital twinning is beneficial and will ultimately:

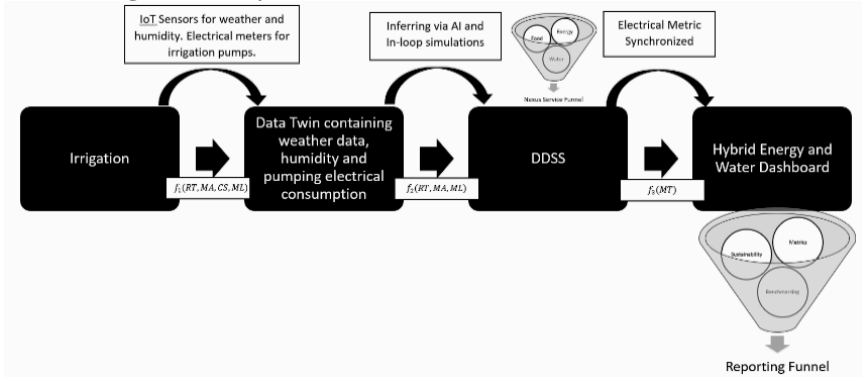
- 1) Identify actual dependence of irrigation on available electrical resources.
- 2) Identify usage patterns pertaining the increased or decreased yield.
- 3) Mitigate the risk of no-irrigation-events.
- 4) Enable scoping studies to include renewable energy sources.
- 5) Seamlessly connect unique DDSS to energy industry for consultation.
- 6) Enable scenario planning based on real-time data and possible schedules.
- 7) Enable reporting to synchronise with local markets, financial agreements, and with smart contracts.
- 8) Data twins could be shared with universities for engagement and training; and
- 9) Causality could be established across the entire food-energy-water nexus.

¹⁰ See Zhou/Hou/Ma, 2013; see for download: <https://www.proquest.com/docview/1442247201>

¹¹ See Gómez/Rodríguez/García/Tarisciotti/Flores-Bahamonde/Pereda/Nuñez/Cipriano/Salas, 2020; see for download: <https://ieeexplore.ieee.org/document/9229426./authors#authors>

¹² See Verdouw/Tekinerdogan/Beulens/Wolfert, 2021; see for download: https://econpapers.repec.org/article/eeeagisys/v_3a189_3ay_3a2021_3ai_3ac_3as0308521x20309070.htm

Figure 2: Outlining the methodology of digital twinning and the entry-points of service levels with reporting service break-out points, specifically for the case of irrigation in soya cultivation



Source: Authors

Up to this point, the novelty of the proposed strategy has been solidified. To reiterate, the twinning of the main electrical resource (irrigation) associated with soybean producers serves as a precursor to the full twinning of the entire soybean producer’s value chain. The benefits highlighted by the points 1- 9 above span initial introductions to digital twins, procurement of minimum infrastructure, and the ability to further connect to emerging markets and third-party experts. Moreover, such initial twinning practices could serve as open training platforms for other prospective soybean producers. The following box exhibits the executive summary of the novel strategy proposed by this paper:

Box: Digital Twinning and the soybean production of the Free State (an Executive Summary highlighting the benefits of the new strategy)

The Free State is becoming one of the most critical soybean producers and sets the scene for small-scale producers. Digital twinning of local soybean production will enable farmers to model, simulate, predict yields, and perform scenario planning in a non-intrusive manner based on the real-time data produced by the actual (physical) soybean ecosystem. The latter strategy leads to producing a virtual representation of the physical system that underpins all the elements, variables, and time-dependent dynamics of the physical ecosystem. Well-established twins of local successful soybean producers could be utilized for training programmes directed towards small-scale soybean producers in need of navigating the soybean ecosystem in a realistic manner so to gain trust and skills.

See on the huge role of soya beans production in the Free State:

<https://www.statista.com/statistics/1139019/soya-beans-production-in-south-africa-by-province/>, and the survey article by Dlamini et al., 2014: <https://www.ocl-journal.org/articles/oclj/pdf/2014/02/oclj130028.pdf>

Source: Authors

In the next section, the emerging markets and their related opportunities when using digital twins for agricultural development in South Africa will be outlined.

3 Emerging markets and opportunities related to the application of digital twins in South Africa's agriculture

This section assumes that the strategy introduced in section 2 was successful and that the soybean producer overcame some of the critical limitations associated with twinning their soybean production ecosystem. The emphasis of this section is on the opportunities that exist for the external entities in the service funnel and the reporting funnel (see figure 1 for the general twin and figure 2 for the electric consumer twin) within the limitations and niche applications that are generated by digital twinning within the South African soybean context. Existing soybean producer-oriented DDSS (whether from small scale farmers or mega farmers) are in need of real-time model-orientated inputs from well-established entities which are existing within the food-water-energy nexus. The need for real-time reporting extends beyond monitoring and evaluation, as real-time information systems also promote reactive problem-solving. Opportunities which are existing in the latter entry point could be:

- 1) Real-time interventions for minimum latency between data generation to actuation. This decrease in latency will allow for early warning systems and reactive system-based notification to all the relevant staff involved;
- 2) Predictive abilities that are enriched with levels of certainty. The predictive analytics could be performed on all levels and layers of the digital twin technology, allowing for a flexible and reliable augmentation of exploratory analytics in the value chain;
- 3) Data-driven case studies that are free of physical testing or process adjustments. These case studies can be replicated an infinite number of times providing a plethora of use cases directed at evidence-based decision making; and
- 4) Causality studies between digital energy counterparts towards the digital food-water counterpart. This specific opportunity is important in the South African context as utility management and resource distribution

are often turbulent and unreliable. Subsequently, being able to quantify the impact of resource distribution in the context of production yield, this will provide an even deeper use case to motivate for the subsequent transformation required to improve the food-water-energy nexus in South African agriculture.

There are further opportunities that exist in the real-time reporting break-out point (see figure 1 and figure 2):

- 1) Seamless integration between process status and policy frameworks, to allow stakeholders to act in time.
- 2) Transparent reporting to public entities.
- 3) Public showcase of sustainability metrics and environmental impact.
- 4) Benchmarking opportunities with similar entities.

What makes this emergent market exciting is the fact that digital twinning does not have to be overly sophisticated but could represent, as a starting point, only a partial representation of a real-world phenomenon, insofar as this representation is adequately depicted, realistic, and accurate. Digital twin technology opens the possibility *“for reasoning from the information content, bringing together the current state of affairs and the expected course of processes, while simultaneously aiming to predict future possibilities based on the information content. Digital twinning technology aims to present the right amount of data and information to the appropriate stakeholders to make the right decision at the right time.”*¹³

The potentials of digital twinning are underscored in four areas within agriculture for livestock management, arable farming, Indoor Farming, and Improving Sustainability)¹⁴:

- 1) Livestock Management: Herd management is a known application of digital twins by making use of sensors on or in livestock to be used at feeding and milking stations or elsewhere to generate continuous data.
- 2) Arable Farming: Digital twins have the capacity to convey the status of current soil, water, crop, and of other important characteristics in the arable land. This information could also lead to future forecasts of these characteristics to influence management actions to better outcomes.

¹³ See Slot, M./E. Lutters, 2021; for download: <https://www.sciencedirect.com/science/article/pii/S2212827121006168?via%3Dihub>

¹⁴ See Smith, M. (2020). For download: <https://agrimetrics.co.uk/2020/04/01/10-things-about-digital-twins-in-agriculture/>

- 3) Indoor Farming: This is a novel and promising prospect of the digital twin domain where growing conditions are fully controlled. This emerging environment would also be more conducive to a variety of analyses given the controlled context.
- 4) Improving Sustainability: Digital twin analyses could assist in measuring the natural capital of agricultural settings, and satellite data will be mostly used, together with sensors. Digital twins will enable the “*tracking of carbon, biodiversity, pollinator and water catchment services. It would tell us whether they are changing and, importantly, whether those changes are caused by us*”.¹⁵

A specific opportunity that is often overlooked relates to the training and up-skilling requirements within evaluation, auditing, and management structures to fully capitalise on the benefit from digital twin technology. A stark limiting factor of digital twin uptake are these factors and if they are not addressed, none of the digital twin systems will have any effect or meaning in terms of the core business structure. It is therefore important that investment opportunities should also fundamentally include the cultural and socio-political climates under which organisations in the South African context function. Any international investor that fails to comply with this imperative will fundamentally fall by the wayside and their efforts will largely become obsolete in the long run. Ultimately, although the technologies in question are metaphysical, the people responsible for the systems, the people who work to make the systems function, and the people intended to make the decisions are the primary custodians that will make the uptake of this technology successful. If this is not addressed, then none of the potential opportunities that arise with these technologies will mean anything (including any niche applications of digital twins).

To summarize the emerging markets and opportunities associated with the twinning of soybean producers (see figure 1 or figure 2), consider the following:

- 1) Nexus entry point – here the focus is on the real time data flow and modelling, with support provided by agricultural experts,
- 2) Reporting exit point – here the focus is towards accurately reporting findings to aid soybean sustainability, long term production strategies, and sector growth,

¹⁵ See Smith, M. (2020). For download: <https://agrimetrics.co.uk/2020/04/01/10-things-about-digital-twins-in-agriculture/>

- 3) Improving the uptake of digital twins will rely on showcasing and training via the aid of live soybean twins, specifically tailored for different South African provinces.

4 Beneficial national and international investment opportunities to make use of digital twinning technologies

Additional to the opportunities and emerging markets previously outlined, beneficial national and international investment opportunities exist for small-scale soybean producers (see table 1)

Table 1: General and soybean-specific investment opportunities

General investment opportunities	Specific investment opportunities to soybean producers
Comprehensive campaigns of agricultural digitisation of critical metrics (linked to the largest resource consumers) and digital literacy spanning these endeavours, from within the South African context.	Digitisation of existing successful soybean producers in the Free State, of which the digital twin could be used for further training and introduction of the seed initiative proposed in this paper. Furthermore, small-scale soybean producer's electrical twins need to be digitised with sufficient training as support.
Creation of predefined digital agricultural metric and technology bundles linked to specific agricultural sectors.	Generating a standard for deploying digital twinning technologies after the completion of the initial seed initiative, specifically for soybean producers.
The need for low power consumption Internet of Things (IoT) devices that enable to communicate over vast distances.	Initially when focussing on twinning the irrigation's electrical consumption of soybean producers, remote electrical meters and water flow meters need to be installed to realise the initial seed initiative (considered to be the path to full twinning).
The need for seamless communication networks that require digital infrastructure investments.	Connecting the small-scale soybean producers to its electrical twin and third-party inputs require local IoT networks and internet connectivity.
Digital training	Prospective soybean producers could gain familiarity with the crop by interrogating twins of existing soybean producers.

Source: Authors

General frameworks and policies exist for the intervention-based service funnels spanning the food-water-energy nexus and the reporting structures which are driving sustainability and benchmarking (see figure 1 and figure 2). However, clear, and more specific, frameworks and policies are needed for the initial digital twinning deployment. This is necessary with reference to the issue how a typical digital citizen/digital farmer (within South African agriculture) initiates such a strategy within existing structures (with emphasis on generating the data twin and capturing the correct accurate metrics), positions the DDSS to enable industry engagement, and transforms (or infers) the correct decision-driving metrics to enable maximum sustainability impact.

Currently, the greatest risk of digital twin development in agriculture, especially in a resource-constrained context such as South Africa (with very unequal access to resources, funding, and financing), is that the benefits are minimal given the costs associated with this technological development. In fact, digital twinning will happen where need and practicality, but also affordability converge. Also, some areas of agriculture will be easier to digitise than others. It has also been pointed out that local technology industries are competing with foreign founders that are much stronger contenders in the digital twin market (Pilling, 2019). Worst still, in the current context of the absence of significant research and development in Africa pertaining to artificial intelligence (AI) in general, the application of sophisticated technologies in Africa's use cases tends to come from contexts that do not represent the relevance and challenges of these specific environments (especially cultural and infrastructural realities).¹⁶

Valid questions therefore are posed as to the benefits of digital twins for agriculture as well as the characteristics that differentiate digital twins from established practices in a context such as the Free State province and the Global South as a whole (see: Pylidianis/Osinga/Athanasiadis, 2021). From the onset, those investing in digital twin technological advances must aim to obtain the highest value from digital twins by including fundamental digital ethics issues that will affect all the actors involved in this emerging industry.

A risk, albeit difficult to imagine at this early stage of digital twin deployment, is the possibility that farmers might *"become separated emotionally or intellectually from the real-world system. It is feared that this could lead to a failure to detect and respond to details that would have been seen in a reality check. Partic-*

¹⁶ See Oxford Insights & International Development Research Centre, 2019. For download: <https://www.oxfordinsights.com/ai-readiness2019>

ularly relevant for livestock farmers is the worry that over-focus on digital performance metrics could reduce empathy.”¹⁷ This latter concern is rather futuristic seeing that in many contexts, digital twinning is hardly utilised in agricultural applications, and discussion and evidence of their potential added value has not taken off extensively. Pettey (2017) argues that “*this will require the enterprise to think about the value of the data and its contributions to the business and partners, and also to identify potential areas where its customers or its own data could drive value but also could be at risk*”. Applying this digital twinning technology to the small-scale farming sector, such as in the Free State, needs a long-term strategy. Creating a critical mass for this technology can also transform this small-scale farming sector.

We therefore recommend that efforts and investments are concentrated towards the following realization plan for introducing digital twin technology to small-scale soybean producers:

- 1) Digitise (or twin) existing successful soybean producers in the Free State and get the involvement of experts, universities, and governments,
- 2) Use (1) above to train small-scale soybean producers and encourage prospective producers,
- 3) Train potential small-scale soybean producers on becoming digital farmers,
- 4) After (3), twin the electrical resource consumption of the prospective small-scale soybean producer and gain familiarity. All minimum digital infrastructure will be created during this critical point pertaining to the individual small-scale soybean producer,
- 5) Expand the twin to include the entire ecosystem and parts of value chain.

Investing in the sequence as stated above is strongly recommended due to its ability to overcome the initial technical issues associated with digital twinning, which relate to the creation of digital infrastructure and the minimum digital skills.

¹⁷ See: Smith, M. (2020). For download: <https://agrimetrics.co.uk/2020/04/01/10-things-about-digital-twins-in-agriculture/>

5 Conclusions and Policy Recommendations

Although the concept of digital twinning is simple and intuitive, it becomes increasingly complex when considering the ecosystem, or the process that needs to be digitised for the sake of usability through making insightful inferences. Depending on the indicator that needs to be reported on, or operationally modelled, the initial capital investment will increase. This is equally true for the South African agricultural sector that hosts a unique set of complex metrics and indicators across the entire value chain. To financially justify the deployment of digital twinning methodologies within smaller agricultural setups, emphasis is placed on the electrical metric that is a common thread indicator, ultimately posing a challenge to all sectors. The digital twin counterpart of the electrical consumption of the agricultural entity or process resembles the usage patterns and opportunities for increased efficiency and improved resource usage, of which reporting, and service levels could integrate with ease as an emerging market in South Africa. Investment opportunities emerge when considering digital twinning technologies within South African agricultural niche applications which are driven by an unreliable electrical resource. These opportunities exist in the preamble of digital twinning deployment for the largest resource consumers for specific metric-driven producers and not necessarily in the DDSS service or reporting funnels.

A critical initial injection is required to lay the foundations to create “digital agriculture citizens” and to promote “digital fluency”. The latter injection will generate cascading effects towards digital twinning uptake and system-wide deployment for the largest agriculture-electrical consumers. Synchronizing digital twinning deployment strategies, specifically within the context of South African agriculture, with the urgent need to improve the efficiency of electrical consumption and to secure uninterrupted supply, will inherently increase the uptake of digital twinning technologies, methodologies, and infrastructure. Mitigating the risks of unreliable electric supply remains the primary inception point of digital twinning technologies within the South African agricultural context and could, possibly, lead to a more natural inclusion and adoption of digital twinning methodologies, given the appropriate investments.

We therefore propose that all successful soybean producers are twinned and used as training platforms for province-specific small-scale or prospective soybean producers, after which their own main resource metric is twinned to ensure technology uptake and trust. The latter niche strategy will ensure that a critical mass is reached in digital infrastructure that will enable small-scale soybean producers to expand towards other parts of the value chain and to benefit fully from digital twinning. Several opportunities exist in the modelling and reporting of third-party entry points, with local and international investments needed in the actual twinning process, especially for digital infrastructure and training.

References

- Adhegaonkar, V., 2015. "Energy Consumption and Economic Growth in India: A Causality Analysis", in: *ANVESHAK-International Journal of Management*, (4. 51. 10.15410/aijm/2015/v4i2/67717).
- Agostinelli, S., Cumo, F., Guidi, G., Tomazzoli, C., 2021. "Cyber-Physical Systems Improving Building Energy Management: Digital Twin and Artificial Intelligence", in: *Energies*. (14. 2338. 10.3390/en14082338).
- Blignaut, P., 2009. A Bilateral Perspective on the Digital Divide in South Africa. In: *Perspectives on Global Development and Technology*. 8. Pages 581-601. 10.1163/156915009X12583611836091.
- Cimino, C., Negri, E., & Fumagalli, L., 2019. "Review of digital twin applications in manufacturing", In: *Computers in Industry* (113. 103130. 10.1016/j.com-pind.2019.103130).
- Dlamini, T. S./P. Tshabalala/T. Mutengwa, 2014, Soybeans production in South Africa, OCL (Oilseeds & fats Crops and Lipids) 2014, 21(2) D207; Research Article: Oil Crops and Supply Chain in Africa; access for download: <https://www.ocl-journal.org/articles/ocl/pdf/2014/02/ocl130028.pdf>
- Dufour, C., Soghomonian, D., Zareh, K., & Li, W., 2018. "Hardware-in-the-Loop Testing of Modern On-Board Power Systems Using Digital Twins". (118-123. 10.1109/SPEEDAM.2018.8445302).
- Gómez, J., Rodriguez, J., Garcia, C., Tarisciotti, L., Flores-Bahamonde, F., Pereda, J., Nuñez, F., Cipriano, A., Salas, J., 2020. "An Overview of Microgrids Challenges in the Mining Industry", *IEEE* (Access: Volume 8. DOI: 10.1109/AC-CESS.2020.3032281).
- Kazemi, N., 2013. "Energy input-output analysis for soybean production", In: *Elixir Agriculture online journal*, (56. 13246-13251).
- Oxford Insights, & International Development Research Centre (IDRC), 2019. *Government artificial intelligence readiness index 2019*. <https://www.oxfordinsights.com/ai-readiness2019>
- Pilling, D. (2019). Are tech companies Africa's new colonialists? *Financial Times*. For download: <https://www.ft.com/content/4625d9b8-9c16-11e9-b8ce-8b459ed04726>
- Presidential Commission on the 4th Industrial Revolution (PC4IR), 2019, published in Government Gazette No. 42388 on 9 April 2019, both long and short versions of the Report of the Presidential Commission on the 4th Industrial Revolution (PC4IR); for download: https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf
- Pylaniadis, C., Osinga, S., Athanasiadis, I., 2021. "Introducing digital twins to agriculture", In: *Computers and Electronics in Agriculture*, 184. 105942. 10.1016/j.com-pag.2020.105942.
- Rathore, M. M., Shah, S., Shukla, D., Bentafat, E., Bakiras, S., 2021. "The Role of AI, Machine Learning, and Big Data in Digital Twinning: A Systematic Literature Review, Challenges, and Opportunities", *IEEE Access*. PP(99): 1-1. 10.1109/AC-CESS.2021.3060863).

- REEEP, 2016). *SWITCH Africa Green: Sustainable Energy Consumption and Production (SECP) in Agriculture and Integrated Waste Management: Research and Training*. For Download: <https://www.reeep.org/sites/default/files/4470%20SWITCH%20AFRICA%20%20SANEDI%20REEEP%20RESEARCH%20REPORT%20FINAL%202016.pdf>
- Slot, M. & E. Lutters, 2021, "Digital twinning for purpose-driven information management in production", in: *Procedia CIRP*, Volume 100, pages 666-671. Access for Download: <https://creativecommons.org/licenses/by-nc-nd/4.0>
- Smith, M., 2020. "10 Things about Digital Twins in Agriculture", in: *Agrimetrics*, The Agrifood Data Market Place 2020/04/01 <https://agrimetrics.co.uk/2020/04/01/10-things-about-digital-twins-in-agriculture/>
- Verdouw, C., Tekinerdogan, B., Beulens, A., & Wolfert, S., 2021. "Digital twins in smart farming". *Agricultural Systems*, (189). 103046. 10.1016/j.agsy.2020.103046).
- Zhou, X., Hou, Z., Ma, Y., 2013. "An Overview of Smart Grid", in: *Applied Mechanics and Materials*, (339). Pages 550-553. Doi: 10.4028/www.scientific.net/AMM.339.550).

Unit 4: Book Reviews and Book Notes

A Guide for Readers of the Unit 4 on Book Reviews and Book Notes

By Samia Nour¹ and Karl Wohlmuth²

The books and documents which are reviewed and noted in this Unit 4 of Volume 23 are grouped into the following classification categories:

- 1 Global Development Reports
- 2 African Development Reports
- 3 Adoption of Digital Technologies in Africa
- 4 Digital Transformation and Entrepreneurship in Africa
- 5 Africa, Development Assistance, and the Global Race between USA and China
- 6 Africa, Digitalization, and the Sustainable Development Goals
- 7 African Studies

Because of the great importance of global development perspectives for Africa's economy, major *Global Development Reports* from OECD, UNDP, UNCTAD, World Bank, IMF, and from other international agencies are reviewed and noted (entry to category 1). As well, major *African Development Reports* from UNECA, African Development Bank (AfDB), and the African Union (AU) are discussed in book reviews and book notes, as they express the new strategies of development for Africa (entry to category 2). Some of these reports have also a focus on digital transformation.

Most of the books and documents reviewed in the Unit 4 are related to the specific theme of volume 23 (2022/2023) of the *African Development Perspectives Yearbook* with the title "*Business Opportunities, Start-ups and Digital Transformation in Africa*". Submissions of articles and publications for review were invited for relevant aspects of the digital transformation process in

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Africa, especially related to three issues: First, *the new business opportunities created by the digital transformation in Africa*. Second, *the impact of digital transformation on the foundation of start-ups and venture capital funds in Africa*. And third, *the long-term implications of the digital transformation for the development of productive sectors in Africa*. Reviews of books and reports are done in two classification categories, namely *Adoption of Digital Technologies in Africa* (entry to category 3) and *Digital Transformation and Entrepreneurship in Africa* (entry to category 4).

In this context we review also books and documents which relate to more specific aspects of the Global Digital Transformation Process for Africa. In two further classification categories we consider publications on *Africa, Development Assistance, and the Global Race between USA and China* (entry to category 5) and on *Africa, Digitalization, and the Sustainable Development Goals* (entry to category 6).

In the last classification category, we review books and reports on *African Studies* to present more general themes which have great importance for Africa's Development Perspectives (entry to category 7).

Because of the great interest in recent years on the aspects of Digital Transformation and Business Opportunities in Africa, the Unit 4 of volume 23 (2022/2023) has many entries (book reviews and book notes). It was possible to get support for this task from key researchers in Africa, but also from staff of UN organizations and from academic and independent researchers. This helped a lot in presenting the major reports and documents on global and African development issues and the new publications on digital transformation, business opportunities and entrepreneurship in Africa. So, we could offer interesting insights to the Global and the African readers of the *African Development Perspectives Yearbook*. Added to the full reviews and the bibliographic information are the links to the website where readers can download the full publication for further reading and for accessing more information, after having informed themselves about the substance of the books, documents and reports which were reviewed/noted in this Unit 4 of Volume 23.

As a unique feature of the *African Development Perspectives Yearbook*, major reports on Africa edited and authored by African institutions are reviewed carefully by teams of reviewers. As an example, the African Economic Outlook (now edited by the African Development Bank, in earlier times also edited by OECD, UNDP, UNECA, and AU) was reviewed in the African Development Perspectives Yearbook from the first issue in 2002 onwards to the issue for 2020. The *African Economic Outlook* project has its base in huge international and regional organizations (African Development Bank, OECD, United Nations Development Programme, African Union, and United Nations Economic Commission on Africa), while the *African Development Perspectives Yearbook* is based on the work of an NGO (the Research Group on African Development

Perspectives Bremen), which is affiliated to the University of Bremen in Bremen, Germany. It is now an Open Access publication.

Taken together, these two annual publications give a wealth of information on Africa. The *African Development Perspectives Yearbook* shares similar values with the *African Economic Outlook* – by informing on a specific theme and by relating the theme to the situation in African countries. While the *African Economic Outlook* has also a Country Notes section on all 54 African countries, the *African Development Perspectives Yearbook* discusses the selected theme for some cases of African countries. A major coincidence is the fact that the authors are in both publications mostly from African countries, but the key actors in the case of the *African Development Perspectives Yearbook* are authors from Africa who are presenting case studies, while the *African Economic Outlook* project is based on the work of African country teams recruited from strong international and regional organizations. It is of interest for readers to look at both publication series: the *African Development Perspectives Yearbook* (published since 1989) and the *African Economic Outlook* (published since 2002). But also, the *Economic Report on Africa* (by UNECA), the *African Development Report* (up to 2016 edited by the African Development Bank), the report *Africa's Development Dynamics* edited by the African Union and the OECD Development Centre, and UNCTAD's *Economic Development Report in Africa Report* were of interest for the Book Review and Book Notes Section of the African Development Perspectives Yearbook, as well as many other annual reports on Africa which are published by international and regional organizations.

The Entries by Classification of Books and Documents

1 Global Development Reports

The United Nations Development Programme (UNDP Special Report, 2022), “New threats to human security in the Anthropocene - Demanding greater solidarity”, by the United Nations Development Programme, New York, USA; Access for Download:

<https://hdr.undp.org/sites/default/files/srhs2022.pdf>, and about the relation to the Human Development Report 2021/2022:

<https://hdr.undp.org/en/towards-hdr-2022>

The preparation of this Special Report 2022 is part of the work which is leading to the 2021/2022 Human Development Report. The report indicates that, as the Covid-19 pandemic got under way, the world had been reaching unprecedented heights on the Human Development Index (HDI). People were, on average, living healthier, wealthier, more educated, and living better and longer than ever.

But under the surface a growing sense of insecurity had been taking root. The report indicates that an estimated six of every seven people across the world already felt insecure in the years leading up to the pandemic. And this feeling of insecurity was not only high—it had been growing in most countries with available data, including a surge in some countries with the highest HDI values.

The report argues that the Covid-19 pandemic has now affected everyone, imperilling every dimension of people's well-being and injecting an acute sense of fear across the globe. For the first time, indicators of human development have declined - drastically, unlike anything experienced in other recent global crises. The pandemic has infected and killed millions of people worldwide. It has upended the global economy, interrupted education dreams, delayed the administration of vaccines and medical treatment, and disrupted lives and livelihoods. In 2021, even with the availability of very unequally distributed Covid-19 vaccines, the economic recovery that started in many countries and the partial return to schools, the crisis deepened in health impacts, with a drop in life expectancy at birth. And the HDI, adjusted for Covid-19, had yet to recover about five years of progress, according to new simulations.

The report argues that the enormous shock of the Covid-19 pandemic has unmasked the fragility of progress, touching nearly everyone on the planet. This shows the compounded threats to human security that are superimposed on the unprecedented Anthropocene context. It shows that improving well-being achievements is not a sufficient condition for human security. The pandemic shows the inability of governments and of the international community to empower and to protect people around the world, especially the most vulnerable. Yet, the pandemic has also shown the actions to tackle the current challenges and to improve lives and well-being. Moreover, the pandemic has opened the doors to aggressive policy interventions, and many developing countries have implemented some sort of income support programme, which in turn has decelerated Covid-19 cases and deaths.

The report indicates that development approaches with a strong focus on economic growth and with much less attention devoted to equitable human development have produced stark and growing inequalities and a destabilizing and dangerous planetary change. Climate change and Covid-19 are interacting in causes, effects, and impacts. The 2020 Human Development Report has shown that no country has achieved a very high HDI value without contributing heavily to the pressures which were driving the dangerous planetary change. In addition to climate change and more frequent disease outbreaks that are linked to planetary pressures, the world confronted biodiversity losses and threats to key ecosystems, from tropical forests to the oceans. People's pursuit of development lead to new threats as a by-product of development: new health threats, increased food insecurity, and more frequent disasters, among many others. Recognizing

that development patterns drive human insecurity, it is required to revisit the human security concept and its implication for the Anthropocene.

The report argues that the 2030 Agenda for Sustainable Development and the agreed Sustainable Development Goals (SDGs) provide an ambitious set of multidimensional objectives that inform action at all levels and mobilize the international community. But efforts remain largely compartmentalized, dealing separately with climate change, biodiversity loss, conflicts, migration, refugees, pandemics, and data protection. Those efforts should be strengthened but tackling them in silos is insufficient in the Anthropocene context. The report argues that it is imperative to go beyond fragmented efforts, to reaffirm the principles of the UN founding documents - the Universal Declaration of Human Rights and the UN Charter - which are also the central ideas underpinning the concept of human security. The report highlights the close connection among security, development, and the protection and empowerment of individuals and communities; and it explores how the new generation of interacting threats, playing out in the Anthropocene context, affects human security and what to do about it.

As for the organization, the report includes two parts, Part I shows how the human security concept helps to identify blind spots when development is assessed simply by measuring achievements in well-being, and it suggests ways to enrich the human security frame to account for the unprecedented challenges of the Anthropocene context. Part II discusses four threats to human security that are superimposed on the Anthropocene context: the downsides of digital technology, violent conflict, horizontal inequalities, and evolving challenges to healthcare systems. The report argues that while the underlying challenge of each threat taken individually is not new, the threats are novel in the expression that they acquire in the Anthropocene context and their interlinked nature, which has been building over time. Part I of the report includes Chapter 1 that examines human security as a permanent and universal imperative and Chapter 2 that shows that the Anthropocene context is reshaping human security. Part II of the report includes Chapter 3 that discusses digital technology's threats to human security and included is Chapter 4 that discusses unearthing the human dimension of violent conflict. Also included are Chapter 5 which discusses inequalities and the assault on human dignity and Chapter 6 that discusses the healthcare systems outmatched by new human security challenges. And finally, the Conclusion suggests the need for greater solidarity and encourages a focus on human development with human security.

The Covid-19 pandemic makes these interconnections more apparent and unmask newly accumulating threats to human security. The uneven pain and the devastation have been widely documented. Women face the brunt of adaptations to remote work and the dramatic increase in violence against them. Informal workers are left outside the social protection systems. People living in urban

poverty are hit particularly hard by the health impacts and the economic consequences of the pandemic. Yet Covid-19 is only one manifestation of the new Anthropocene context. The Report includes novel work and estimates of the scale of the threats in the Anthropocene context.

The Report argues for expanding the human security frame in the face of the new generation of interconnected threats playing out in the context of the Anthropocene. It proposes adding solidarity to the human security strategies of protection and empowerment. Solidarity recognizes that human security in the Anthropocene must go beyond securing individuals and their communities to move for institutions and policies to systematically consider the interdependence across all people and between people and the planet. The report argues that protection, empowerment, and solidarity when working together will be the key that advances human security in the Anthropocene.

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World Bank Group, 2021, World Development Report 2021- Data For Better Lives, 349 pages, Washington D. C.: IBRD/The World Bank;

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<https://openknowledge.worldbank.org/bitstream/handle/10986/35218/9781464816000.pdf>

This report is about the data revolution which is transforming the world. The untapped data resources can be used in productive ways. The value of data is of great importance, as data can be used for various purposes to generate economic and social value. Data can be used far beyond the sphere for which the data were collected, especially so in our time of collecting big data and using methods for rapid data processing. The use of data is confronted significant barriers for applications, such as lack of trust, misaligned incentives, and incompatible data systems. The data can be used for reducing poverty and for increasing the livelihood of the people at global scale, but data collection and processing can also harm people in our fragmented world, being affected by mistrust, conflicts, nationalism, and extremism, and by so many other bad ills and situations. The helpful and the harmful potential of the data needs attention by development research and development policy. A new social contract is requested in the report to balance the helpful and the harmful effects of data use. Such a social contract requires that an equitable access for using and reusing data is ensured; then it is possible to get economic and social value out of them. But trust among all

partners, a requirement for equitable access, is not easy to reach. Some problems are made how it can be achieved.

The report outlines how both, public and private sectors could benefit from such a data revolution. The design of public policies and the delivery of services by public agencies can be improved. As well, private sectors could benefit when the data revolution improves market efficiency and job creation. The report is illustrating how better data governance can help to increase value creation; it shows what this requires for data infrastructure and data institutions. Sharing the benefits from the data revolution requires that data governance is improved quickly. It is also considered in a final chapter how integrated national data systems could work for the benefit of low income and poor people.

The report has an Overview to summarise the main messages. In Part I on Advancing Development Objectives through Data there is a chapter 1 on harnessing the value of data for the poor, while chapter 2 is on data as a force of public good; chapter 3 is on data as a resource for the private sector, and chapter 4 is on creative reuses of data for greater value. Part II is on Aligning Data Governance with the Social Contract. Chapter 5 is on data infrastructure policy, as an equitable access for the benefit of the poor people is dependent on such infrastructure changes; chapter 6 is on data policies, laws, and regulations, by building a trust environment; chapter 7 is on creating value in the data economy through competition, trade, and tax policy; and chapter 8 is on institutions for data governance, to build trust through collective action. The final Part III is on Moving towards an Integrated National Data System. Chapter 9 is therefore on ways of creating an integrated national data system. The structure of the report is related to the ambition to use the data revolution for digital transformation.

The report is very useful, as data governance is enormously important in our time of digital transformation. This is a global report, and so reports on the data revolution in Africa as a region need to complement the findings, by addressing the role of the African Continental Free Trade Area (AfCFTA) to transform Africa as a region of harmonized data governance. It may be true that the experiences of COVID-19 with digitization will help Africa to develop integrated national and regional data systems. The war between Russia and Ukraine is however an event that may affect negatively all such expectations at the global level, as trust is destroyed for decades. There will be spill-over effects to Africa, leading to new tensions, conflicts, rivalries, pressures from and for markets, new fiscal space problems, etc. The war came unexpected, and so what has happened in Europe could also happen in Asia and in Latin America; the balancing and rebalancing of power between USA/Europe and China/Russia will not be an easy task. This process will be accompanied by severe consequences for energy, food, and weapons markets. The effects of the war in Europe on the poor in the world and especially on Africa will be so huge that we need to

rethink first the global security order. The UN Security Council will need a reform so that a global data governance architecture can become a reality.

The data revolution in times of increasing global uncertainty may reemphasize the threat potential of data use and data processing. The report is of some value, but it is not clear how an environment of trust can be established; this is the weak part of the report so that further inputs are requested to fill the gaps.

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United Nations Conference on Trade and Development (UNCTAD), The Least Developed Countries Report 2021, The least developed countries in the post-COVID world: Learning from 50 years of experience, United Nations Publications, 300 East 42nd Street, New York, New York 10017, United States of America, 180 pages. ISBN: 978-92-1-113006-5/eISBN: 978-92-1-005605-2/ISSN: 0257-7550/eISSN: 2225-1723/Sales No. E.21.II.D.4/UNCTAD/LDC/2021. Access for Download: https://unctad.org/system/files/official-document/ldc2021_en.pdf

The United Nations Conference on Trade and Development (UNCTAD) publishes annually the Least Developed Countries Report. The report for 2021 focusses on the least developed countries (LDCs) in the post-COVID world; it also refers to the learning processes for the LDCs from 50 years of experience. The report argues that the outlook for LDCs is grim: mired in the health, economic, and social crises brought about by the COVID-19 pandemic; in 2020 they recorded their worst growth performance in about three decades. More broadly, these crises have reversed the progress that had been painstakingly achieved on several dimensions of development, notably on the fronts of poverty, hunger, education, and health. Reversing these gains will have lingering adverse consequences on the development of LDCs over the mid-term.

The report argues that although development progress has been made over the past 50 years, core challenges have persisted and have become more complex and urgent. However, progress on some fronts has been disappointing, including with respect to the slow development of productive capacities and the ensuing scant progress in growth-enhancing structural economic transformation; the persistence of several symptoms of underdevelopment, such as low levels of labour productivity, high poverty rates, low levels of human capital formation, and persistent under-performance in human well-being; a lingering vulnerability to external shocks and limited resilience due to restricted resources and policy space, and weak institutional development. In addition to a widening income and development gap between most LDCs and other developing countries (ODCs), and the small number of countries to have graduated from the LDC category up to now (2020) – in the 26 years since 1994, only six countries have graduated out

of a total of 53 countries to have ever formed part of the LDC category. The report indicates that it is important to identify successful experiences, and to investigate what policies have contributed to their achievement. It is also important to interrogate the development policies pursued by the LDCs to discover where they have been lacking, and to take lessons from the past experiences of LDCs to formulate innovative proposals for the future.

The report indicates that the COVID-19 crisis has dramatically highlighted the institutional, economic, and social shortcomings of the development path followed by most LDCs. Although the COVID-19 pandemic has affected all countries, the impact on LDCs has been particularly severe because of their limited resilience and the diminished capacity to react to the COVID-19 shock and its aftermath. Also, the pandemic emerged at a time when development progress was already slow and unsatisfactory. Their low resilience is reflected in the extremely low COVID vaccination rates that LDCs have achieved and to recognize that, as of mid-2021, only 2 per cent of the population have been vaccinated, as compared to 41 per cent in developed countries. Many LDCs risk being left behind as the economies of ODCs and developed countries to recover from the COVID-19 pandemic; they may spend the coming years recovering from it and may eventually achieve little real progress on the Sustainable Development Goals (SDGs) during the 2020s. The present situation is therefore exceptional and requires decisive action by both the international community and the LDCs themselves to counter the risks of hysteresis and a lost decade.

Regarding the structure, this report includes five chapters, structured as follows. Chapter 1 provides an overview of 50 years of the LDC category; Chapter 2 explains the achievements of 50 years in terms of growth, transformation, and sustainability; Chapter 3 undertakes to evaluate past and present strategies for furthering development; Chapter 4 discusses estimating the cost of achieving sustainable development goals (SDGs) in the LDCs during the post-pandemic decade; and Chapter 5 focuses on lessons learnt and future development trajectories.

Chapter 1 shows the objectives of the report, it provides an overview of 50 years of the LDC category, and it shows the landmark in LDC history, the origin of the LDC category, the evolution of the LDC category, the present critical juncture, and the main development challenges that led to the establishment of the LDC category 50 years ago.

Chapter 2 shows the achievements of 50 years in terms of growth, transformation and sustainability; it provides a bird's eye view on the long-term performance of LDCs, on medium-term considerations and on boom-and-bust cycles, but also looking at the patterns of growth (the structural dynamics, the inclusivity, and the sustainability transformation) when such issues are placed at the centre of development planning and policymaking. The chapter also refers to the largely insufficient level of resources (financial, institutional) which are

made available to reach the desired development goals; the weak alignment between the priorities of development partners and those of national authorities, which fails to create synergies between the interventions and policies of these actors. The chapter 2 analyses the growth performance of the LDCs over the past 50 years and examines, among others, episodes of growth acceleration and deceleration in LDCs, the convergence or divergence of these countries in relation to higher income country groups, progress made in structural economic transformation, as well as the broader LDC achievements in the social dimensions of sustainable development. This chapter indicates that the past 50 years of experience of the LDC development trajectory have highlighted the struggle of these countries to achieve sustainable development, as evidenced by their erratic growth trajectory over this period, but also by their widening income gap vis-a-vis other developing countries (ODCs). These reviews of the past reflect the failure of most of these countries to decisively advance in their structural economic transformation. As shown by Chapter 2, the LDCs as a group have realized significant improvements in GDP growth over the past 50 years of the existence of the category of LDCs; however, consistent progress across the multiple dimensions of development has been elusive.

Chapter 3 evaluates past and present strategies for furthering development, including the multilateral strategies for furthering development in LDCs and the national strategies for furthering development; presented are also national case studies, and reviews of the policies that have underpinned LDC performance over the past 50 years. The chapter presents the successive multilateral initiatives undertaken by the international community to accelerate development in these countries, as well as the domestic policies that LDCs are putting in place to further their sustainable development. The chapter concludes with an account of successful development experiences of two LDCs – Bangladesh and Senegal – and the contrasting routes and policies they have chosen to respond to similar problems of underdevelopment, and the clear strides they have made towards sustainable development. Chapter 3 shows the combination of these outcomes, explains the disappointing results in the graduation record from the LDC category, including the failure to meet the graduation target which is part of the Istanbul Programme of Action (IPoA). As the policy efforts put in place by the international community and by national authorities during the past half century have progressively become more focused and specific, some hopes may be there for future developments of the LDCs in terms of graduation, at least for a selected group of countries.

Chapter 4 presents a costing of the investments and the spending required for LDCs to reach the most critical SDGs. By focusing on different targets, it provides a picture of the very substantial amounts of financial resources which will need to be mobilized to meet some critical targets of the 2030 Agenda for Sustainable Development. The chapter explains the way of estimating the cost of

achieving the Sustainable Development Goals (SDGs) in the LDCs during the post-pandemic decade, referring to the methodology and the data. The LDCs' financial needs to achieve selected Sustainable Development Goals (SDGs) are huge and expanding the sources of financing to reach the targets is therefore of great importance. The report also explains the challenges for the next decade of development in LDCs. The report argues that the sustainability and resilience of development outcomes in LDCs remains markedly fragile, with most of the development goals and targets set during 40 years of LDC programmes of action not fully achieved. This long period of policy efforts and the progression in policymaking have been insufficient to reverse the disappointing outcomes alluded to above. This has been mainly due to a combination of factors, including the biased growth and development model, which – especially since the 1980s – has been largely focused on exports and foreign demand, while overlooking the domestic side of the economy. Weak domestic demand, due to low average incomes and high levels of poverty, brought only insufficient stimulus to domestic supply; thereby the development model failed to create a dynamic supply-demand virtuous circle. And weak domestic input-output linkages (partly deriving from the shortcomings mentioned above) failed to create dense interactions among companies (whether domestic or international, public or private, small or large), sectors, industries, and different areas of the countries (e. g. rural and urban). A majority of LDCs which is heading into the new decade, being significantly below full strength, fails to stimulate the development of productive capacities, not placing structural impediments to sustainable development (such as the low level of productive capacities and insufficient investment) at the top of the list of priorities and of the ensuing action programmes. These results clearly indicate that the ambition levels among the international community and among the domestic authorities need to be raised. When looking forward, the estimates presented in this report – despite of the uncertainties surrounding precise figures and the caveats expressed in the chapter – clearly show that LDCs face enormous investment and spending requirements to reach the Sustainable Development Goals (SDGs). Critically, these requirements by far exceed the amounts and the modalities of financing which are presently available to these countries.

Chapter 5 focuses on the lessons learnt to future development trajectories; The chapter presents a broad vision for the next decade of development processes and development policies for LDCs. It highlights the main challenges that these countries will face and shows the interest of the international community in supporting the development of LDCs. This chapter explains the challenges for the next decade of development in LDCs, the global community's interest in LDC development and the support for it, the new Programme of Action, including the national measures, the new priority actions for consideration, and the new generation of international support measures. The

new Programme of Action will have to focus more than so far on the structural transformation through the development of productive capacities, on green growth strategies, and will need to recall the urgency to build forward and to transform. The national measures will include new priority actions for strengthening the state capacity and the agency, expanding the local enterprise base, and adopting a more strategic approach to human capital and labour policies. This chapter outlines novel policies to address the myriad of challenges which are facing the LDCs. The chapter suggests priorities for domestic policies, calls for a new generation of international support measures (ISMs) in favour of LDCs, and discusses the principles guiding the formulation of these new ISMs to graduation. The report recommends a new generation of international support measures (ISMs), advocating principles to guide the new generation of ISMs, such as for trade, external financing for development, and technology transfer. The LDC report for 2016 has revealed a strategy for graduation by looking at appropriate ISMs.³

The report for 2021 is a useful review of 50 years of the LDC category, but it is not clear if a new strategy will follow. The concept of the “productive capacities” is still too vague, as is the idea of a “graduation” from the status of an LDC. It may be that such reports are more important for keeping the UNCTAD alive than for the LDCs in their struggle for a new development path.

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Government of United Arab Emirates (UAE) and United Nations (UN) at the Commemoration of the United Nations’ 75th Anniversary, Future Possibilities Report 2020, 70 pages, Published: © 2020 Centennial Lab, Ministry of Cabinet Affairs and the Future, UAE, P. O. Box 21200, Dubai, United Arab Emirates/UAE, ISBN 978-1-64970-314-9; access for download: https://www.un.org/sites/un2.un.org/files/20200720_un75_uae_futurepossibilitiesreport.pdf

The Future Possibilities Report 2020 aims to contribute to the current debate by exploring how countries can leverage global trends for economic growth as well as for human and sustainable development and harness the potential of the Fourth Industrial Revolution (4IR). The Future Possibilities Report 2020 is based on extensive research into the factors that shape a country’s capacity to seize the opportunities that emerge from transformational trends, and it provides a new conceptual framework for national development. The Report elaborates a practical and positive approach for businesses and countries to leverage

³ See the chapter 3 of the LDCs report 2016: https://unctad.org/system/files/official-document/ldc2016_ch3_en.pdf

possibilities which are associated with ongoing global transformations, many of which will be accelerated by the COVID 19 crisis. By exploring the findings of the Report, governments and businesses can identify areas that offer potential, as well as reflecting on issues on which they need to collaborate to build capacity.

The Future Possibilities Report 2020 provides a positive opportunity-focused approach for achieving systemic change, with a view to providing tools for all nations to shift their focus to the future; it focuses on opportunities that achieve the twin objective of financial returns while contributing to human and sustainable development. The relevance of the Report is demonstrated from the fact that it is useful for the governments; the governments can use it to define a vision that commands wide societal support, to select which trends to focus on, and to develop and to implement then concrete action plans. The Report is useful for businesses, as business can use the Report to inform investment decisions, to identify other stakeholders to work with, to engage with governments, and to advocate for transformational public policies.

The Report indicates that the COVID-19 crisis has laid bare the fault lines and has exacerbated many negative megatrends, widening the divide between rich and poor countries, between haves and have-nots, between those who have access to work, healthcare, education, or digital technologies and those who have not. Now more than ever, the world's people need a functioning and effective international machinery that produces innovative solutions to these global trends, ensuring a "build back better" (BBB) framework⁴ and securing a viable future for the next generations. The Future Possibilities Report 2020 lays out a powerful and important set of policy initiatives for "building back better" after the COVID-19 pandemic.

The Future Possibilities 2020 Report sets out to explain how countries can leverage them to reset their economies in the post-COVID world by identifying six transformational trends that are creating possibilities, and by concentrating on the factors that explain a country's capacity to take advantage of those possibilities for the benefit of society. The Report envisages encouraging governments, businesses, and societal stakeholders to think differently about development. By providing a practical approach, the report can help them to identify the trends to prioritise and to work together to create ecosystems that will support the development of new business models, products, and services. It will also support the process of rebuilding society in engaging with a positive, possibilities-focused future perspective.

The COVID crisis of 2020 has made it obvious that it is no longer enough for government policies to aim to boost the productivity of the whole economy. The link between productivity and economic growth is weakening and, in many

⁴ See on the BBB framework: <https://www.whitehouse.gov/build-back-better/>

countries, growth is becoming less of a priority relative to issues such as climate change and income inequality. More importantly, the COVID pandemic has highlighted that efficiency can stand in the way of resilience which is needed for human security. Countries instead need to identify a goal - whether improved health or food security, better connectivity, or greater use of renewable energy sources - and to define transformational public policies that create conditions for businesses to innovate and to lead globally in finding solutions.

The Report indicates that the COVID 19 crisis has laid bare many shortcomings of our current economic models that are focused on efficiency and financial returns. The Report substantiates the need for systemic change to ensure better outcomes for society and human well-being. However, models that spell out practically how such systemic change can be achieved at the country level are scarce. The Future Possibilities Report 2020 offers a practical approach for countries to achieve growth and systemic change by leveraging possibilities offered by transformational trends. In the same way that businesses leverage market trends, the countries' long-term success depends on their capacity to strategically leverage transformational global trends. Those megatrends - such as the advancement of technologies, the transition to low carbon economies, the focus on sustainability or smarter use of resources - are transforming industries, economies, and societies and give rise to countless possibilities for improved growth and societal well-being. By leveraging these trends, countries can improve their economic as well as their societal outcomes. According to the Report there are many examples of countries and cities that have leveraged global transformations to alter their development path. China's 1980s reforms enabled it to ride the wave of globalisation. Liberalisation of financial markets made London a global hub. India and the US seized early the opportunities created by the emergence of the Internet.

The Report indicates that realising possibilities associated with global trends could accelerate progress at scale, but only if the right conditions are in place. Government policymakers and business leaders can build capacity to leverage trends by recognising them, investing in them, and putting in place transformation policies that enable all actors in their societies to take advantage of the possibilities they present. By highlighting the potential to capitalise on new growth possibilities, the Report aims to improve the understanding of what elements of transformational policies the countries need to put in place and how to create the necessary capacity to leverage trends. It aims to shift the global conversation from a risk-based view of transformational trends towards a positive, possibility-focused perspective that recognises global megatrends as an engine for advancing socioeconomic development. This perspective is particularly important when people think about the post-COVID world.

The organization of the report includes three parts. In Part 1, the report explains why countries have been moving away from traditional economic

policies that target GDP growth and assume trickle-down effects, to focus on a wider range of social and environmental objectives. In Part 2, the report discusses how the six transformational trends drive possibilities. In Part 3, the report analyses how governments and businesses can use the framework to drive change. Finally, Part 4 of the report provides the conclusions. Key is the framework of the six global transformations in Part 2: The Exabyte Economy (Hyperconnected Devices, Data, and People); the Well-being Economy (Redefining Health); the Net Zero Economy (Scalable low carbon solutions); the Circular Economy (Waste not, want not); the Bio Growth Economy (New agriculture and biomaterials); the Experience Economy (From ownership to usership).

The Report analyses how countries can leverage the possibilities emerging from these six transformational trends for their future economic growth and societal wellbeing. The trends were selected because of their systemic and global nature and because they are expected to generate significant possibilities in a wide range of sectors over the next 5-10 years. The six transformational trends presented in the Future Possibilities Report 2020 emerge from a combination of new business models, advanced technologies, and changes in attitudes and behaviours. They are based on a set of cross-cutting structural trends: ageing populations, the reengineering of urban life, rising global mobility, the influence of younger generations, changing global trade patterns, diversifying investment flows, the expanding middle class in emerging economies, and growing interest in measures of progress other than GDP growth.

The Report argues that the transformational policies to drive change and to help countries to make these possibilities happen need core capacities. The core capacities are government visions to develop and to implement a long-term strategy providing strong directionality to align the efforts of diverse stakeholders. In addition to advanced technology to enable new ideas to be developed and adapted, particularly solid ICT infrastructure and widespread digital skills are needed. In addition to innovation which includes both R&D and entrepreneurship, investments in basic and applied science in research institutions, and a culture of creativity are requested. To increase the pool of talent, it is necessary to enable labour market transitions to be navigated, by including the installation of measures to attract and to mobilize outside talent, and by supporting education that develops soft skills. Beside of all this, improving business friendliness, in the shape of rule of law, absence of corruption, minimal red tape, access to finance, trust, and social capital, is part of the package of measures to implement future possibilities. In addition to market dynamics that drives investment, with a larger market size creating scope for economies of scale, the outcomes of improving efficiency and deploying new solutions can help to secure the future possibilities.

The Report is interesting as capturing six megatrends and making them relevant for policymakers. That the Report is appearing in 2020 at the occasion of 75 years of the United Nations signals that the smaller emerging countries look carefully at the role of this world organization.

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UNDP/United Nations Development Programme, Human Development Report 2020, The next frontier - Human development and the Anthropocene, Copyright 2020, by the United Nations Development Programme, 30th Anniversary 2020 Human Development Report UN Plaza, New York, NY 10017, ISBN: 978-92-1-126442-5/eISBN: 978-92-1-005516-1/Print ISSN: 0969-4501/eISSN: 2412-3129, 412 pages, free access for download: <https://hdr.undp.org/sites/default/files/hdr2020.pdf>

The Human Development Report 2020 with the title “The next frontier - Human development and the Anthropocene⁵” is the 30th Anniversary Human Development Report and is the latest in the series of global Human Development Reports. The Human Development Report is published by the United Nations Development Programme (UNDP) since 1990 as an independent publication and presents analytically and empirically grounded discussions of major development issues, trends, and policies. The report indicates that every person, everywhere in the world, has been affected by the Covid-19 pandemic. Amidst untold suffering the process of producing a Human Development Report often appeared less urgent over the course of 2020, but it was then decided to tell the huge extent of the pandemic crisis for human development. The Report attempts to document the unfolding and devastating impact of the pandemic on human development, supporting UNDP’s response to the crisis. The Report aims to provide an important contribution by discussing the COVID-19 pandemic and by honouring 30 years of Human Development Reports. The report indicates that thirty years ago, UNDP had created a new way to conceive and to measure progress. Instead of using growth in GDP as the sole measure of development, the world’s countries are ranked by their human development: it was measured whether people in each country have the freedom and the opportunity to live the lives they value.

The structure of the report is organized in three parts and seven chapters, organized as follows, Part I focuses on renewing human development for the Anthropocene, and it includes Chapters 1 - 3. Chapter 1 discusses charting

⁵ The Anthropocene is (according to Wikipedia) a proposed geological epoch dating from the commencement of significant human impact on Earth’s geology and ecosystems, with anthropogenic climate change as an expression of this human impact.

human development in the Anthropocene, Chapter 2 shows the scope, the scale, and the speed of human pressures on the planet. Chapter 3 focuses on empowering people for equity, innovation, and stewardship of nature. Part II focuses on acting for change, it includes chapters 4 - 6, Chapter 4 focuses on empowering people, unleashing transformation, Chapter 5 discusses shaping incentives to navigate the future, Chapter 6 focuses on building nature-based human development. Part III investigates measuring human development and the Anthropocene, and it includes Chapter 7 that focuses on the way towards a new generation of human development metrics for the Anthropocene.

The Human Development Report (HDR) 2020 discusses the belief that people's agency and empowerment can bring about the action the world needs so that the people can live in balance with the planet in a fairer world. It is emphasized that the people are at an unprecedented moment in history, in which human activity has become a dominant force shaping the planet. These impacts interact with existing inequalities, threatening significant development reversals. The report indicates that nothing short of a great transformation is needed, and the report explores how to jumpstart that transformation. The Human Development Report (HDR) 2020 explains the climate crisis, the biodiversity collapse, and the ocean acidification. The report also gives evidence from scientists all over the world that, instead of a planet shaping humans, humans are knowingly shaping the planet. The Human Development Report (HDR) 2020 gives evidence that too much went wrong: humanity has achieved incredible progress, and the people have taken the Earth for granted, thereby destabilizing the very systems upon which the people rely for survival. Covid-19, which almost certainly sprang over to humans from animals, offers a glimpse of the people's future, in which the strain on the planet mirrors the strain facing societies. It took Covid-19 very little time to expose and to exploit overlapping inequalities, as well as weaknesses in social, economic, and political systems, and to threaten the positive reversals in human development.

The Human Development Report (HDR) 2020 also indicates that while the devastating effects of Covid-19 have taken the world's attention, other layered crises, from climate change to rising inequalities, continue to take their toll. The challenges of planetary and societal imbalance are intertwined: they interact in a vicious circle, each making the other worse. The Human Development Report (HDR) 2020 is striving to continue its work on measuring and interpreting changes on human development while easing planetary pressures, as these pressures affect more and more the human development perspectives. The report argues that the strain on the planet mirrors the strain facing many societies. Indeed, the planetary and the social imbalances reinforce one another. As the Human Development Report 2019 with the title "Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century" made clear, many inequalities in human development continue to increase.

Climate change, among other dangerous planetary changes, will only make them worse. The Human Development Report (HDR) 2020 indicates that the world may be entering a new geologic age called the Anthropocene in which humans are a dominant force shaping the planet's future. That future is already taking a frightening shape in many ways, from climate change to plunging biodiversity and to the epidemic of plastics in world oceans. The Human Development Report (HDR) 2020 argues that the Covid-19 pandemic may be the latest harrowing consequence of the imbalances which are threatening the human lives on the planet. Scientists have long warned that unfamiliar pathogens will emerge more frequently from interactions among humans, livestock, and wildlife, squeezing ecosystems so hard that deadly viruses spill out. The report indicates that collective action on these crises from the Covid-19 pandemic to climate change becomes more difficult against a backdrop of social fragmentation.

The report indicates that consciously or not, human choices, shaped by values and institutions, have given rise to the interconnected planetary and social imbalances the world people face. The report shows that the world's people have different choices, but they need to decide. They have the power to embark on bold new development paths that allow for the continuing expansion of human freedoms in balance with the planet. If they decide not in this direction, they will lose such freedoms very quickly. The report indicates that the concept of human development (and of the human development reports) is celebrating its 30th anniversary this year, and this is an opportunity to contribute to the complex predicaments that this new anthropogenic age poses to the world people. And that is the central message of this year's global Human Development Report. Human development is not just possible in the context of easing planetary pressures; it is instrumental to doing so. The report calls for a just transformation that expands human freedoms while easing planetary pressures. For people to thrive in the Anthropocene, new development trajectories must do three things: enhance equity, foster innovation, and instil a sense of stewardship of the planet. These outcomes matter for the world's people to secure their future on the planet. All countries have a stake in this protection work. The Human Development Report (HDR) 2020 organizes its recommendations around mechanisms for change: social norms and values, incentives and regulation, and nature-based human development. Each mechanism of change specifies multiple potential roles for the world's people, for governments, for firms and for political and civil society leaders to act pro-actively.

The Human Development Report (HDR) 2020 goes on to explore new metrics for a new age. Among them is a planetary pressures-adjusted Human Development Index, which adjusts the standard Human Development Index (HDI) by a country's per capita carbon dioxide emissions and by the material footprint. The Report also introduces a next generation of dashboards, as well as metrics that adjust the HDI to account for the social costs of carbon dioxide

emissions and/or for changes of natural wealth. The report suggests that policies are needed to ensure that all people flourish while easing planetary pressures. The Human Development Report 2020 gives a signpost for this way.

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International Labour Organization (ILO) (2021), World Social Protection Report 2020–22: Social protection at the crossroads – in pursuit of a better future”, ILO Flagship Report, International Labour Office: Geneva: ILO, 2021. 318 pages. ISBN 978-92-2-031949-9 (print)/ISBN 978-92-2-031950-5 (web PDF); access for download: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_817572.pdf

The International Labour Organization (ILO) has published in 2021 its flagship report “World Social Protection Report 2020–22: Social protection at the crossroads – in pursuit of a better future”. It discusses social protection considering the impact of the COVID-19 pandemic. This ILO flagship report provides a global overview of recent developments in social protection systems, including social protection floors, and covers the impact of the COVID-19 pandemic on such systems. Based on new data, it offers a broad range of global, regional, and country data on social protection coverage, on benefits, and on public expenditures. Following a life-cycle approach, the report analyses progress in regard of universal social protection coverage, with a particular focus on achieving the globally agreed 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs).

As for the objectives of the report, considering the world struggles to recover from the COVID-19 pandemic, and as less than nine years remain (from the publication date) to achieve the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs), there is need for very quick action programmes. The report discusses the current state of social protection systems as a base to recommend actions and changes of the systems. In addition, the report reviews progress made in recent years, identifies the remaining gaps and the challenges, and sketches out possible pathways for the future. The report monitors key social protection indicators, such as the extent of both legal and effective coverage and the adequacy of benefits, as well as expenditure and financing indicators, and the report also discusses major challenges in realizing the right to social security for all. The report emphasizes the importance of a human rights framework for social protection systems, continuing the approach taken in previous editions.

As for the organization of the report, the report is structured in a way that recognizes the disruption caused by COVID-19. Chapter 1 is on Social

Protection at the Crossroads as COVID-19 is changing the existing social protection systems and is testing their relevance. The Chapter 2 reviews the situation prior to the pandemic and highlights a range of pre-existing challenges, many of which were exacerbated by the crisis. Chapter 3 focuses specifically on the health, economic and social impacts of COVID-19, and on the social protection responses to it, and sets out possible pathways for the future. Chapter 4 examines in turn specific areas of social protection, following a life-cycle approach that reflects the four social protection guarantees. Section 4.1 focuses on social protection for children, specifically looking at child and family benefits, and its complementarity with care services. Section 4.2 addresses schemes and programmes ensuring income security for people of working age, including maternity protection, unemployment protection, employment injury protection, and disability benefits. Section 4.3 focuses on income security in old age for women and men, with a particular emphasis on old-age pensions. Section 4.4 addresses the crucial role of universal health coverage for achieving the SDGs. Chapter 5 concludes the report by discussing policy options and priorities for the future of social protection, harnessing its key role for achieving the SDGs by 2030. A focus in this chapter is on social justice. There are also annexes, such as on measuring social protection coverage in developed and developing countries.

The report indicates that despite progress in recent years in extending social protection in many parts of the world, when the Coronavirus Disease (COVID-19) pandemic hit the world, many countries were still facing significant challenges in making the human right to social security a reality for all. This report provides a global overview of progress made around the world over the past decade in extending social protection and building rights-based social protection systems, including floors. And the report covers as well the impact of the COVID-19 pandemic. In doing so, it provides an essential contribution to the monitoring framework of the 2030 Agenda for Sustainable Development.

The report provides five messages; the first message is that the pandemic has exposed deep-seated inequalities and significant gaps in social protection coverage, in comprehensiveness, and for the adequacy across all countries. Pervasive challenges, such as high levels of economic insecurity, persistent poverty, rising inequality, extensive informality, and a fragile social contract, have been exacerbated by COVID-19. The crisis also exposed the vulnerability of billions of people who seemed to be entitled to a relatively well protection but were not adequately protected from the socio-economic shock waves it has emitted. The pandemic's socio-economic impacts have made it difficult for policymakers to ignore various population groups – including children, older persons, unpaid caretakers, and women and men working in diverse forms of employment and in the informal economy – who were covered either inadequately or not at all by existing social protection measures. In revealing

these gaps, this report shows that the pandemic has propelled countries into unprecedented levels of policy action, with social protection at the forefront.

The second message is that COVID-19 provoked an unparalleled social protection policy response. Governments marshalled social protection as a front-line response to protect people's health, jobs, and incomes, and to ensure social stability. Where necessary, governments extended coverage to hitherto unprotected groups, increased benefit levels or introduced new benefits, adapted administrative and delivery mechanisms, and mobilized additional financial resources. However, despite some international support, many low- and middle-income countries have struggled to mount a proportionate social protection and stimulus response to contain the pandemic's adverse impacts in the way that high income countries have been able to do, leading to a "stimulus gap" arising largely from significant coverage and financing gaps.

The third message is that socio-economic recovery remains uncertain and enhanced social protection spending will continue to be crucial. The most recent IMF forecasts warn of a divergent recovery, whereby richer countries enjoy a swift economic rebound while lower income nations see a reversal of their recent development gains. Ensuring a human-centred recovery everywhere is contingent on equitable access to vaccines. This is not only a moral imperative, but also a public health necessity: a deep chasm in vaccine availability will unleash new viral mutations that undermine the public health benefits of vaccines everywhere. Already, however, inequitable vaccine access, yawning stimulus gaps visible in the crisis response, unfulfilled calls for global solidarity, increasing poverty and inequalities, and recourse to austerity cuts all indicate the prospect of uneven recovery. Such a scenario will leave many people to fend for themselves and derail the progress made towards the achievement of the 2030 Sustainable Development Agenda and the realization of social justice.

The fourth message is that countries are at a crossroads in regard of the trajectory of their social protection systems, and many countries also face significant fiscal constraints. This report shows that nearly all countries, irrespective of their level of development, have a choice: whether to pursue a "high-road" strategy of investing in reinforcing their social protection systems or a "low-road" strategy of minimalist provision, succumbing to fiscal or political pressures. The report suggests that countries can use the policy window prised open by the pandemic and build on their crisis-response measures to strengthen their social protection systems and progressively close protection gaps to ensure that everyone is protected against both systemic shocks and ordinary lifecycle risks. This would involve increased efforts to build universal, comprehensive, adequate, and sustainable social protection systems, including a solid social protection floor that guarantees at least a basic level of social security for all over the course of their lives. The alternative would be to acquiesce in a low-road approach that fails to invest in social protection, thereby trapping countries in a

“low cost–low human development” trajectory. This would represent a lost possibility for strengthening social protection systems and reconfiguring societies for a better future.

The fifth message suggests that establishing universal social protection and realizing the human right to social security for all is the cornerstone of a human-centred approach to obtaining social justice. Doing so contributes, when including healthcare and sickness benefits, to preventing poverty and containing inequality, enhancing human capabilities and productivity, fostering dignity, solidarity, and fairness, and reinvigorating the social contract.

The report discusses the state of social protection and indicates that despite some progress that has taken place, the progress that has been made is not enough. According to the report the limited progress is demonstrated from the fact that, as of 2020, only 46.9 per cent of the global population were effectively covered by at least one social protection benefit (Sustainable Development Goal/SDG indicator 1.3.1), while the remaining 53.1 per cent – as many as 4.1 billion people – were left wholly unprotected. Furthermore, according to the report, behind this global average, there are significant inequalities across and within regions, with coverage rates in Europe and Central Asia (83.9 per cent) and the Americas (64.3 per cent) above the global average, while Asia and the Pacific (44.1 per cent), the Arab States (40.0 per cent), and Africa (17.4 per cent) have far more marked coverage gaps.

According to the report, the limited coverage is demonstrated from the fact that only 30.6 per cent of the working-age population are legally covered by comprehensive social security systems that include a full range of benefits, from child and family benefits to old-age pensions, although women’s coverage rate lags the rate of the men by a substantial 8 percentage points. This implies that a majority share of the working-age population – 69.4 per cent, or 4 billion people – are only partially protected or not protected at all. Access to healthcare, sickness and unemployment benefits has taken on a special relevance during the pandemic. While almost two thirds of the global population are protected by a health scheme of some kind, significant coverage and adequacy gaps remain. When it comes to income protection during sickness and unemployment, the coverage and adequacy gaps are even more pronounced. Approximately a third of working-age people have their income security protected by law in case of sickness, and less than a fifth of unemployed workers worldwide actually receive unemployment benefits.

The report argues that gaps in the coverage, comprehensiveness, and adequacy of social protection systems are associated with significant underinvestment in social protection, particularly in Africa, the Arab States, and in Asia. Countries spend on average 12.9 per cent of their gross domestic product (GDP) on social protection (excluding health), but this figure masks staggering variations. High-income countries/HICs spend on average 16.4 per cent, or twice

as much as upper-middle-income countries/UMICs (which spend 8 per cent), six times as much as lower-middle-income countries/LMICs (2.5 per cent), and 15 times as much as low-income countries/LICs (1.1 per cent). According to the report this financing gap for building social protection floors has widened by approximately 30 per cent since the onset of the COVID-19 crisis, owing to the increased need for healthcare services, income security measures, and reductions in GDP caused by the crisis.

To guarantee at least a basic level of social security through a nationally defined social protection floor, lower-middle-income countries/LMICs would need to invest an additional US\$ 362.9 billion and upper-middle-income countries/UMICs a further US\$ 750.8 billion per year, equivalent to 5.1 per cent and 3.1 per cent of GDP respectively for the two groups. Low-income countries/LICs would need to invest an additional US\$ 77.9 billion, equivalent to 15.9 per cent of their GDP. COVID-19 threatens to imperil years of progress towards achieving the Sustainable Development Goals (SDGs), reversing gains in poverty reduction. It has also revealed the pre-existing stark protection gaps across all countries and has it made impossible for policymakers to ignore the persistent social protection deficits experienced in particular by certain groups, such as informal workers, migrants, and unpaid caretakers. This crisis has resulted in an unprecedented yet uneven global social protection response. High-income countries/HICs were better placed to mobilize their existing systems or introduce new emergency measures to contain the impact of the crisis on health, jobs, and incomes. Mounting a response was more challenging in lower-income contexts, which were woefully ill prepared.

The report highlights five key messages but implies that social protection for children remains limited, yet is critical for unlocking their potential, and that social protection for women and men of working age provides insufficient protection against key risks, while social protection measures for older women and men still face coverage and adequacy challenges. Social health protection is an essential contribution to universal health coverage and taking the “high road” towards universal social protection is of key importance for a socially just future.

The report indicates that COVID-19 has acted as a stress test for social protection systems. It has further exacerbated pre-existing gaps in coverage, comprehensiveness, and adequacy of protection, while also revealing the stark inequalities in access to social protection – across regions, within countries, and for workers in different forms of employment. The crisis has poignantly demonstrated not only that from the viewpoint of human rights it is unacceptable to deny people their fundamental rights and to jeopardize their human dignity. Consequently, while the call to accelerate progress towards universal social protection by taking a “high-road” scenario to recovery is not a new one, it has acquired greater urgency.

The report argues that an inclusive recovery and a just transition of world economies towards a more digital, greener, fairer, and human-centred future of work requires reinvigorated social protection systems, linked to care policies, that can help people navigate transitions and seize new opportunities. As a lubricant of change, social protection systems support structural transformations, contributing to the promotion of decent, productive, and freely chosen employment, providing a conducive environment for sustainable enterprises while supporting those who have hitherto been left behind. In other words, social protection is essential if a human-centred future of work is to become reality. To fulfil their important transformative function, national social protection systems need to adapt to new realities, especially in regard of ensuring that workers in all forms of work are adequately covered. This requires, as a matter of priority, building a social protection floor that guarantees at least a basic level of income security and access to healthcare for everyone, throughout their life course. Establishing such basic social protection guarantees is a key element of a transformational approach that puts people at the centre of policies. Achieving this objective by 2030 requires strong political will, translated into effective strategies and policies, legal frameworks, and sustainable financing mechanisms. Less than nine years remain to achieve the 2030 Agenda, including SDG targets 1.3 and 3.8. The report suggests that in a world where the greatest share of the population today has no, or insufficient, access to social protection and is locked in a vicious cycle of vulnerability, poverty, and social exclusion, it is imperative that both individual countries and the global community step up efforts to make the right to social security a reality for all. Social protection has a key role to play in supporting people in their life and work transitions and in the structural transformation of the economy and society, as part of a human-centred approach. Accelerating progress towards universal social protection is indispensable for achieving social justice.

The report is useful as a source of coverage data to learn about the progress towards reformed social protection systems, New Measurement methods are presented in the Annexes.

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United Nations University-Institute for Environment and Human Security (UNU-EHS), *Interconnected Disaster Risks – 2020-2021*, by United Nations University, Institute of Environment and Human Security (UNU-EHS) (2021), Authors: O’Connor, Jack; Eberle, Caitlyn; Cotti, Davide; Hagenlocher, Michael; Hassel, Jonathan; Janzen, Sally; Narvaez, Liliana; Newsom, Amy; Ortiz Vargas, Andrea; Schutze, Simon; Sebesvari, Zita; Sett, Dominic; and Yvonne Walz, United Nations University, Institute for Environment and Human Security (UNU-EHS), Bonn, Germany. 64 pages. Access for Download: <http://collections.unu.edu/view/UNU:8288>, and:

https://i.unu.edu/media/ehs.unu.edu/attachment/23907/UN_Interconnected_Disaster_Risks_Report_210902_Full_Report.pdf

The study by the United Nations University, Institute of Environment and Human Security (UNU-EHS) was published in 2021 under the title “Interconnected Disaster Risks” and it aims to discuss the interconnected disaster risks by looking at 10 examples of great relevance, including also the COVID-19 pandemic. The structure of the report is composed of five chapters organized as follows: Chapter 1 provides the introduction; Chapter 2 discusses the cases (ten disastrous events in 2020/2021). Chapter 3 focuses on connecting the dots, it explains interconnectivity, root causes, and emerging risks, by focussing on a Deep Dive into the interconnectivity of ten disastrous events in 2020/2021. So, it is argued in the chapter that the world’s people are all interconnected to these disastrous events; it discusses the root causes of the ten disastrous events, including the human-induced greenhouse gas emissions, the insufficient disaster risk management, the fact of undervaluing the full environmental cost in decision-making, the emerging risks including accelerating climate change, increasing societal challenges for disaster risk, and the problems of managing the escalating bio-diversity crisis. Chapter 4 focuses on solutions, explains examples of integrated approaches, addresses trade-offs and enablers. And finally, Chapter 5 provides the conclusions.

The report indicates that all the world’s people are interconnected; their actions have consequences for all of them. As the world’s people become ever-more interconnected, so do the risks they share. To manage these risks, the world people need to understand why and how they are interconnected. Only then can the world’s people find appropriate solutions. The report argues that the world today is facing an unprecedented level of extreme events impacting people and nature, being evident in the ever-increasing frequency of severe weather events, epidemics, and human-made disasters. According to the report, in 2020/2021 the world has witnessed various record-breaking disasters that showed clearer than ever before how interconnected the world’s people are, for better or worse. Society will likely remember most of these disasters as tragic, but largely isolated events that affected certain parts of the world for some time. This report however explains that these events are interconnected with each other, with other larger processes, as well as with people action or inaction. They can lead to future disasters or will worsen existing problems such as biodiversity loss or poverty. The report analyses ten interconnected disasters that took place in 2020/2021. They were selected for their notoriety and representation of larger global issues, which have changed or will change the world’s people lives across the world. The ten interconnected disasters include 1. Amazon Wildfires – Wildfires fuelled by global appetite; 2. Arctic Heatwave – Spiralling into a climate disaster; 3. Beirut Explosion – When the global community abandons

ship inspection and safe unloading and storing; 4. Central Viet Nam Floods – When being prepared is no longer enough; 5. Chinese Paddlefish Extinction – The fish that survived the dinosaur extinction but not humankind; 6. COVID-19 Pandemic – How a pandemic is showing the world’s people the value of biodiversity; 7. Cyclone Amphan – When a cyclone and a pandemic combine; 8. Desert Locust outbreak – How manageable risks spin out of control; 9. Great Barrier Reef bleaching – Losing more than a natural wonder; 10. Texas cold wave – A preventable catastrophe? The COVID-19 pandemic, which was facilitated or amplified by people’s hyper-connected society, demonstrated in the clearest form possible that there are no borders or boundaries that can contain disasters. While this interconnectivity has been globally recognized for COVID-19, it equally applies to many other large-scale disasters which took place in 2020/2021.

The report indicates that disasters are interconnected and that disasters co-occur. Mainly, interconnections of disasters are not limited to those between faraway locations; they can also compound each other, as happened with the COVID-19 pandemic and Cyclone Amphan in the border region of India and Bangladesh. In an area where almost 50 per cent of the population is living under the poverty line, the COVID-19 pandemic and subsequent lockdowns left many people without income options, including migrant workers who were forced to return to their home areas and were housed in cyclone shelters while under quarantine. On 20 May 2020, Super Cyclone Amphan hit the region causing over 100 fatalities, leading to damages of more than \$13 billion, and displacing 4.9 million people. Many people, concerned over social distancing, hygiene, and privacy, avoided evacuating to shelters. While the pandemic made it more difficult to prepare for the cyclone, the cyclone in turn also worsened the conditions for pandemic response in its aftermath, as health centres were destroyed, and COVID-19 cases spiked. The pandemic also influenced response capacities to the desert locust outbreak, for example by disrupting supply chains for pesticides. As the number of disasters per year continues to rise, co-occurring disasters will become much more frequent.

The report indicates that disasters can be connected to individual and collective human behaviour. A high global demand for meat means that there is also a high demand for animal fodder, such as soy, which requires large plots of farmland. Combined with local political decisions and limited monitoring and enforcement, this has led to a record rate of deforestation and to wildfires in the Amazon. Through the interconnections of global supply chains, meat consumption is one of the root causes contributing to the destruction of the Amazon. The impacts of forest fires and widespread deforestation are already felt globally as they exacerbate climate change and threaten biodiversity. Therefore, the individual decision to eat meat and poultry can contribute to disaster risks.

The report finds that disasters share the same root causes; the root causes are the underlying factors that create conditions for disasters to occur. After identifying sets of root causes for each event, the three most identified common root causes shared between these 10 events are human-induced greenhouse gas emissions, insufficient disaster risk management, and under-valuing environmental costs and benefits in decision-making. The report explains that disasters should no longer be viewed in isolation; when recognizing common root causes and emerging risks resulting from disasters like these, and when becoming aware of the interconnectivity between them, it is possible to understand them better. This will also enable taking collective actions at the global level that will change the larger, systemic processes behind them and ideally prevent similar events from occurring in the future.

The report demonstrates that interconnected root causes call for interconnected solutions; as the interconnected nature of events and their underlying root causes are increasingly creating emerging risks at all scales, it is time to recognize the shortcomings of fragmented responses. Ideally, the solutions they implement will have benefits across different dimensions. Cutting greenhouse gas emissions, for instance, could eventually reduce the frequency and severity of hazards linked to atmosphere and ocean warming, thus reducing risk in vulnerable areas. Additionally, slowing down climate change is beneficial for biodiversity and ecosystems as it gives more time for ecosystems and species to adapt to changing conditions. This would not only help to protect biodiversity but would also allow maintaining the benefits that a healthy reef provides to society such as coastal protection, recreational value, and fish for consumption. These types of solutions use interconnectivity to people's advantage to reduce risks and the severity of impacts, and they also help to avoid a cascade of disastrous events and therefore the emerging risks they contribute to.

The report indicates that addressing clearly the trade-offs is important for solutions. Solutions that address the tip of the iceberg rather than the underlying structures are not only bound to be less efficient, but they also bring with them additional risks. Actions designed to reduce the risk in one system can have negative impacts on another. Addressing any potential trade-offs is important to ensure that implemented solutions do not become part of a further problem. For example, one solution to reduce the disaster risk is to build sea walls or river dams that can come with negative impacts on biodiversity and ecosystem health. A better solution would be to integrate ecosystem-based measures along with built infrastructure that can help to reduce disaster risk, while also protecting biodiversity. The report suggests that individuals can be part of the solution; while many of the solutions require actions on international, national, or regional scale, but individual actions or inactions also matter. Because disasters can be connected to individual and collective human behaviour, individuals can be part of the solution if they take some action. This supports solutions or avoids a

further risk creation. People can be agents of change if they learn about the risks and adjust their own behaviour at the individual level, while also demanding change and action from the society they live in.

In Chapter 1, the introduction to the report indicates that the world's people live in an interconnected world that can be seen every day through increased transport, trade, and technology flows, as the world's people lives are more intertwined than ever with societies, economies, and ecosystems in distant parts of the world. The report indicates that the year 2020 brought this interconnectivity into sharp focus with the COVID-19 pandemic, highlighting the risks which will follow from the increasing interconnectedness of the world's people for the environment if left unchecked. While this pandemic has united the world in a struggle more intensive than ever before, it has also overshadowed the numerous record-setting disastrous events worldwide: from record-high temperatures on land and sea, to extreme cold waves, insect plagues, species extinctions and wildfires, and explosions in urban areas. Although the world's people are coming to think of disaster risks as being interconnected, the disastrous events themselves are still largely reported and perceived as being isolated incidents. The report suggests that to build more resilient communities and sustainable futures, the world's people need to better understand how global disasters are connected and why they happened in the first place. Chapter 2 is on the 10 disastrous events in 2020/21, while chapter 3 analyses the interconnectedness of events, the root causes of events, and the emerging risks following in the future. Chapter 4 discusses the solutions, by looking at the various forms of attacking the root causes (no regrets, win-win-win) and by considering the integrated strategies and the enablers for working on solutions.

In Chapter 5, the Conclusions are presented. The report argues that the world is a living, dynamic system interconnected on multiple scales. While these interconnectivities are not new, they are affecting and accelerating changes across scales in increasingly unexpected ways. Widespread environmental change combined with the global exchange of people, ideas, living organisms, and goods exposes individuals and societies to new types of risks with new types of interconnectivities. The past is no longer a reliable source in planning for future development or risk reduction. The failure to address interconnected root causes and emerging risks is accelerating the climate crisis, is creating new and more intense extreme events, is increasing societal vulnerabilities, and is leading the world's people to tipping points, including mass extinctions and loss of ecosystem services. The report argues that solutions which are conceived by the people for the global society must confront these systemic issues and must allow for interconnected ways of solving multiple problems at once. The report recommends that people must try to maximize risk reduction and adaptation benefits across multiple sectors, and so will act for different members of society locally and globally to avoid the rise of inequalities. The report shows that the

way the world's people understand and perceive risks influences their abilities to respond to them. The report suggests that, since the risks associated with these disastrous events are interconnected, thinking in fragmented, isolated, and insular ways is no longer tenable, and the world's people must instead think of themselves and their actions as part of a set of interconnected systems. The report argues that, though this world is bigger and more complex than people can even begin to comprehend, the world's people actions and voices matter, and collectively the world's people can change these systems for the better.

Because of the presentation of cases of disastrous events, the deep analysis of the root causes, and the identification of the possible solutions this report is highly relevant and gives hope to understand better what we need to do now. As events are interconnected, also the solutions must reflect the need for interconnected action.

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2 African Development Reports

UNECA (United Nations Economic Commission for Africa) (May 2021), Economic Report On Africa 2020: Innovative Finance For Private Sector Development In Africa, 203 pages; Publications, Economic Commission for Africa, P. O. Box 3001, Addis Ababa, Ethiopia: First Printing December 2020/May 2021; Sales no.: E.20.II.K.2/ISBN: 978-92-1-125139-5/eISBN: 978-92-1-005124-8/Print ISSN: 2411-8346/eISSN: 2411-8354; Access for Download: DOI: <https://doi.org/10.18356/9789210051248>, and: https://uneca.org/sites/default/files/fullpublicationfiles/ERA_2020_mobile_2_0201213.pdf, and about the series "Economic Report On Africa": <https://www.un-ilibrary.org/content/periodicals/24118354>

This report is described in the Foreword (p. ix) in the following words: "The 2020 edition of the Economic Report on Africa: Innovative Finance for Private Sector Development in Africa examines the innovative financial instruments, practices and policies required to enable African countries to make a step-change in growing the gamut of businesses, including start-ups, micro and small enterprises, social enterprises, professional businesses (such as lawyers and doctors), exchange-listed corporates, and public-private companies the businesses that will drive inclusive economic growth, create jobs and make pathways to better livelihoods for the African people. The idea is timely in this digital age, when some African countries such as Ghana, Kenya, Rwanda, and Uganda are already embarking on the financial technology (fintech) revolution to pave a bright new path for the unbanked population, including women entrepreneurs and youth-led small and medium enterprises." Therefore, the

report is also useful as a source how the digital transformation of the business and the finance sector in Africa can be promoted. It is intended to work with this report on a model that is fit for all sizes of business firms and for all stages of firms in the growth cycle. Thereby, the old discussion about the “missing middle” between large firms and small firms should be overcome by new analyses and policy proposals.

The report has eight (8) chapters. Chapter 1 is on recent economic and social development in Africa; chapter 2 is on the structure and composition of the private sector in Africa; chapter 3 is on accessing finance from the corporate banking sector in Africa; chapter 4 is on tapping into the potential of African finance markets, such as equity and debt markets; chapter 5 is on long-term financing for sustainable development in Africa; chapter 6 is on leveraging global innovations in financial technology in Africa; chapter 7 is on regulations to support financing in Africa; and chapter 8 is on conclusions and policy recommendations. It is good news to learn via this report about the increasing interest in the topic and about the growing strength of the financing sector for the growth of businesses in Africa.

Five key issues are discussed (see the summary pages xviii-xix) in the report: First, financing innovations can arise from multiple sources; second, a transparent and effective regulator institution is mandatory; third, the absence of a sound eco-system can impede firms even when financing is readily available; fourth, innovative financing of the private sector and of business growth generates firm value added, gainful employment, tax revenue for government, stable investment returns for entrepreneurs, and the growth of financial institutions; and fifth, the transformation from innovative finance and from a fully operational financial sector to economic growth, lower inequality, and reduced poverty is a long term task and necessarily involves feed-back mechanisms. This scheme of interactions and policy actions is presented in great detail in the report; it is important as it shows that the financing systems for business in Africa are not functional as they are not appropriate to the growth cycle of firms. Small firms cannot grow as the eco-system is not adapted to the stages of their growth cycle. Small firms have access to retained earnings and to informal borrowing, but not to the multiple financing sources which the larger firms have access to. The regulation of the finance system is not appropriate as it regulates only segments which are relevant for larger firms and for a certain stage of the growth cycle. Eco-systems of finance need to be functional so that all sizes of firms and all stages in the growth cycle are served. Innovative financing of the private sector and of business growth supports key developmental objectives (generating value added, creating gainful employment, raising tax revenues for government, providing for stable investment returns for entrepreneurs, and allowing for a steady growth of financial institutions). Feedback mechanisms from innovation financing to firm growth are requested,

what means that this transformation process will be a long term one, depending on coherent and coordinated government and business firm actions.

This is a deep investigation of innovative financing and the growth of firms. The series of UNECA which issues are called “Economic Report on Africa” is of great value for policymakers, because of highlighting major policy gaps in African countries.

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UNCTAD, 2021, Reaping The Potential Benefits Of The African Continental Free Trade Area For Inclusive Growth, Economic Development In AFRICA Report 2021, Geneva: United Nations 2021, 224 pages, UNCTAD/ALDC/AFRICA/2021/ISBN: 978-92-1-113004-1/eISBN: 978-92-1-005602-1/ISSN: 1990-5114/eISSN: 1990-5122/Sales No. E.21.II.D.3; access for download:

**https://unctad.org/system/files/official-document/aldcafrica2021_en.pdf,
and: <https://unctad.org/webflyer/economic-development-africa-report-2021>,
and: <https://unctad.org/topic/africa/economic-development-in-africa-report>**

The UNCTAD Publication Series *Economic Development In Africa Report* is highlighting economic trends in Africa which are of great importance for the continent, such as a report on the potential benefits of the African Continental Free Trade Area (2021), a report on illicit financial flows as impacting sustainable development in Africa (2020), a report on “Made in Africa” on strategies of how to generate brands in Africa and to strengthen the rules of origin for enhancing intra-African Trade (2019), a report on the role of migration for structural transformation (2018), a report on tourism for transformative and inclusive growth (2017), a report on debt dynamics and development finance in Africa (2016), and many other reports back to the issue for 2001. All these reports are highly informative, but also bring the “development philosophy” of UNCTAD to the readers.

UNCTAD argues about the new report for 2021 (unctad.org/Africa/series): “Africa has experienced remarkable growth since 2000, yet this has not translated into significantly improved livelihoods for most Africans. Fewer than half of countries in Africa have experienced inclusive growth in recent decades. This report aims to equip Governments in Africa and development partners with knowledge of how the African Continental Free Trade Area can be beneficial for inclusive growth and how complementary policies are necessary to make the Free Trade Area inclusive within and across countries in Africa. To realize the export potential of Africa, intra-African tariff barriers and non-tariff barriers need to be reduced, and productive capacities need to be increased to facilitate regional trade. Regional productive capacities, value chain development in agri-food processing and the vehicles industry are identified as potential drivers of

transformative growth. An analysis is provided of how the expected gains from trade, production, investment, and growth opportunities under the African Continental Free Trade Area can be inclusive. For the benefits of the Free Trade Area to be fully harnessed and inclusive, informal trade and its stakeholders should be considered in both design and implementation.” UNCTAD is looking at developing productive capacities, at strengthening transformative and inclusive growth, and at relying on more effective mechanisms for global and regional cooperation.

The Report for 2021 includes an Introduction, a Chapter 1 on inclusive growth in Africa, a Chapter 2 on people, informality and inclusivity, a Chapter 3 on shared prosperity through the African Continental Free Trade Area (this is the guiding chapter of the Report 2021), a Chapter 4 on an integrated framework and on cost-efficient trade measures, and a Chapter 5 on main messages and policy recommendations. These five chapters comprise a new, a visionary, and a largely extended frame for the African Continental Free Trade Area (AfCFTA), based on inclusivity in all spheres and for all people, regarding also informal trade and informal production, giving emphasis on developing productive capacities, aiming at a transformative regional integration process, and focussing in AfCFTA on shared prosperity for all people and for all countries all over the continent.

It is investigated how the AfCFTA can become inclusive in growth and development. This is not an easy task for policymakers in Africa as the report emphasizes that – with calculations based on growth incidence curves - 17 countries were able to reduce poverty and inequality, while 18 countries could reduce poverty but had increases of inequality, and 14 countries could not reduce poverty or inequality (page 171). And, the small and medium enterprises, the enterprises of women and youth, and the informal ventures could benefit from the AfCFTA, especially if governments follow inclusive policy interventions. The untapped potential for intra-African trade is huge and is certainly a source for inclusive growth and development; the AfCFTA could also help to increase resilience in health, food, and energy sectors. Inclusive policies for implementing the AfCFTA also require coherent policies among the member countries, although the structural conditions are so different. The Report by UNCTAD adds a useful dimension to the current discussion about the potentials of the AfCFTA.

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African Development Bank Group, 2021, African Economic Outlook 2021, From Debt Resolution to Growth: The Road Ahead for Africa, 180 pages, ISBN 978-9973-9854-4-6 (print), ISBN 978-9973-9854-5-3 (electronic), African Development Bank Group, Avenue Joseph Anoma, 01 BP 1387 Abidjan 01, Côte d’Ivoire, www.afdb.org; access for download: <https://www.afdb.org/en/documents/african-economic-outlook-2021>

This report has three chapters. The basic issue of the report is how to respond to the COVID-19 pandemic of the year 2020, and how to develop strong recovery programmes. The Chapter 1 is rich in information on Africa's Growth Performance and Outlook amid the Covid-19 Pandemic. The editors of the report argue about the effects of the pandemic: "Real GDP in Africa is projected to grow by 3.4 percent in 2021, after contracting by 2.1 percent in 2020. This projected recovery from the worst recession in more than half a century will be underpinned by a resumption of tourism, a rebound in commodity prices, and the rollback of pandemic-induced restrictions. Macroeconomic fundamentals have weakened because of the pandemic. Although counterbalancing forces kept average headline inflation stable at 10.4 percent in 2020, core inflation has risen in many countries. Fiscal deficits are estimated to have doubled in 2020 to a historical high of 8.4 percent of GDP, leading to increased debt burdens. A gradual consolidation process is expected in 2021 and beyond."

It is reported on the effects of the COVID-19 pandemic: "The adverse effects of COVID-19 will reverse hard-won gains in poverty reduction in Africa. About 30 million Africans were pushed into extreme poverty in 2020, and about 39 million more could fall into extreme poverty in 2021. The monetary cost of lifting the new extreme poor to the \$1.90 a day poverty line is estimated at \$4.5 billion for 2021—about \$90.7 million on average per country. Although lockdowns have been effective at mitigating the spread of COVID-19 in Africa, they have had severe economic consequences. Evidence shows that African countries with more stringent lockdown restrictions have experienced fewer COVID-19 cases than those with less restrictive policies."

Of great importance in the report is the Agenda for Action to support economic recovery and to build resilience. The editors argue in terms of key policy actions: "Policy priorities to support economic recovery and build resilience include continuing support for the health sector to consolidate gains in the fight against the pandemic; sustaining monetary and fiscal support; expanding social safety nets and making growth more equitable; minimizing the long-term implications of the pandemic on human capital accumulation; accelerating structural transformation through digitalization, industrialization, and diversification; and strengthening regional and multinational solidarity." All these recommendations are important, but it is not made clear how this can be implemented in a time of global and regional political and economic uncertainty, and especially in times of growing debt problems.

The chapters 2 and 3 go a long way to describe the debt-related problems of Africa. While chapter 2 is on debt dynamics and its consequences, chapter 3 is on debt resolution and the nexus between government and growth. The editors write about the main problems of increasing debt-to-GDP ratios and about the shifts from traditional lenders (bilateral and multilateral official creditors) to private and commercial creditors (especially from China's state-owned

enterprises and from international capital markets: “Fiscal stimulus packages by African governments to contain the pandemic have had direct implications for public debt levels. The average debt-to-GDP ratio in Africa is projected to increase by 10 to 15 percentage points by 2021. Moreover, Africa’s debt continues to shift from traditional lenders towards private and commercial debt with significant vulnerabilities.” And what is of great value, chapter 2 gives details about the rapidly changing debt dynamics and all the vulnerabilities involved. There is not much new information, but the new trends are summarized in a quite readable form so that policymakers in Africa can use the analyses and the recommendations.

Chapter 3 is on debt resolution and on the nexus between governance and growth. The editors of the report argue: “Debt resolution in Africa has often been disorderly and protracted with costly economic consequences. The current international financial architecture makes orderly sovereign debt restructuring complex to achieve. To avoid high debt resolution costs and limit the likelihood that debt crises re-emerge, the international community needs to push for enhanced global coordination. African countries need to adopt legal and financial innovations that facilitate debt restructuring. Strengthening the nexus between governance and growth is required to get out of the COVID-19 crisis and avoid a looming debt crisis. African countries must eradicate all forms of “leakages” in public resource management and pursue digitization and fair competition to reignite growth.” Regrettably, the initiatives of the G20 countries to resolve the debt problems of Africa in times of COVID-19 have largely failed, just because only traditional lenders played a small role for some few African countries, while commercial and private lenders were not part of the initiatives. A country like China with its state-owned enterprises can easily change the positions between the bilateral/multilateral debt status and the commercial/private debt status. And still there is no common position of Africa on debt resolution.

Two main policy issues remain, namely “accelerating digitalization” and “investing in transparency”, as argued by the editors of the report: “Two important strategies could revitalize African economies: Launching an accelerated digitalization, an all-out effort to harness digital technologies to propel Africa into the Fourth Industrial Revolution and boost job creation - and promoting free and fair competition and investing in transparency to enhance production efficiency.” Regrettably, although there is some progress in some countries and some sectors, it is not broad-based, despite of the new policies of the African Union. The African Union pushes the African Continental Free Trade Area (AfCFTA) and the Digital Strategy; both these initiatives pave the way for common positions and give hope for this development. A major insight of the Report is the need to complement debt restructuring by governance system reforms. Avoiding “leakages” in public resource management is a key policy advice. Public Financial Management (PFM) reform requires a) prudent fiscal

decisions, b) credible budgets, c) reliable and efficient resource flows and transactions, and d) institutionalized transparency and accountability; these four areas are a priority list of important actions to make any debt restructuring strategy to get workable. Both pillars (debt restructuring and public financial management) are not working in many countries and situations.

This is a useful report for policymakers and for the media to learn more about the policies pursued in Africa. The African Development Perspectives Yearbook has reviewed all issues of the African Economic Outlook; the editorial and conceptual changes over all these years were fundamental and reflected the changes of Africa's position in the global system.

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The United Nations Economic and Social Commission for Western Asia (ESCWA) and the Saudi Development and Reconstruction Program for Yemen (2020), Arab LDCs (Least Developed Countries), Development Challenges and Opportunities, 125 pages, United Nations publication issued by ESCWA, United Nations House, Riad El Solh Square, P. O. Box: 11-8575, Beirut, Lebanon. Access for Download: <https://reliefweb.int/sites/reliefweb.int/files/resources/arab-ldc-development-challenges-opportunities-english.pdf>

The United Nations Economic and Social Commission for Western Asia (ESCWA) and the Saudi Development and Reconstruction Program for Yemen (2020) published a report which focusses on the Arab Least Developed Countries (LDCs) and their development challenges and opportunities. The report argues that four member States of the United Nations Economic and Social Commission for Western Asia (ESCWA) are classified as LDCs: Mauritania, Somalia, Sudan, and Yemen. The latter three are also plagued by conflict and face chronic challenges in meeting the Istanbul Programme of Action (IPoA) concerning the graduation criteria from the LDC category. The report indicates that attempts by these governments to build sound systems of governance that would make their economies more resilient have been hampered by conflict and external shocks, such as the global financial, food, and oil price crises; weak human, technological and institutional capacities; limited technology transfer; a lack of domestic resources; inequality; and more recently the socioeconomic effects of the COVID-19 pandemic. These factors together induce a vicious cycle of low productivity and investment, and ultimately of low levels of human development.

The report provides an analytical overview of the progress and the challenges faced by Arab LDCs, with a focus on the special vulnerabilities which these countries are experiencing due to conflict and political instability. This report also builds on the lessons learnt from the IPoA decade to provide key

findings and recommendations for the next decade. The report has an Introduction and six chapters.

Chapter 1 focuses on the main developments and trends of the Arab Least Developed countries (LDCs) and explains the basic criteria for inclusion in the international 'least developed countries' category. It outlines the main political developments that have affected the four Arab LDCs, namely Mauritania, Somalia, Sudan, and Yemen. The report indicates that these countries are also vulnerable to persistent transnational shocks, conflicts, and crises, such as the COVID-19 pandemic, the desert locust infestations, the floods, and other natural disasters, which have significant implications for their economies, humanitarian needs and population displacement. Conflicts and wars as in Yemen, conflicts in and sanctions on Sudan, and civil war and conflicts in Somalia add to all these crises due to natural disasters.

Chapter 2 offers a detailed account of governance and instability aspects in Arab LDCs and analyses the interwinding of internal and external factors of corruption, fragility, and forced human mobility. Despite the overall negative scorings of governance performance, each Arab LDC has its own political contexts of unrest and feeble and varying attempts to overcome them. This chapter highlights the adjacent role of the international community and considers its current inadequacy, and it calls for a more assertive and impactful aid intervention and development support, particularly as transition has been underway and presents a unique opportunity for democratic rule, human development, and economic growth, needed for the graduation from the LDC category in the next decade.

The report argues that the four Arab LDCs have negative scores, indicating weak perceptions of participation in selecting government and freedom of expression, association or media (voice and accountability); high perceptions of political instability or violence (political instability); poor quality of public and civil services as well as government credibility in formulating and implementing policies without political pressures (government effectiveness); the inability to create and enforce policies that promote the development of the private sector (regulatory quality); low confidence in and compliance with the rules of society (rule of law); and use of public power for private gain (control of corruption). The report shows clearly that the Arab LDCs have performed badly, with the most prominent shortfall being in political stability which deteriorated because of the civil wars and conflicts mainly in Yemen, Somalia, and the Sudan.

Chapter 3 on socioeconomic structural challenges analyses the process of both economic and social development and growth in these countries, starting with the size and structure of the overall economy, its growth rates, the extent of its sustainability and its inclusion, in addition to shedding light on the macroeconomic problems, such as unemployment and inflation. It then assesses the strengths and deficiencies of societal development in Arab LDCs, including

health, education, social and physical infrastructure, and technology needed for sustainable development. And then, the report explains the influence of international institutions on development policies and the overall impact of all these aspects on the poverty situation in the countries. This chapter presents investigation at two levels: the external level, comparing the Arab LDCs to other LDCs worldwide as a whole; and the internal level, comparing the four Arab countries to each other. The key findings are that consumption-based growth has failed to help develop sustainable productive sectors; inadequate social infrastructure has weakened population resilience and ability to resist disease and to develop the economic potential; imported development policies have weakened state institutions and failed to bring about equitable social and economic development; and the worsened poverty situation has been a consequence of all these issues. Therefore, the report recommends that the implementation of new approaches is essential to reverse the negative trends.

Chapter 4 on Aid to Arab LDCs under the IPoA trends and challenges demonstrates that in the Arab LDCs the aid flows and the donor activities since 2011 had little alignment with the objectives and the priorities as set out in the IPoA. Conflicts, political instability, natural and man-made disasters, climate shocks, and weak institutional capacity of recipient economies have been the key factors shaping the trajectory of donor operations in these countries. In the context of the Arab LDCs' fragile political and socioeconomic circumstances, the bulk of aid was concentrated in the humanitarian sector, with far less resources being allocated to long-term development. This humanitarian focus has both, undermined these countries' potential for structural transformation as envisioned in the IPoA and weakened their resilience and ability to respond to further crises. The key findings are that the principles of aid effectiveness highlight the complex issues of competing interests between funders, receiving state administrations, and the intended beneficiary populations; the difficulties in implementing the principles of the IPoA have resulted in a low level of development and a worsening of the absorptive capacity in the four countries; the shift from development to humanitarian assistance presents long-term challenges and risks for the future and should be reversed and replaced by a humanitarian-development-peace (HDP) strategy. The report indicates that Somalia, Sudan, and Yemen remain countries with prominent humanitarian needs. The greatest share of Official Development Assistance (ODA) allocated to these countries is humanitarian aid, while aid to social sectors, such as education, health, and social infrastructure, remains low. ODA to Mauritania is more diverse. As economic and productive sectors remain underfunded in Arab LDCs, shifting away from aid dependence and meeting development targets remains unattainable.

Chapter 5 on Emerging Crises tackles the arising occurrence of emergencies in Arab LDCs during the second decade of the 21st century. The report discusses four main groups of crises, namely: a) the grave and increasing humanitarian

emergencies, b) the impact of Covid-19 on the health sector and the economy, c) the ramifications of climate change on land and people, and lastly d) the desert locust invasion and its ensuing damages to livelihoods and food security. A key finding is that climate-related crises are likely to increase in frequency and severity. Consequently, the report recommends that mitigation measures must be included in all national planning and development financing in Arab LDCs. Another key finding is that the COVID-19 pandemic has placed additional pressure on the economies of Arab LDCs, beyond the destructive impact of political instability; the report recommends that the long-term impact of the pandemic on LDCs must be addressed with capacity-building and financing for all related needs.

Chapter 6 provides the conclusion and shows that the last decade has been characterised by a worsening of crises and of poverty levels in the four Arab LDCs. While Somalia and the Sudan have been at war for decades, Yemen entered a full-scale civil war since 2014, after decades of instability, while Mauritania is the only one of the four LDCs where instability has not led to a major conflict, but the country is threatened not only by internal political instability, but also by the rise of militant armed actors and other crises in neighbouring states. The report indicates that there are various underlying fundamental structural issues which have all contributed to a greater or lesser extent to the current state of affairs; they have been exacerbated by emerging challenges during the decade, all of which need to be addressed. The report provides recommendations on governance and social development and argues that social development is essential to rebuild these countries, create national economies, and provide opportunities for the next generations of citizens. The report provides recommendations on economic development and argues that economic development and improved living standards are the fundamentals for societies to flourish and to avoid instability and conflict. Therefore, the report suggests that the implementation of measures to reverse economic decline are essential to increase stability.

The report is informative, but it is not so obvious that a Saudi Program for Reconstruction in Yemen is the ideal partner for such a United Nations publication. On the other side, it is a reminder that Saudi Arabia has a great responsibility to give humanitarian assistance. Both countries, Saudi Arabia and Yemen will benefit from the reconstruction in Yemen.

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**United Nations Economic Commission for Africa (UNECA) (2019), Economic Report on Africa 2019: Fiscal Policy for Financing Sustainable Development in Africa, 186 pages, Publications Economic Commission for Africa, P. O. Box 3001, Addis Ababa, Ethiopia Sales no.: E.19.II.K.2/ISBN: 978-92-1-125135-7/eISBN: 978-92-1-004036-5/Print ISSN: 2411-8346/eISSN: 2411-8354; United Nations 2019, Addis Ababa, Ethiopia. Access for Download:
<https://repository.uneca.org/bitstream/handle/10855/41804/b11928190.pdf?sequence=1&isAllowed=y>**

The 2019 edition of the Economic Report on Africa of UNECA aims to discuss “Fiscal Policy for Financing Sustainable Development in Africa”. The report indicates that Africa is making steady progress in building the critical ingredients for sustainable and resilient societies, but that progress towards achieving the Sustainable Development Goals (SDGs) is slow and uneven across the continent. Access to basic infrastructure, such as energy, water and sanitation services, is improving but falls well below the global average. The report confirms that effective implementation of the African Union Agenda 2063 and the 2030 Agenda for Sustainable Development requires African countries to scale up investments in science, technology, and innovation (STI) to promote rapid and inclusive growth. The costs of these investments are enormous and require increased resource mobilization.

The report includes eight chapters organized as follows: Chapter 1 is the introduction and discusses recent economic and social developments, Chapter 2 focuses on fiscal policy and development finance; Chapter 3 shows tax policy and performance in Africa; Chapter 4 discusses non-tax revenues for financing sustainable development; Chapter 5 examines tax administration in Africa; Chapter 6 discusses multinational corporations, tax avoidance, and evasion and natural resources management; Chapter 7 focuses on fiscal and public debt sustainability; and finally, Chapter 8 provides the conclusions and policy recommendations.

The report indicates that the Addis Ababa Action Agenda of 2015⁶ provides a new global framework for financing sustainable development by aligning all financing flows and policies with economic, social and environmental priorities. It recognizes the importance of domestic public resources, supplemented by international assistance, in attaining sustainable development and achieving the SDGs. However, despite the numerous fiscal reforms undertaken by many

⁶ See on the Addis Ababa Action Agenda (AAAA): <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=2051&menu=35>

African countries since 2000, government revenue as a share of GDP (21.4 per cent in 2018) remains low relative to the continent's potential and the financial resources needed to achieve national development aspirations. African countries can, according to estimates, boost the government revenue by 12–20 per cent of GDP by implementing countercyclical fiscal policy, taxing “hard to reach” sectors, tapping more effectively nontax revenue, introducing forms of e-taxation, and fighting tax evasion and avoidance, particularly in the natural resources sector.

The report argues that the financing needs across the continent to meet the SDGs are huge, and that the financing gap is wide. The report suggests that to narrow the financing gap, African countries need to enhance domestic resource mobilization, and that requires sustained improvement in the efficiency and efficacy of fiscal policy. This Report provides an evidence-based assessment of the nature and performance of fiscal policy in Africa. It analyses both challenges and opportunities and identifies best practices to draw policy recommendations and to facilitate exchange of experiences. This can help member states to undertake necessary fiscal policy reforms and to improve macroeconomic management. The Report addresses critical questions of fiscal policy and the financing of the SDGs in Africa. These include the nature and role of fiscal policy; the potential of fiscal policy, including tax and nontax revenue, to enhance domestic resource mobilization; and the role of fiscal policy in macroeconomic management and achievement of the SDGs. The Report examines the key opportunities as well as the challenges in making fiscal policy more effective and efficient and offers policy lessons and recommendations to inform fiscal policy reforms in Africa. Data for the Report's analysis include secondary sources and primary data and information collected from 12 African countries (Angola, Benin, Chad, Ethiopia, Ghana, Kenya, Mauritius, Mauritania, Mozambique, South Africa, Sudan, and Zimbabwe).

The key findings of the report are that the global economic growth and the favourable domestic conditions underpinned Africa's economic performance, but progress on social development has been slow. The fiscal policy can be an anchor for macroeconomic stability and a key tool for achieving the sustainable development goals (SDGs). The corporate tax reductions offer little incentive for investments. The indirect taxes have been the main source of tax revenue. Improving the efficiency of revenue collection could greatly increase non-tax revenue. Leveraging the use of information technology could tighten compliance and lower administrative costs. Base erosion and profit shifting are major sources of revenue leaks. The potential to mobilize the domestic fiscal resources is not utilized.

The report provides several key policy recommendations. It argues that African countries can increase government revenue by 12–20 per cent of GDP by adopting a policy framework to strengthen revenue mobilization in six key areas.

First, Fiscal policy options, anchoring fiscal policy to national medium-term financing strategies, could allow African countries to leverage the full potential of all government revenue—tax and non-tax—for accelerated and sustained growth underpinned by macroeconomic stability. To safeguard macroeconomic stability, countries must align fiscal policy with the business cycle, improving revenue mobilization and reducing spending to curb supply-side pressures, while lowering taxes and increasing spending when economic activity slows. Second, Tax policy options, African governments must widen the tax base by bringing “hard to tax” sectors into the tax net, including agriculture, the informal economy, the digital economy, and the natural resources sector. Countries must reassess tax incentives and drop those that do not serve the intended purpose. Limiting the use of tax incentives in the agricultural and natural resources sectors could stem tax leakages and enhance revenue collection. Third, Non-tax revenue options matter. Investing in better data collection methods and implementation could strengthen monitoring of non-tax revenue collection and non-reporting. Non-tax revenue collection can be enhanced by establishing strong institutions with high levels of expertise, building new infrastructure, and establishing effective coordination between central and local governments. Fourth, Tax administration options, reforming tax administration systems through digitization and other information technologies could increase revenue mobilization. Countries that have digitized their tax administration have increased compliance rates and saved on compliance costs. The rollout of digital technologies needs to be accompanied by capacity building for policy makers and tax collectors on how to take advantage of data generated through digitization for more efficient assessments. Fifth, Policy options for the natural resources sector, African countries should strengthen their oversight of the natural resources sector. They could consider a more equitable and less administratively challenging approach to assessing what share of multinational corporations’ profits to tax, or they could base taxes on variables that are harder to manipulate than corporate income. At the same time, governments need to close loopholes to thwart base erosion and profit shifting. Sixth, Debt policy options, the new dynamics of public debt in Africa calls for adapting debt sustainability strategies and frameworks to current debt portfolios. That includes improving revenue mobilization to enhance debt servicing and reduce long-term borrowing. The Report calls for better debt management strategies underpinned by increased deepening of domestic capital markets and reliance on local currency-denominated debt instruments.

It would be interesting to see why Africa falls so much short regarding the potential for raising public revenues (by 12- 20 percent of GDP). Such a wide margin gives hope that changes are possible, and the recommendations along six key areas signal that action is possible to reduce the shortfall of public revenues. It would be necessary to go deeper into country studies to reveal the factors

which are impeding progress towards the increase of the public revenues. All these recommendations are important elements of a holistic strategy to be considered in the long run, but political economy considerations are needed to get to the implementation.

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**United Nations Economic Commission for Africa (UNECA) (2020),
Economic Report on Africa 2020: Innovative Finance for Private Sector
Development in Africa, UNECA, First printing 2020, 203 pages, Sales no.:
E.20.II.K.2/ISBN: 978-92-1-125139-5/eISBN: 978-92-1-005124-8/Print ISSN:
2411-8346/eISSN: 2411-8354; Economic Commission for Africa (ECA),
Addis Ababa, Ethiopia. Access for Download:
<https://repository.uneca.org/bitstream/handle/10855/43834/b11988824.pdf?sequence=1&isAllowed=y>**

The 2020 edition of the Economic Report on Africa discusses innovative finance for private sector development in Africa. The report explores innovative forms of finance for business development in Africa, advancing the discussion of finance beyond just the flow of funds, detailing key aspects of innovative financing for the development of the private sector and proposing a policy framework on innovative financing of the private sector for African countries. Its menu of policy options, best practices and strategic guidance supports decision makers and policymakers in creating and using innovative finance to support business development in pursuing economic growth, financial inclusion, and the sustainable development goals (SDGs).

The 2020 edition of the “Economic Report on Africa” focuses on innovative finance for private sector development in Africa, it examines the innovative financial instruments, practices and policies required to enable African countries to make a “step-change” in growing the gamut of businesses, including start-ups, micro and small enterprises, social enterprises, professional businesses (such as lawyers and doctors), exchange-listed corporates, and public-private companies - the businesses that will drive inclusive economic growth, create jobs and make pathways to better livelihoods for the African people. The report’s timing fits this digital age, the idea is timely in this period of digital transformation, when some African countries, such as Ghana, Kenya, Rwanda, and Uganda, are already embarking on the financial technology (fintech) revolution to pave a bright new path for the unbanked population, including women entrepreneurs and youth-led small and medium enterprises, while uncertainty hangs over the continent due to the COVID-19 global pandemic and associated lockdowns.

The report includes seven chapters organized as follows: Chapter 1 shows recent economic and social developments in Africa; Chapter 2 focuses on the

scope of the private sector in Africa; Chapter 3 explains accessing financing from the corporate banking sector in Africa; Chapter 4 discusses tapping into the potential of African markets; Chapter 5 discusses long-term financing for sustainable development in Africa; Chapter 6 focuses on leveraging global innovations in financial technology in Africa; Chapter 7 discusses regulations to support financing in Africa; and Chapter 8 provides conclusions and policy recommendations.

According to the report, Africa today, in the wake of COVID-19, is facing an unprecedented threat to its “hard-earned” growth over the last decade. The pandemic is global, but the resilience of the African region depends on the strategies and policies countries’ adopt now, building on recent initiatives to accelerate economic growth to meet national development aspirations in line with the Sustainable Development Goals (SDGs) and the African Union’s Agenda 2063, and to do so in a financially and environmentally sustainable manner. The cost to achieve the SDGs by 2030 in Africa will increase dramatically due to population growth, a dynamic that could seriously undermine the efforts to end extreme poverty and inequality, to tackle climate change, and build a resilient infrastructure in Africa. But the cost will also increase because of the pandemic which is affecting the fiscal capacity and the fiscal space of Africa.

According to the report increasing the role of the private sector stands out among the widely advocated options for such investments, especially given the low levels of investment by governments and the donor community. This option resonates with the African Continental Free Trade Area (AfCFTA)’s initiatives to harness the “demographic dividend”, to grow the middle class, to increase the use of technology, to promote rapid urbanization, and to boost opportunities for regional and global value chains for African businesses as strategic drivers of economic growth in Africa. And, the continent is endowed with a strong natural resource base, abundant human capital and, most important, strong entrepreneurial activity among its people, features that together signpost the road to private sector development. The report argues that the private sector is the engine of economic growth and of sustainable development in Africa, but most African private businesses are small, and the sector has relatively few firms in the medium and large categories—the “missing middle” and the “missing large.” Mainly due to financial constraints, small and medium enterprises (SMEs) in Africa struggle to survive and do not easily grow into large firms, with so many SMEs collapsing within the first three years – Africa as the “valley of death.”

The report indicates that even so, SMEs are the backbone of African economies, mainly because they represent about 90 per cent of private businesses and account for more than 60 per cent of employment in most countries. The number of large firms listed on national and regional capital markets is limited. A productivity gap between SMEs and large firms is common, explained by the

low-value-added and the labour-intensive sectors in which SMEs mostly operate, also by their limited use of technology and their low participation in foreign markets. The exceptions are SMEs that export or operate internationally, which are more productive, contribute more to higher-paying jobs (especially in low-wage segments of the economy), and grow four (4) per cent faster than non-exporting SMEs. The report shows that the lack of access to finance, especially for SMEs, is among the main impediments to private sector development in Africa. As the report points out, the financial services sector is still dominated by commercial banks. It features rudimentary forms of non-bank financial institutions (such as insurance firms and housing finance firms) and nascent capital markets (which do not provide the full mix of equity, company bonds, and government bonds). It lacks tailored financing mechanisms for start-ups and young enterprises (such as venture capital) and for company restructuring (such as leveraged buyouts).

The report highlights five key messages regarding innovative financing in Africa. First, financing innovations can arise from multiple sources simultaneously, such as banks, fintech, financial markets, and long-term sources like capital markets and development banks. Businesses need to consider leveraging different sources according to their financing needs - which may change as a firm goes through its growth cycle. In Africa, for example, large mature firms use capital markets to raise additional funding via initial public offerings (IPOs), but small new firms typically rely on retained earnings or informal borrowing. Second, a transparent and effective regulatory institution is mandatory to minimize risk and to oversee the financial operations of firms and peer institutions. For instance, the prevalence of high loan default rates in Africa is attributed to the lack of effective regulatory oversight, which eventually translates into high costs for loans. Third, the absence of a sound eco-system can impede firms even when financing is readily available, which affects firms of all sizes, depending on their stage in the growth cycle. Fourth, innovative financing of the private sector and for business growth generates firm value added, gainful employment, tax revenue for government, stable investment returns for entrepreneurs, and the growth of financial institutions. Those elements together boost economic growth, thus contributing to reduce poverty and inequality, and for achieving the Sustainable Development Goals (SDGs). Fifth, the transformation from innovative financing and from a fully operational financial sector to economic growth, lower inequality and reduced poverty is long term and necessarily involves feedback mechanisms. To enable economic recovery and reasonable SDGs progress, African economies should fully explore the contribution of innovative financing for the private sector and enhance the eco-system for private sector development.

The report provides five key recommendations. First, regulating the banking sector. Although innovative finance receives a lot of attention in the report, the

banking sector remains the most important source of capital for loans and funding to the private sector in most African countries, which need to regulate the banks. Moreover, to develop the private sector, governments need to strengthen and to make the regulation of banks and other sources of capital more transparent.

Second, creating financial stability through effective policies. The development of well-functioning financial systems requires not only sound regulations, but also supervisory mechanisms for banking, capital markets, and other financial services. Policymakers must continue to improve the regulation of the financial service sector and to support innovative financing in the private sector. Third, amending and updating financial sector legislation and regulatory policies. The report recommends that public policymakers (including central banks) consider amending banking and financial services legislation to enable innovative private sector funding. The process could lead to lobbying, to opening for a debate on a range of banking and financial service issues. The report suggests that African institutions, such as the Association of African Central Banks (AACB)⁷ and the UN Economic Commission for Africa (UNECA)⁸ should review existing financial regulatory policies in Africa further, identifying what works best in each sub-region and country, given the different stages of capital market development across the continent. Fourth, promoting innovative private sector financing. African governments must explore the full range of policy measures to stabilize the financial system and to enable continued funding of the private sector.

The report indicates that critical activities include continuing to increase African government capacity, to strengthen financial sector resilience, and to support all financial innovations that could mitigate the impact of the global COVID-19 pandemic on African economies. Fifth, embracing the African Union Digital Transformation Strategy (AUDTS)⁹ and the African Continental Free Trade Area (AfCFTA)¹⁰, the current global pandemic is expected to expand the use of fintech, including mobile money. The report indicates that Africa can deepen and broaden financial markets by supporting the digital payment systems and platforms that underlie electronic payments and transfers through two important continental integration initiatives, mainly, the African Union Digital Transformation Strategy (AUDTS) and the African Continental Free Trade Area

⁷ See on AACB: <https://aacb.org/>

⁸ See on UNECA: <https://www.uneca.org/>

⁹ See: <https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030>

¹⁰ See: <https://au.int/en/cfta>

(AfCFTA). These initiatives promise to streamline policies and regulations on critical aspects of digital payment systems and platforms across Africa.

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<https://www.oecd-ilibrary.org/docserver/0a5c9314-en.pdf?expires=1644998630&id=id&acname=guest&checksum=1B2DDA289EB5D9A3ECDD7F5F046B3828>, and: <https://doi.org/10.1787/0a5c9314-en>

The report “Africa’s Development Dynamics 2021” discusses the digital transformation for quality jobs; it was prepared jointly by the African Union (AU) and the OECD Development Centre. This edition of the series presents the latest information on development policies on the African continent and its five regions. It presents a new narrative assessing Africa’s economic, social, and institutional performance in view of the targets set by the African Union’s Agenda 2063. This third edition of the report on “Africa’s Development Dynamics” explores how digital transformation creates quality jobs and contributes to achieving the “African Union Agenda 2063”, thereby making African economies more resilient to the global recession triggered by the COVID-19 pandemic.

The AU/OECD Development Centre (2021) edition contains eight chapters, but includes also a. The first two chapters explore Africa’s digital transformation and priority actions, offering lessons for mutual learning across the continent and beyond. The next five chapters focus respectively on the five regions as defined by the Abuja Treaty: Southern, Central, East, North, and West Africa. These chapters tailor policy recommendations to each region. The eighth chapter discusses the state of Africa’s development financing in the context of the 2020 global economic crisis and highlights key policy areas to ensure its sustainability.

The report argues that the global economy was struck heavily by the COVID-19 pandemic in 2020, and that the path to recovery will depend on collective action. The African continent, which is highly exposed to external shocks, has experienced its first recession in 25 years, with a decline in gross domestic product (GDP) of between 2.1% and 4.9%, according to the scenarios mapped out by the African Union (AU) in July 2020 in collaboration with the OECD Development Centre. African governments have responded to the

pandemic with lockdowns, social protection measures, economic support measures, and recovery measures. The African Union (AU) is supporting these efforts, especially by setting up a COVID-19 fund to bolster the continent's response to the economic, social and health ramifications of the pandemic. It is, beside of organizing supplies of vaccines for the continent, also co-ordinating a call to creditors, including financial institutions, to cancel/restructure member countries' debt and to ease the burden from paying interest rates and debt repayments. Maintaining fiscal space is imperative if Africa is to play a key role in the global economic recovery, to facilitate the continent to create more jobs, and to achieve the goals set out under Agenda 2063.

The report indicates that safeguarding the progress made in terms of continental integration will also be essential. Flagship African Union initiatives in this regard include medium and long-term solutions to the economic crisis triggered by the pandemic, including the African Continental Free Trade Agreement (AfCFTA), which seeks to facilitate cross-border supply chains for food, pharmaceutical, and other essential products. The digital transformation could, in this context, drive more innovative, inclusive, and sustainable growth, and in so doing could contribute to the achievement of Agenda 2063. The third edition of the AU/OECD (2021) annual economic report examines how this transformation could support the creation of jobs and of new opportunities for young people. It sets out several examples of the continent's digital inventiveness, galvanised, it seems, by the COVID-19 crisis. The report indicates that digital transformation could help African societies to liberalise, to encourage productive entrepreneurship, to promote transparent governance, to diversify economies – making them more resilient to macroeconomic shocks – and to foster regional integration.

The report identifies four priorities for implementing this ambitious action plan. The First Priority focuses on ensuring universal access to the digital solutions best suited to local contexts. In addition to communication and energy infrastructure, a full range of public policies are needed to achieve a positive digitalization for all. This will involve reducing inequalities, especially between women and men, and between megacities and rural areas, as well as reducing the cost of accessing data, which is often higher than in other regions of the world. The Second Priority is related to making digital technology a lever for productivity, especially for small and medium sized enterprises (SMEs). Various African countries are leading the way in protecting intellectual property rights and digital security, and in facilitating financing solutions within a legal framework conducive to innovation. The Third Priority is related to developing skills tailored to the fourth industrial revolution (4IR) so that the expertise of the African workforce is aligned with 21st century markets, while facilitating the adoption of digital innovations by the informal sector. The Fourth Priority is related to co-ordinating the multiplicity of digital strategies at the continental,

regional, national, and local levels to better prioritise, implement, monitor, and evaluate progress. When the AfCFTA is implemented in 2021, it will include a component on establishing a single digital market in Africa that will complement multisectoral approaches.

The report suggests that for Africa's economic recovery to be sustainable, the digital transformation must be felt in all the continent's priority sectors. This will require the commitment of all stakeholders, both private and public, and of the continent's partners. As a partner, the OECD is making a significant contribution to this effort by developing a deeper policy dialogue on digitalisation between private stakeholders, civil society, and decision makers in Africa and other regions of the world.

The report indicates that COVID-19 poses an unprecedented threat to financing Africa's development by creating new risks and exacerbating pre-existing vulnerabilities. The amount of financing per capita decreased over 2010-18 for both domestic revenues and external financial flows, by 18% and 5%, respectively. Between 2019 and 2020, the ratio of tax to gross domestic product (GDP) is expected to decrease by about 10% in at least 22 African countries; total national savings could drop by 18%, remittances by a fourth; and foreign direct investment by 40%. Donors have pledged to maintain official development assistance (ODA) at their pre-crisis levels, although their capacity may depend on economic trends. This negative shock is increasing fiscal expenditure to support health and economic activities, which will probably double fiscal deficits. As a result, Africa's debt will soar to about 70% of GDP in current US dollars, with debt exceeding 100% of GDP in at least seven countries. The report indicates that the G20 debt moratorium that began in April 2020 provides a necessary respite for some African countries, but it remains insufficient. The report argues that suspending debt service and, in some cases, restructuring the debt may prove necessary to free up resources that are critical to achieving the African Union's "Agenda 2063: The Africa We Want". Where possible, debt negotiations should include the growing group of private sector lenders. Debt support is limited largely to official creditors.

The report argues that the COVID-19 crisis strengthens the role of digitalisation in contributing to Africa's productive transformation and in fulfilling Agenda 2063, the African Union's vision for the continent's development. The report indicates that the digital transformation is expanding to almost all economic sectors, most rapidly to healthcare due to COVID-19. The continent boasts headline digital successes. The mobile money revolution is a well-known example: with the world's highest number of accounts – 300 million – it is altering local job markets, starting in East Africa. More than 500 African companies provide technology-enabled innovation in financial services (fintech). Some African start-ups' valuations now exceed a billion dollars. Over 640 tech hubs are active across the continent. However, digital innovations must expand

far beyond these islands of success to achieve Agenda 2063 objectives and to create a mass number of jobs for the youth.

The report suggests that moving forward, governments can drive Africa's digital transformation and trigger large-scale job creation, by including spheres outside the digital sector, through four complementary actions which are described below. The *first action* is related to the promotion of the dissemination of digital innovations beyond large cities through place-based policies and ensuring universal access to digital technologies calls for enhancing coverage, affordability, and the availability of suitable content. The report indicates that Internet access has expanded thanks to the growing prevalence of mobile phones, for instance, as 72% of Africans now use them regularly, with the highest number in North Africa (82%) and the lowest in Central Africa (63%). The report indicates that however, digital adoption remains unequal across genders, income groups, and other socioeconomic and ethnic groupings. Only 26% of the continent's rural dwellers use the Internet regularly, compared to 47% of its urban inhabitants.

The report shows that the *second action* is related to preparing Africa's workforce to embrace digital transformation and to guarantee social protection. The report indicates that by 2040, own-account and family workers will represent 65% of employment under current trends. The share of own-account and family workers will be the highest in West Africa, accounting for 74% of employment in 2040, and the share will be lowest in North Africa at 25%. Presently, 45% of youth feel their skills are inappropriate for their jobs. The apparition of new livelihoods on the web requires setting solid regulatory schemes and providing social protection for informal iWorkers.

The report argues that the *third action* is related to removal of barriers to innovation that prevent smaller firms from competing in the digital age. The report indicates that dynamic small and medium-sized enterprises (SMEs) need support to adopt the most appropriate digital tools for innovation and trade. For example, having a website is positively associated with a 5.5% increase in the share of direct exports in firms' sales. Only 31% of firms in Africa's formal sector have a website, compared to 39% in Asia, and 48% in Latin America and the Caribbean. Today, only 17% of Africa's early-stage entrepreneurs expect to create at least six jobs, the lowest percentage found globally. Enticing these firms to scale up is critical for job creation.

The report finds that the *fourth action* is related to deepening regional and continental co-operation for digital transformation. The report indicates that the digital technologies pose new challenges to national regulators. Supranational co-operation can provide solutions in areas such as digital taxation, digital security, privacy, personal data protection, and cross-border data flows. The report suggests that harmonising continental and regional regulations is an important complement to national laws. The report indicates that, as of today,

only 28 countries in Africa have personal data protection legislation in place, while 11 have adopted substantive laws on digital security incidents.

The report is valuable as it gives a lot of new data on the continent and on the five regions of Africa, but also attaches useful policy recommendations. New insights are given on the dynamics of labour markets in times of digital transformation.

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3 Adoption of Digital Technologies in Africa

Sekoetlane Phamodi (Ed.), Michael Power, and Avani Singh (2020), Making ICT Policy in Africa: An Introductory Handbook, Friedrich Ebert-Stiftung, Published by fesmedia Africa, Friedrich Ebert-Stiftung (FES), P O Box 23652, Windhoek, Namibia; ISBN: 978-99945-77-89-7; 76 pages. Access for Download: <http://library.fes.de/pdf-files/bueros/africa-media/18173.pdf>

This handbook focuses on the making of ICT policy in Africa and argues that the information and communication technologies (ICTs) have had a profound impact on almost all areas of public and private life. From facilitating communication and information-sharing, increasing access to educational opportunities, ensuring better access to government services, and enabling business opportunities, these technologies have accelerated human development and have improved the quality of people's lives in incalculable ways. The handbook argues that ICT policy seeks to regulate the access to and the use of ICTs. It is essential that, as the role played by ICTs continues to expand, ICT policies are designed in a manner that is informed, rights-based, and technologically appropriate, and that barriers for scaling-up – including cost, access, infrastructure, and capacity – are addressed.

This Introductory handbook to the development of ICT policy in Africa aims to assist law makers, government officials, lawyers, civil society organisations (CSOs), academics, and members of the public who are engaged in the development and implementation of ICT policy. Its primary purpose is to provide an introductory overview of the fundamental concepts and the regulatory issues emerging in the process of ICT policymaking, and to introduce good practice models for how to approach both the process and the issues as they emerge. Also, this handbook aims to guide and to support the user to participate meaningfully in ICT policy making processes as they also develop their knowledge through further research and through direct experience.

This handbook seeks to provide users with the overarching principles, the good practices, and the strategies that can be applied in a multitude of circumstances. It may also be used as a training resource. Particularly, it provides

practical exercises and resources which can be completed in both self-managed as well as in facilitated learning contexts.

Regarding the format, the handbook is structured in four Chapters, mainly, Chapter 1 which focuses on ICT governance frameworks; Chapter 2 which discusses the digital ecosystem; Chapter 3 which shows the rights affected by ICT policy making; and Chapter 4 which discusses ICT policies. This composition makes it a valuable tool for developing countries in their ambition to develop an ICT Policy Framework.

Chapter 1 explains the Governance Frameworks and the reasons why they matter; it gives a conceptual understanding of what constitutes ICT policy. It distinguishes between different legal instruments and how they interact with one another to form the ICT governance framework. It further provides an overview of the main imperatives driving ICT policy development. Chapter 2 discusses the digital ecosystem and introduces the layer model of the Internet to frame a conceptual understanding of the digital ecosystem. It provides a conceptual understanding of what functions and relationships ICT policies typically govern, as well as identifying which key role players are involved in the development of ICT policy, and their respective and inter-related functions in this process. Chapter 3 discusses the rights affected by ICT policymaking; it sets out which rights are most directly impacted by ICT policies and how. It considers the public international law implications for how ICT governance frameworks are developed. It reflects on some of the most significant legal challenges and debates concerning human rights and the Internet. Lastly, it considers some existing principles and instruments for how domestic and public international law has been applied to selected ICT governance and human rights problems in Africa. Chapter 4 discusses ICT policies related to guiding principles and for the policymaking process in practice. It offers an overview of the guiding principles underpinning the ICT development process – from formulation to implementation. It outlines and describes the most significant steps in the ICT policy making cycle. It draws on the lessons learned in the policy development processes in various countries in the region and further abroad, providing comparative analyses and good practice guidelines, with specific reference to African examples.

The handbook discusses the ICT policymaking process and argues that the policy making process will always vary according to the laws, norms, and standards that have been set in place in the contexts where they must apply. The handbook discusses the four broad steps in the policymaking cycle which support the formulation of effective and responsive regulatory instruments: agenda setting; formulation and adoption; implementation; and evaluation and termination.

The Handbook is useful for policymakers in governments and for the entrepreneurs of the digital economy in Africa who seek to avoid legal and administrative barriers which are impeding their business activities.

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Cariolle, J. and Carroll, D., 2020, Digital Technologies for Small and Medium Enterprises and Job Creation in Sub-Saharan Africa, Research Report, FERDI (Fondation pour les études et recherches sur le développement international) 2020, 107 pages; access for Download: <https://hal.archives-ouvertes.fr/hal-03004583/file/rapport-ferdi-digital-technologies-for-small-and-medium-enterprises-and-job.pdf>

The report discusses digital technologies for small and medium enterprises and job creation in Sub-Saharan Africa. The report indicates that the future of African prosperity will probably depend on digital technologies adoption and diffusion. Digital technologies are called upon to play a critical role where individuals and firms are strongly constrained in their daily interactions by significant transactions costs, informational asymmetries, missing infrastructures, and high levels of uncertainty. These market imperfections, which are often structural in nature in Sub-Saharan Africa, have been accentuated by the Covid-19 crisis. In this context of current crises and long-lasting handicaps to development, the digitization of African economies opens new perspectives for removing obstacles to private sector expansion and job creation, especially so for Micro, Small and Medium Enterprises (MSMEs).

The report is the third one by the Digital for Development Research Initiative (DDRI). The report is an attempt to deepen the comprehension of the past, current, and forthcoming transformations induced by the diffusion of digital technologies among African small and medium enterprises (ASMEs). It provides an overview of the contributions of digital technologies to SME performance in Sub-Saharan Africa and of the perspectives offered by the ongoing digitization of the economy for private sector development. The report is divided into six sections. The first section provides the introduction; the second section provides a brief review of the literature to draw a general picture of the expected consequences of digitization on private sector development in Africa. The third section provides a descriptive overview of African SMEs, their size, their domestic performance, their export performance, and their degree of digitization. The fourth section is dedicated to an econometric investigation of the effects of the adoption and diffusion of basic digital tools and technologies being of relevance to SMEs – i. e. Internet, email, websites, and mobile money – on total sales, labour productivity, exports, and the workforce of SMEs. In the fifth section, the report takes a forward-looking approach through case studies on cutting-edge technologies and digital innovations adopted by several African

firms. This section consists of a review based on case studies for firms on the experiences of firms for overcoming logistics and mobility barriers in e-commerce, connecting the informal economy through digital platforms, using mobile technology and weather data for Insurtech, linking truck drivers and owners to cargo, using drone technologies to boost harvest and to improve health care access, unlocking green digital technologies to increase energy access, and streamlining municipal tax payments and water utility access for households and businesses. The use of these digital innovations in Africa is already widespread, and the case studies are highlighting their deployment contexts, obstacles, impacts, and the development potential. The sixth section concludes. Useful is the Executive Summary, and some of the appendices.

The report provides a significant contribution compared to existing empirical evidence on the impacts of digital technologies on African firms, as the quantitative analysis in the report presents various novelties. First, it investigates relationships between different usages of digital technologies – namely, Internet, email, websites, and mobile money – and various dimensions of firm performance – revenue, labour productivity, employment, and exports. Second, it exploits repeated cross-section survey data, drawn from the World Bank Enterprise Surveys covering a large sample of 40 African countries, surveyed between 2006 and 2018. Third, the empirical analysis separates the spill-over effects of digital technologies diffusion from the consequences of their individual adoption. Fourth, to identify the impacts of email on firm performance, the report adopts an instrumental variable (IV) approach, building on exogenous variations in international Internet connectivity induced by the staggered laying of submarine telecommunications cables (SMCs) and their exposure to external shocks. Finally, the report also adopts a forward-looking approach of appraising digitalisation in Sub-Saharan Africa. To this end, the report proposes a deeper dive on several promising key players currently pushing frontiers in the digitalisation landscape in Sub-Saharan Africa in general, and especially so in West Africa, using cutting-edge technologies and digital innovations to improve small and medium enterprise (SME) development and job creation throughout the region. It draws a big picture of both domestic and international firms leveraging a diverse set of technologies, serving diverse communities, and offering a wide array of products and services destined for SMEs as well as consumers.

The report uses data from the World Bank Enterprise Surveys (WBESs) conducted between 2006 and 2018 over separate samples of small and medium enterprises (with 20-99 equivalent permanent full-time workers) on the one hand, and micro-enterprises (with less than five equivalent permanent full-time workers) on the other hand, to draw a general picture of MSMEs located in some 42 sub-Saharan African countries. These surveys are representative of the formal, non-agricultural, and urban African private sector. Regarding the patterns

of digital technologies adoption by MSMEs, three main technologies are addressed: email and websites, which are Internet-based ICTs, and mobile money, which is a digital financial service. Information on mobile money technology is only available in recent waves of standard enterprise surveys for a restricted sample of SMEs covering 14 countries.

The report indicates that digital technologies are called upon to play a critical role where individuals and firms are strongly constrained in their daily interactions by large transaction costs, informational asymmetries, missing infrastructures, and high levels of uncertainty. These market imperfections, endemic in many regions of Sub-Saharan Africa, have been accentuated by the Covid-19 crisis. In the current context of a global health and economic crisis, and because of long-lasting handicaps to African development, the digitisation of African economies opens the door to new possibilities for removing obstacles to private sector expansion and job creation, especially so for Small and Medium Enterprises (SMEs).

The report indicates that the potential of basic digital technologies, such as email, websites, and mobile money, has not been fully exploited by African SMEs to date. While the uptake of mobile phone technology has facilitated the multiplication of Internet-based innovations throughout the region, this trend is hampered by the large Internet divide and the low levels of Internet penetration among firms. In 2015, Internet penetration rates in SSA did not exceed 60 percent of the population, with some countries like Niger, Sierra Leone, or Guinea-Bissau displaying penetration rates lower than five percent of the population. According to World Bank Enterprise Surveys conducted between 2013 and 2018, less than 60% of SMEs were using email for their operations, and less than 30% used a website for business-related purposes. By comparison, 90% of large firms surveyed over the same period declared using email and/or a website during their activities. The development potential of digital technologies is therefore strongly constrained by their low diffusion and use by SMEs, which are so far the greatest job providers and wealth creators in the region.

The report indicates that the empirical evidence suggests that beyond the direct dividends of digital technologies adoption by SMEs, their diffusion across space and industries may have not yet reached the critical mass of users to unleash their expected positive network effects, knowledge spillovers, or economies of scale. However, there is a subsequent risk that their burgeoning diffusion only benefits first-movers, large, and productive firms with sufficient absorptive capacity, at the expense of more fragile ecosystems, thereby concomitantly provoking revenue losses, job destruction, or firm exits. The report finds that indeed there is evidence of negative spatial spillovers on firm-level sales and employment, explained by localisation diseconomies, that is, by the negative spillovers of email diffusion among firms working in the same location and industry. These results therefore lend credibility to the hypothesis

that email diffusion increases competition between firms, and primarily benefits the most performing ones, as already evidenced in other studies in the literature.

According to the report, however, the empirical analysis, in line with recent findings on digitisation and job creation in Africa, supports that the net dividends of digital technologies on SMEs are positive. Analyses of the relationship between digital technology usage (i. e. email, websites, and mobile money) on firm-level performance indicators suggest that firms adopting digital technologies have more workers, higher sales, and higher exports, are more productive, and potentially generate positive spillovers on other firms. On the other hand, when the diffusion of these technologies remains limited, there is a risk that they benefit only the most highly performing or innovative companies, and they can generate negative spillover effects on the rest of the entrepreneurial ecosystem. Such evidence of thresholds in digital spillover effects suggests that the positive impact of digital technologies diffusion could be much larger if the digital divide within industries and locations is lower, and if the technology absorption capacity of firms is greater. Therefore, the analysis of the report gives additional support to legitimize key areas of intervention identified by development institutions and agencies: ensuring that the regulatory framework in the telecommunications and banking sectors is conducive to sustained investments in digital infrastructure and to the expansion of digital technologies and related services at affordable prices; developing digital skills and promoting digital entrepreneurship; and extending social protection coverage to protect the potential “losers” of the digitalisation process.

According to the report, the case studies on first movers and innovators harnessing digital technologies to overcome market failures which are affecting multiple sectors in SSA economies reveal key information on firm deployment, use of digital technologies, preliminary impacts, and challenges and obstacles to operations. The digital solutions concocted by these firms are often multifaceted and innovative in nature, combining such diverse technologies as cloud computing, blockchain, mobile money and airtime payments, mobile applications, drones, and digital platforms where service providers and clients can transact with one another. These firms have provided solutions to overcome barriers created by imperfect information, high transaction costs, underdeveloped market structure, and missing infrastructures, and so these firms are increasing market efficiency for both consumers and producers. The firms detailed in the report are operating in diverse sectors, including e-commerce, Insurtech, precision agriculture, medical logistics, transportation logistics, provision of electricity and municipal water services, job and gig economy platforms, and payment of municipal taxes. Many firms have won prestigious awards and secured significant investment funding, and several have shown significant positive impacts on both client and producer welfare as measured by econometric impact evaluations. In contrast, many firms have also been faced

with challenging setbacks, including unforeseen issues with digital technology, bureaucracy and red tape, low take-up of services, and problems with access to finance. The report finds that despite these challenges, the preliminary successes of these firms suggest that opportunities for leveraging innovative digital technologies to overcome market failures in SSA economies are significant.

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OECD/Organization for Economic Cooperation and Development, 2021, OECD Business and Finance Outlook 2021: AI in Business and Finance, OECD Publishing, OECD: Paris, September 2021, 161 pages. Access for Download:

**<https://doi.org/10.1787/ba682899-en>,
and: https://read.oecd-ilibrary.org/finance-and-investment/oecd-business-and-finance-outlook-2021_ba682899-en#page1, and:
<https://www.oecd-ilibrary.org/sites/ba682899-en/index.html?itemId=/content/publication/ba682899-en>**

The OECD Business and Finance Outlook 2021 is an annual publication that presents unique data and analysis on the trends, both positive and negative, that are shaping tomorrow's world of business, finance, and investment. The latest edition of the "OECD Business and Finance Outlook 2021: AI in Business and Finance" is on the role of Artificial Intelligence (AI). The report is the seventh edition of the "OECD Business and Finance Outlook" and it discusses important aspects of Artificial Intelligence (AI) in business and finance. The outlook indicates that Artificial intelligence (AI) is transforming many aspects of people's lives, including the way they provide and use financial services. AI-powered applications are now a familiar feature of the fast-evolving landscape of technological innovations in financial services (FinTech). Yet the world has reached a critical juncture for the deployment of AI-powered FinTech. The outlook indicates that policy makers and market participants must redouble their engagement on the rules needed to ensure trustworthy AI-powered applications for trustworthy financial markets.

The outlook is composed of six chapters, Chapter 1 examines the trends and policy frameworks for AI in finance, Chapter 2 focuses on AI in finance, Chapter 3 explains human rights due diligence through responsible AI, Chapter 4 discusses competition and AI. Chapter 5 examines the use of SupTech to enhance market supervision and integrity, and Chapter 6 discusses managing access to AI advances to safeguard countries' essential security interests.

The outlook indicates that Artificial Intelligence (AI) has progressed rapidly in recent years and is being applied in settings ranging from health care to scientific research, and to financial markets. It offers opportunities, amongst

others, to reinforce financial stability, enhance market efficiency, and support the implementation of public policy goals. These potential benefits need to be accompanied by appropriate governance frameworks and best practices to mitigate risks that may accompany the deployment of AI systems in both the public and private sphere. Using analysis from a wide range of perspectives, the OECD Outlook 2021 examines the implications arising from the growing importance of AI-powered applications in finance, responsible business conduct, competition, foreign direct investment, and regulatory oversight and supervision. It offers guidelines and various policy solutions to help policy makers achieve a balance between harvesting the opportunities offered by AI while also mitigating its risks.

The outlook indicates that deployment of AI applications across the full spectrum of finance and business sectors has progressed rapidly in recent years, such that these applications have become or are on their way to becoming mainstream. Artificial Intelligence (AI), i. e. machine-based systems which are used to make predictions, recommendations, or decisions based on machine or human input for a given set of objectives, is being applied in digital platforms and in sectors ranging from health care to agriculture. It is also transforming financial services. In 2020 alone, financial markets witnessed a global spending of over USD 50 billion in AI, and a total investment in AI venture capital of over USD 4 billion worldwide, accompanied by a boom in the number of AI research publications and in the supply of AI job skills.

The outlook argues that AI applications offer remarkable opportunities for businesses, investors, consumers, and regulators. AI can facilitate transactions, enhance market efficiency, reinforce financial stability, promote greater financial inclusion, and improve customer experience. Banks, traders, insurance firms, and asset managers increasingly use AI to generate efficiencies by reducing friction costs and by improving productivity levels. Increased automation and advances in “deep learning” can help financial service providers to assess risk quickly and more accurately. Better forecasting of demand fluctuations through data analytics can help to avoid shortages and overproduction. Consumers also have increased access to financial services and support thanks to AI-powered online customer service tools.

The Outlook 2021 indicates that as AI applications become increasingly integrated into business and finance, the use of trustworthy AI technologies becomes more important for ensuring trustworthy financial markets. Increasing complexity of AI-powered applications in the financial sector, as well as the functions supported by AI technologies, pose risks to fairness, transparency, and the stability of financial markets that current regulatory frameworks may not adequately address. Appropriate and transparent designs and uses of AI-powered applications are essential to ensuring that these risks are managed, including

risks to consumer protection and trust, as well as AI's ability to introduce systemic risk for the sector.

The Outlook 2021 shows that explain-ability, transparency, accountability, and robust data management practices are key to trustworthy AI in the financial sector. Explaining how AI algorithms reach decisions and other outcomes is an essential ingredient of fostering trust and accountability for AI applications. Outcomes of AI algorithms are often unexplainable, however, which presents a conundrum: the complexity of AI models, that can hold the key to great advances in performance, is also a crucial challenge for building trust and accountability. Transparency is another key determinant of trustworthy AI technologies. Market participants should be able to know when AI is being used and how it is being developed and operated to promote accountability and to help minimise the risks of an unintended bias and of discrimination in AI outcomes. Data quality and governance are also critical as the inappropriate use of data in AI-powered applications and the use of inadequate data can undermine trust in AI outcomes. Failing to foster these key qualities in AI systems could lead to the introduction of biases generating discriminatory and unfair results, market convergence and herding behaviour, or the concentration of markets by dominant players, among other outcomes, which can all undermine market integrity and stability.

This 2021 edition of the "OECD Business and Finance Outlook" focuses on these four determinants of trustworthy AI technologies in the financial sector. It examines these determinants in the key areas of finance, competition, responsible business conduct, and foreign direct investment, as well as their impact on initiatives by regulators to deploy AI-powered tools to assist with supervisory, investigative, and enforcement functions.

The Outlook finds that explain-ability, transparency, accountability, and robust data management practices are key components of the OECD AI Principles adopted in May 2019. Chapter 1 introduces these Principles and how they can be used to frame policy discussions on AI in the financial sector alongside two alternative and complementary frameworks – the AI Lifecycle system and the OECD framework for the classification of AI systems.

According to the Outlook explain-ability poses a defining challenge for policy makers in the finance sector seeking to ensure that service providers use AI in ways that are consistent with promoting financial stability, financial consumer protection, market integrity, and competition. Chapter 2 focuses on these issues. Difficulty in understanding how and why AI models produce their outputs can affect financial consumers in various ways, including making it harder to adjust their strategies in times of market stress. This chapter identifies recommendations for financial policy makers to support responsible AI innovation in the financial sector, while ensuring that investors and financial consumers are duly protected and that the markets around such products and services remain fair, orderly, and transparent.

The Outlook argues that robust data management practices can help to mitigate potential negative impacts of AI-powered applications on certain human rights. Chapter 3 highlights the importance of robust and secure AI systems for ensuring respect of human rights across a broad scope of applications in the financial sector, focusing on the rights to privacy, non-discrimination, fair trial, and freedom of expression. It sets out practical guidance to help mitigate these risks and illustrates how OECD Due Diligence Guidance for Responsible Business Conduct can assist financial service providers in this regard.

The Outlook explains that better accountability and less opacity in the design and operation of AI algorithms can help to limit anti-competitive behaviour. Chapter 4 explores the implications of AI for competition policy. It examines the potential anti-competitive risks that AI applications could create or heighten. These include collusive practices, but also strategies by firms to abuse their market dominance to exclude competitors or to harm consumers. Anti-competitive mergers may also pose concerns, for instance when they combine AI capacity and datasets. The chapter further discusses the detection problems, evidentiary challenges, and enforcement challenges related to AI that policy makers and competition authorities are starting to address.

The Outlook indicates that AI-powered applications developed for the public sector also need to be explainable, transparent, and robust. Chapter 5 analyses how regulators and other authorities are turning to AI applications to help them to supervise markets, to detect rule breaches, to enforce regulations, and to reduce the burdens on regulated entities. Supervisory technology (SupTech) tools and solutions face many similar challenges to private sector AI innovations, not least of all the need for quality data inputs, algorithm designs, outcomes that public officials understand, and investment in skills and public-facing transparency regarding use and outcomes. Each of these factors must inform governments' SupTech strategies.

The Outlook argues that governments also seek to strike a balance between transparency, openness, and security imperatives in the context of policies to guard against possible impacts of foreign acquisitions of some AI applications. Chapter 6 analyses recent developments in policies to manage risk for essential security interests that may result from transfer of AI technologies to potentially malicious actors or hostile governments through foreign direct investments. This chapter also explores related security concerns arising from financing of research abroad as a parallel legal avenue to acquire know-how that is unavailable domestically without requiring the acquisition of established companies.

The study is useful as an introduction to understand the new roles of Artificial Intelligence (AI) technologies for the dynamics of the financial market, for the outreach of regulation activities, and for the preservation of competition in financial markets and finance technology markets.

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4 Digital Transformation and Entrepreneurship in Africa

Schuerkens, Ulrike/Mohamed Branine/Aminu Mamman (eds). *Pour une sociologie du management en Afrique et dans le monde arabe*. Paris: L'Harmattan, 2019, 240 pages. ISBN: 978-2-343-18455-5, 26 Euros. Access to Info: https://www.editions-harmattan.fr/livre-pour_une_sociologie_du_management_en_afrique_et_dans_le_monde_arabe_ulrike_schuerkens_mohamed_branine_aminu_mamman-9782343184555-64629.html

Does this title announce a work on sociology or a work on management? After finishing the reading, I would say that it is a publication that can be classified in both categories according to the two implicit parts that compose it. This is one of the first books published by the researchers of the ManaGlobal Project which is affiliated with the European Union's Horizon 2020 Research and Innovation and Science Policy Experts (RISE) Group and particularly within the framework of the Marie Skłodowska-Curie grant agreement no. 823744. It is coordinated by Professor Ulrike SCHUERKENS of the University of Rennes 2, Professor Mohamed BRANINE of the University of Dundee in Scotland, and Professor Aminu MAMMAN of the University of Manchester. It is a collective work of two hundred and forty-five pages, composed of eight chapters written by different researchers who are involved in this ambitious research project.

The first chapter is the introduction in which the editors of the book present the objectives and the methodological discharge of ManaGlobal. Thus, they state that "ManaGlobal goes beyond literature reviews and academic debates to study realities on the ground through collaborative, exploratory, and ethnographic research that results in a clearer diagnosis and better understanding of business and management practice in African and Arab countries. The research aims to understand the specificities of business management in the context of African and Middle Eastern countries and in particular, the hybridization between i) globalized governance norms, mainly inspired by North American and European discourse and ii) local norms of business conduct that are products of local customs and sometimes political regimes."

The second chapter, entitled "Sociological and Anthropological Study of Globalization and Localization" is by Professor Ulrike Schuerkens. It is drawn from research on global management and local receptions in all major regions of the world over the past decades. It seeks to assess the general situation of management in the world, considering it as a social system where some countries are winners of socio-economic globalization, others are losers, and some are both.

In the third chapter, entitled "GLOBALIZATION: A Challenge for Management Practices in Companies Around the World", Ulrike Schuerkens

shows the diversity of practices that are covered by a hegemonic discourse on Western practices. The author uses case studies from different continents to give an overview of management practices in different regions of the world before presenting a critical and uncompromising assessment.

M. Branine and D. Pollard are the authors of the fourth chapter, which explores the nature and the content of Islamic management practices and their implications for human resource management (HRM) in Arab countries. Their approach is qualitative and based on an extensive review of the relevant literature and on the use of examples from selected Arab countries. They conclude that there is a gap between Islamic management theory and management practice in Arab countries. They argue that there is a gap between the knowledge available to national and international managers to carry out local management and the capacities of what is required of the local workforce to manage it effectively. The study is an important contribution to the scarce Francophone literature on the issues of Islamic human resource management (HRM).

Chapter five, written by A. Mamman and M. Zakaria, deals with spirituality and Ubuntu as a basis for building African institutions, organizations, and leaders. It aims to provide an innovative approach to building organizations and developing effective leaders and people, based on spirituality and the African philosophy of Ubuntu. The authors develop an argument to provide a theoretical and practical justification for using spirituality and Ubuntu to adapt the modern Western-based approach to managing organizations and their people.

Chapter six is a discussion of convergence/divergence theory in management. For A. Mamman, N. Baydoun and A. Bolanle Adeoye, who are the authors, the main purpose of the research is to answer the following question: Should multinational companies adapt innovation in human resource management (HRM) and if so, why and how? Using a methodological approach that is somewhat oversimplified because it is based only on firms in Nigeria, they arrive at results that suggest that the performance management (PM) policies of MNEs are partially "ethnocentric", while in domestic firms they are largely "polycentric". In addition, they find that many employees feel that their supervisors are biased against them and that their views are not considered when reviewing PM policies, nor do they receive feedback on their evaluations from their managers. The discussion of the implications of their findings is interesting.

In chapter seven, Michel Villette looks at the sociology of expatriates who are working in multinational companies in the United Arab Emirates (UAE). He analyses their integration into the social milieu and their lifestyles which are characterized by a search for personal enrichment away from the Emirati population. The author explores the social immersion activities of these workers which reveal an expatriation behaviour with little willingness or possibility of immigration/integration of the workers. He notes the need for further research to track the behaviour at the time of economic activities within firms.

The final chapter eight is a paper by M. Branine and C. Okecha on servant leadership¹¹. It explores the contours of this concept and analyses the literature devoted to it. Thus, they highlight several research results that conclude that servant leadership is generally effective and universal in scope. At the same time, they explore a rich literature on UBUNTU, an African philosophy that posits that an individual's existence is defined by the existence of other individuals and that "a person is a person through other persons". Hence their research question: "What do servant leadership and UBUNTU leadership have in common?" The empirical study they conducted to answer this question was done in ten (10) small and medium enterprises in Nigeria from which a sample of 285 employees were drawn. It concludes that, depending on the socio-economic context, the two types of leadership can coexist together or be deployed in parallel in African companies.

All in all, this book is a production signed by the ManaGlobal project; it aims to justify the project's merits through an analysis that highlights gaps in knowledge that the research conducted by the project team intends to help fill. In the collection, two moments can be clearly distinguished in the course of the work. The first is a descriptive analysis of the socio-economic and sociological context of the chosen field. The second is an analysis of the relevance and performance of human resource management (HRM) practices in Africa and the Arab world. All these studies are very interesting but remain essentially exploratory as they suffer from the same methodological limitations related to the composition and size of the samples selected. It is hoped that the results of the ManaGlobal project will make a significant contribution to the knowledge of managerial practices in Africa and the Arab world.

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The United Nations Conference on Trade and Development/UNCTAD (2021), Technology and Innovation Report: Catching Technological Waves, Innovation with equity, United Nations Publications, New York, and Geneva. 196 pages. ISBN: 978-92-1-113012-6/ eISBN: 978-92-1-005658-8/ISSN: 2076-2917/eISSN: 2224-882X/Sales No. E.21.II.D.8; Access for Download: https://unctad.org/system/files/official-document/tir2020_en.pdf

¹¹ Servant leadership: In the sense of empowering staff through staff leaders so that self-organization and value creation emerge in companies. See on the definition: <https://www.investopedia.com/terms/s/servant-leadership.asp>

The United Nations Conference on Trade and Development (UNCTAD) publishes its Technology and Innovation Report 2021 with the two major themes of Catching technological waves and Innovation with equity. The report was prepared during the times of the COVID-19 pandemic whose long-term implications are not yet clear. Nevertheless, the deep structural factors it addresses will apply both in normal times and in times of crisis. The report argues that human development in recent decades has been accompanied by rapid changes in technology and by an increasing proliferation of digitized devices and services. And the pace of change seems likely to accelerate being the result of “frontier technologies”, such as artificial intelligence (AI), robotics, biotechnology, and nanotechnology. These technologies have already brought enormous benefits – dramatically highlighted in 2020 by the accelerated development of coronavirus vaccines. But rapid advances can have serious downsides if they outpace the ability of societies to adapt. There are fears, for example, that jobs are disappearing as more economic activity is automated, and that social media is exacerbating divisions, anxiety, and doubt. Overall, there are concerns that frontier technologies will further widen inequalities or create new ones. Most of these issues have been voiced in developed countries. But the implications could be even more serious for developing countries – if poor communities and countries are either overwhelmed or simply left behind. The report considers how developing countries can catch the wave of frontier technologies, and how they are balancing innovation with equity in pursuit of the Sustainable Development Goals.

Concerning the structure, this report includes five chapters. Chapter 1 discusses catching technological waves. Chapter 2 focuses on forging ahead at the digital frontiers. Chapter 3 focuses on humans and machines at work. Chapter 4 discusses innovation with equity and assesses the impact of frontier technologies on users. Chapter 5 focuses on preparing for the future and argues that countries at all stages of development should promote the use, the adoption, or the adaptation of frontier technologies.

Chapter 1 discusses catching technological waves, prosperity amidst poverty, multifaceted inequalities, wide income gaps, drivers of income inequality, and reducing inequality. It summarizes the current state of global inequalities – indicating both their extent and their drivers. This chapter explains that during recent decades of digitization, the world has seen growing prosperity. People on average are living longer and healthier lives, getting more education and better access to clean water, sanitation, and electricity. Incomes too have been rising. Rapid economic growth in emerging economies has fuelled the rise of a global middle class. This chapter shows that governments can shape the policy environment and build domestic productive and innovation capacities to minimize the risks and to maximize the benefits – achieving innovation with equity. The report indicates that this will require a balanced approach, protecting

people while ensuring that these new technologies are used to build robust and sustainable productive capacities. At the same time, civil society organizations should be pressing for more equal and sustainable futures. The report suggests that all this activity can be supported by stronger international cooperation.

Chapter 2 focuses on forging ahead at the digital frontiers, on rapid growth of frontier technologies, and on a “frontier technologies readiness index”. This chapter looks at the rapid proliferation of frontier technologies and introduces a readiness index which shows which countries are best prepared to use, to adopt, and to adapt these technologies. This chapter shows that there is no single definition of frontier technologies, but they are generally understood to be new and rapidly developing technologies that take advantage of digitalization and connectivity. These technologies can have dramatic impacts on economies and societies as well as on the development of other technologies. This report covers 11 such technologies: artificial intelligence (AI), the Internet of Things (IoT), big data, blockchain, 5G, 3D printing, robotics, drones, gene editing, nanotechnology, and solar photovoltaic (Solar PV). Most of these technologies have emerged in a period of dramatic falls in the prices of data storage and solar energy. This report shows that frontier technologies can increase productivity and improve livelihoods. AI, for example, combined with robotics can transform production and business. 3D printing allows faster and cheaper low-volume production and rapid iterative prototyping of new products. Using these and other innovations, enterprises in developing countries can leapfrog previous paradigms and move ahead rapidly. This chapter shows that despite low resources and capabilities, many firms and farms are already doing so. In Nigeria, for example, IoT is being used to generate advice on farming techniques. And in Colombia, 3D printers are being used to create fashion items, such as caps, bracelets, and dresses. Only a few countries currently produce frontier technologies and in the short run this is unlikely to change. But all countries need to prepare for them. To assess progress, this report has developed a country readiness index. This index accounts for technological capacities which are related to physical investment, human capital, and technological effort, and covers national capacities to use, to adopt, and to adapt these technologies. The Readiness for Frontier Technologies Index (RfFTI) comprises five building blocks: ICT deployment, skills, R&D activity, industry activity, and access to finance. The index was calculated for 158 countries. In general, the economies most ready are in Northern America and Europe while those least ready are in sub-Saharan Africa, and in the developing economies generally. Developing countries need to work towards universal internet access and need to ensure that all their citizens have opportunities to learn the skills to be more ready for frontier technologies.

Chapter 3 shows humans and machines at work and discusses accelerating towards Industry 4.0. This chapter shows how frontier technologies could

transform economies and workplaces, affecting inequality through impacts on jobs, wages, and profits, increasing the risks of unemployment, and increasing income divides. The chapter discusses the impact of frontier technologies on labour markets and jobs, and the consequences for inequalities within and between countries. In many respects, frontier technologies have effects which are near to the technologies of earlier eras of technological innovation. They have great potential for addressing existing needs, increasing productivity, and improving livelihoods, and can play an essential part in development. The chapter shows that nevertheless, while offering distinctive opportunities, fresh waves of technological change also create new kinds of problems. One risk is that frontier technologies could disrupt labour markets. A standard view has been that innovations in processes increase productivity and thus destroy jobs, while innovations in products generate new markets and thus create jobs. There is also the possibility that frontier technologies could reduce the labour component of production, so reducing the incentive for developed countries to move labour-intensive work to less industrialized economies. Examined are also the challenges for developing countries, such as the demographic changes which may lower the technological and the innovation capacities; the slow diversification for production and trade; the weak financing mechanisms leading to low financial inclusion; and the issues of intellectual property rights and of technology transfers which are limiting industrialization. The chapter also indicates the importance of the national strategies for taking advantage of these technologies, and the role of promoting their use, adoption, and adaptation to diversify and to transform the structure of their economies and to generate higher and sustainable incomes.

Chapter 4 considers frontier technologies from the perspective of final users and discusses the ambitions of realizing innovation with equity. It discusses technologies as affecting inequalities through design and access, and the risks of biases and forms of discrimination. It examines how people are affected by goods and services that embody these technologies. Specifically, this chapter considers and looks at how the poor may be disadvantaged, either by lack of access, by biased design, or just by unintended consequences. It refers to the challenges for developing countries, including the rise of income poverty, the increase of digital divides, and the shortage of skills. This chapter also shows that technologies are affecting inequalities through design and access but shows also that frontier technologies have a huge potential for improving people's lives and protecting the planet. During the COVID-19 pandemic, for example, AI and big data have been used for screening patients, for monitoring the outbreak, for tracking and tracing cases of the disease, for predicting its evolution, and for assessing infection risks. Other examples have ranged from the use of IoT to monitor the quality of groundwater in Bangladesh and to the use of drones to deliver medical supplies to remote communities in Rwanda and Ghana. But

technology is rarely a solution on its own. Problems such as poverty, hunger, and climate change, or inequalities in health or education are inevitably complex and multidimensional. Technology is neither inherently good nor bad; it is a means to an end. Technology, frontier or otherwise, may support initiatives of all kinds, social, political, or environmental, but all technology needs to be used carefully if it is to help rather than hinder. This chapter shows that governments can direct technology towards sustainable development by extending the access to digital infrastructure and STI skills, by scaling up innovations that target the poor, by setting ethical frameworks, by conducting technology foresight and assessments, by supporting inclusive innovation, by deploying new technologies at scale, by improving public services, by bridging digital divides, by investing in STI skills, and by supporting active social citizens. This chapter suggests that governments will need to improve access to digital infrastructure, to develop the necessary skills, and to scale up innovations that target the poor.

Chapter 5 focuses on preparing for the future; it indicates that the impetus needs to come not just from national governments and the civil society but also from the international community. Together they can foster a global ecosystem that encourages innovation while protecting the vulnerable people and ensuring access for all. This chapter shows key requirements for equitable outcomes including national governance, international cooperation, and social activism. The chapter shows that technological progress is essential for sustainable development, but can also perpetuate inequalities or create new ones, either by limiting access to more privileged groups and affluent countries, or through built-in biases or unintended consequences. The task for governments is to maximise the potential offered by frontier technologies, while also mitigating harmful outcomes, and ensuring access for all. Countries at all stages of development need to promote the use, adoption, and adaptation of frontier technologies, preparing people and firms for the new possibilities ahead. The report suggests that the key requirements for equitable outcomes are including first, effective national governance to guide technological change; second, international cooperation for supporting developing countries and strengthening a global framework for science, technology and innovation (STI) for development; and third, vigorous citizen activism that can raise awareness and create a critical mass to ensure that society and institutions steer technological change towards sustainable and inclusive development. The report also suggests that the key policy areas are first, including guiding innovation towards reducing inequalities; second, adopting frontier technologies while mastering existing technologies and mitigating risks; and third, strengthening social protection systems to provide safety nets for workers who may lose their livelihoods. The report also suggests that priorities for international cooperation are including first, building stronger national capacities in STI and smoothing technology transfer; second, increasing women's participation in science, technology,

engineering, and mathematics (STEM); and third, improving foresight and technological assessment, and promoting an inclusive debate.

The report concludes by arguing that whole economies and societies are being reshaped by rapid technological change. As with earlier waves of technological revolution, the full picture will be slow to emerge. But it is safe to say that the long-term changes will be more far-reaching than we imagine – along all dimensions of development. To address these, governments and the other development actors will need to prepare fast. Developing countries, particularly the least developed countries, cannot afford to miss this new wave of rapid technological change. Governments cannot know how technologies will develop but they can help shape the paths that such technologies take in their own economies and societies. Each country will need STI policies appropriate to its stage of development. For some this will mean promoting frontier technologies while renewing efforts to take full advantage of existing technologies to diversify their economies and to upgrade traditional sectors such as agriculture. Others can engage more deeply with the development of frontier technologies. But all countries need to prepare people and firms for a period of rapid change. For developing countries, success in the twenty-first century will require a balanced approach – building a robust industrial base and promoting frontier technologies that will help deliver the 2030 Agenda and its global vision of people-centred, inclusive, and sustainable societies.

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5 Africa, Development Assistance, and the Global Race between USA and China

Mzukisi Qobo (2022), *The Political Economy of China - US Relations. Digital Futures and African Agency*, International Political Economy Series: ISSN 2662-2483/ISSN 2662-2491 (electronic), Print ISBN: 978-3-030-86409-5/Electronic ISBN: 978-3-030-86410-1; Palgrave Macmillan, Springer Nature Switzerland AG (2022), 6330 Cham, Switzerland. Access for Download (chapter by chapter): <https://link.springer.com/book/10.1007/978-3-030-86410-1>

This book offers a rich perspective on Africa's agency in the changing global order marked by intense geopolitical contestations. It discusses ways in which the African continent has been on the margins of the global economic system because of the actions of major powers and Africa's own leaders, and how this legacy can be overcome. The book covers an uncharted ground in analysing the intersection between geopolitical rivalry, digital futures, and Africa's place in the world. This text makes a clarion call for African leaders and citizens to define

better development pathways for the continent through insisting on ethical and transformation leadership as well as building credible institutions that are inclusive. This, according to the author, will ensure a sounder basis for Africa's positive agency. Further, the book makes a strong case for structural transformation that is innovation-led, and that African decision-makers should leverage US-China rivalries to achieve Africa's own development interests. The book covers an uncharted ground in analysing the intersection between geopolitical rivalry and digital futures. It sheds light on the history of race in the USA and how this undermined America's moral leadership in the world. It assesses the extent to which the US-China rivalry over trade and technology are redefining Africa's agency. The book is a source from Africa (South Africa), and the basic idea is to look at the history of the continent and the impact of the trade and technology rivalries between USA and China. This is a fruitful approach as China and USA bring their development models and experiences to Africa, and they are the strong powers in global technology competition, especially so for ICT (information and communications technologies).

The book has three parts. Part 1 is on Imperfections of the International Liberal Order and Africa's Plight. The defects of the International Liberal Order (in the form of the international monetary system and the international trading system) are related to Africa's position in the multilateral economic system which excluded more and more Africa from agenda-setting. In the Part 2 Africa is studied as a Theatre for Major Power Rivalries. The chapters on the US-China rivalry and on the US-Africa relations show that Africa was not given the chance to bring in their long-term interests for structural transformation and a multilateralism which may have been benefitting the continent. In the Part 3 there is a discussion of Digital Futures and African Agency. It is important to understand that Africa's agency was weakened over decades, and that the global digital transformation is a new point in world history where Africa can regain its position as an agent. There is a valuable discussion on the implications of US-China Tech wars and what all this means for Africa. Africa's Digital Futures are analysed by looking at the power play between USA and China and what it means for Africa in the current phase of continental integration. This is a timely analysis of the digital age and the implications for Africa, and it makes very clear that Europa has lost not only its credibility as a geopolitical actor, but also its position to shape the future of Africa technologically and economically. To avoid new dependencies for Africa, the continent needs to work on self-reliant digital transformation strategies by selecting with great care and foresight the digital paths which the continent and the members of the African Union (AU) would need to go, by applying the fourth industrial revolution (4IR) technologies (from 5G to AI tools). This means that dependence exclusively on one tech giant (either from China or USA) will not be helpful at the African country-level or the

regional level. African agency will be a key task to be determined at all governance levels in Africa (the public and the private ones).

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Balineau, Gaëlle, Arthur Bauer, Martin Kessler, and Nicole Madariaga (2021), *Food Systems in Africa: Rethinking the Role of Markets*, Africa Development Forum Series. A co-publication of the Agence française de développement (AFD) and the World Bank, Washington, D. C.: IBRD/The World Bank. Bibliographic information: doi:10.1596/978-1-4648-1588-1. ISBN (paper): 978-1-4648-1588-1/ISBN (electronic): 978-1-4648-1589-8, World Bank Publications, 11 January 2021 - Business & Economics. 167 pages. Access for Download: <https://documents1.worldbank.org/curated/en/411891611821377295/pdf/Food-Systems-in-Africa-Rethinking-the-Role-of-Markets.pdf>

This report discusses food systems in Africa and the role of markets; it covers physical food markets. This volume, jointly published by the World Bank and the Agence française de développement (AFD), the French development agency, fills an important research gap by examining food supply and distribution infrastructure. In their focus on the upstream and downstream environments of food markets, the report sheds light on the literature, but they also consider a development that cannot be accepted, that “hunger is gaining ground”. Food remains Africans’ largest household expense, consuming 44 percent of budgets on average. Therefore, the issue discussed in the book is so important for Africa and the Africans.

The report presents a systemic analysis of food markets that runs through a continuum of actors, from producers to consumers. The report criticises the practice of financing isolated (development) projects that excessively concentrate on production and that neglect logistics, distribution, consumers, and market governance more broadly. National governments and their technical and financial partners are included in this critique, which consequently advocates for a more systems-oriented approach to programmes that would genuinely strengthen the capacity of African societies to achieve the United Nations’ food-related Sustainable Development Goals (SDGs).

The report indicates that the responses to the COVID-19 pandemic have affected food systems, disrupting national and international supply chains with curfews, travel reductions, and other constraints for overland, air, and marine freight operations. Wholesale and retail food distributors have had to shut down or partially close markets, reducing access for all city dwellers, especially the most vulnerable populations who depend on markets and street vendors. Producers and growers, too, have lost customers and sales, as have traders and small truckers. These - often informal - workers have then lost their means of

subsistence. The report shows that the effects of the COVID-19 pandemic on the African continent worry many observers, even though each country's situation differs in the intensity of the crisis, the measures taken by its national and local governments, and the effectiveness of its domestic and international food supply and distribution channels.

The report indicates that enormous food security challenges loom in the wake of the COVID-19 pandemic. The volume was published during the near-term COVID-19 emergency. The volume indicates that in the medium term, the food system's weaknesses uncovered by the pandemic will call for solutions that bolster food system sustainability and resilience. The volume's systems-oriented, structural analysis provides substantive solutions to such issues. The systemically important role of food markets has been recognized for a very long time. Although some issues confronting contemporary African food systems differ from those of 10 or 20 years ago, but others remain constant. Exceedingly high transaction costs between African producers and consumers contribute to a too-high cost of living, by about 30 percent, forcing large swathes of Africans to remain in relative or extreme poverty.

The volume examines food systems in three West African cities—Abidjan (Côte d'Ivoire), Rabat-Salé-Témara (Morocco), and Niamey (Niger) - and confirms the negative country-specific effects of the "non-markets situation" of inefficient urban food supply chains. Espousing a dynamic vision of food markets, the volume discusses major trends such as the rapid uptake of information and communications technologies by the food value chains, the effects of such technologies, the rapid development of supermarkets, and the risks associated with climate change and poor governance - trends that call for thinking about tomorrow's food systems today.

The report indicates that rapid population growth, poorly planned urbanization, and evolving agricultural production and distribution practices are changing "food ways" in African cities and creating challenges: Africans are increasingly facing hunger, undernutrition, and malnutrition. Yet change also creates new opportunities. The food economy currently is the main source of jobs on the continent, promising more employment in the future in farming, food processing, and food product distribution. These opportunities are undermined, however, by inefficient links among farmers, intermediaries, and consumers, leading to the loss of one-third of all food produced. The volume is an in-depth analysis of food system shortcomings in three West African cities: Abidjan, Côte d'Ivoire; Rabat, Morocco; and Niamey, Niger. Using the lens of geographical economics and sociology, the report draws on quantitative and qualitative field surveys and on case studies to offer insightful analyses of political institutions. The volume shows the importance of "hard physical infrastructure", such as transport, storage, and wholesale and retail market facilities. The volume also describes the "soft infrastructure" of institutions that facilitate trade, such as

interpersonal trust, market information systems, and business climate. The volume finds that the vague mandates and the limited capacities of national trade and agriculture ministries, regional and urban authorities, neighbourhood councils, and market cooperatives often hamper policy interventions. The main volume provides the conclusion that the international development policy makers and their financial and technical partners have neglected urban markets for far too long, and that now it is the time to rethink and to reinvest in this complex yet crucial subject.

The organization of the volume includes an Overview and three chapters which are organized as follows: Chapter 1 describes the challenges of improving in African cities food system sustainability via market infrastructure; Chapter 2 then focuses on physical infrastructure in the three cities Abidjan, Rabat, and Niamey; Chapter 3 focuses on new private sector and government institutions to facilitate market matching in the three African towns. Regarding the methodology, the volume uses an analytical approach using case studies for three West African Cities. Because the cross-cutting nature of food systems and market infrastructure calls for using several disciplines and tools to inform about operational policy recommendations, the volume is based on case studies of three cities: Abidjan in Côte d'Ivoire; Rabat-Salé-Témara in Morocco, and Niamey in Niger. To assemble these case studies, the volume collected quantitative and qualitative data on urban markets by conducting numerous surveys. The volume indicates that the three cities present different geographical locations and income levels, making it possible to highlight common features and important differences - all being useful for informing public policies. To complement the insights from the case studies, the volume draws on a review of the geographical and urban economics literature for its theoretical framework. The main finding of the report shows the role of physical market infrastructure in connecting farmers to urban consumers and shaping regions.

The report mentions that there is one simple conclusion of the analysis, that international development policy, but also then national and local development policy, have neglected urban food markets for too long so that the agriculture sector, the agribusiness firms, and the agricultural processing value chains were also suffering from neglect. The book gives a reemphasis on this fact, based on food market cases in African cities. It is valuable that the book starts with a look at the relevant SDGs and then gives a focus on market infrastructure as reflecting on the foods systems' physical and institutional infrastructure. It is not clear what is new in this book, but it is not at all bad to reemphasise the issues in this form, based on the SDGs and some new data.

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Guillaumont P., Guillaumont Jeanneney S., Wagner L. (2020), *Measuring vulnerabilities to improve aid allocation, especially in Africa*, 149 pages. Fondation pour les études et recherches sur le développement international (Ferdi), juillet 2020, ISBN: 978-2-9550779-7-9, FERDI, Clermont-Ferrand, France ; Access for Download:

<https://ferdi.fr/dl/df-kGGi2VeycifCXwsrwDr3kSxP/book-measuring-vulnerabilities-to-improve-aid-allocation-especially-in-africa.pdf>

The book focuses on measuring vulnerabilities to improve aid allocation, especially in Africa. This book is part of a long research work conducted at the Foundation for Studies and Research on International Development (FERDI) about vulnerability and the allocation of foreign aid. For more than 10 years, FERDI has argued that aid allocation should account for the structural vulnerability of recipient countries. FERDI has produced a variety of theoretical and practical work on the subject, and progress has been made in this area on the international scene. The book presents a conceptual framework to account for the different forms of vulnerability in the allocation process. It shows that it is possible to do this without calling into question the principle of performance-based allocation, a principle to which donors are attached, but on the contrary makes performance-based allocation more credible.

The book explains that the rules governing the selection of countries to get support at the World Bank and the African Development Bank (AfDB) only account for the vulnerability of African economies, by approaching the problem mainly through the creation of special windows or funds. This derogatory approach breaks from the general allocation rule which is based mainly on an assessment of countries' performance in terms of economic and social policies. On the other hand, the European Commission (EC) makes structural economic vulnerability an important criterion for the allocation of assistance.

The aim and purpose of the book is to show why, and how, to reform the allocation system of the World Bank and of the African Development Bank (AfDB) to better account for African vulnerabilities. The structure of the book is organized in four parts. The first part of the book explains the rationale for the reform by showing that accounting for the vulnerability of African economies for aid allocation would increase the effectiveness, equity, and transparency of aid. The second part examines the issue of the most appropriate vulnerability indicators to be used in an aid allocation formula. The third part presents the general conceptual framework in which the reform should be implemented and shows through some simulations of various allocation models that the proposed reform is possible and necessary. Finally, the fourth part shows how aid for regional integration can also be in response to the vulnerability of African countries which are characterized by their small size or their remoteness.

The scientific relevance of the book appears from the fact that it was published in this period of the coronavirus pandemic which is throwing an unforgiving light on the importance of the attention paid to the problems of vulnerability by international financial institutions. Although the analysis in the book does not deal specifically with the vulnerability which results from a global health shock like coronavirus because it deals with natural shocks which are recurrent or increasing in magnitude, and are different for different countries, however, the analysis contributes in two ways to taking the global coronavirus pandemic into account. Firstly, the effect of coronavirus will be felt differently in the different countries covered in the book depending on the indicators of economic vulnerability and of societal vulnerability proposed in the book. Secondly, the structural factors of resilience are similar whatever the nature of the shock. It just needs to be noted that the response to exceptional global shocks like coronavirus cannot be met by a process of regular aid allocations, but rather by exceptional measures. After what is hoped will be an immediate international response to the coronavirus shock, if the future aid allocation is made on the principles proposed in the book, the criteria used would naturally reflect the shock received from the coronavirus depending on the country.

The book argues that it is widely recognized that, on average, African countries are not only poorer, but also more vulnerable than countries in other continents. This high vulnerability, combined with low income per capita, is a major handicap to their development. The vulnerability of an economy results from the apparition or the recurrence of exogenous shocks of various origins, such as economic, climatic, or societal shocks. This may be due to the instability of the international price of primary products, which still constitute a large proportion of the exports of many African countries, or episodes of severe drought, which drastically reduce agricultural production (or, conversely, floods), or violence, for instance when the country becomes the hub of an international drug trade or is raided by foreign armed gangs or, as recent history has shown, is affected by epidemics and pandemics that are costly not only in terms of human lives but also in terms of economic activity. If the economic vulnerability of African countries is not new, their political fragility seems to have increased, and it is likely that climate change will exacerbate its consequences.

African countries are likely to be hit by climate change in the coming years, even though they can hardly be blamed for it. The book indicates that this is a challenge for the international aid policy of developed countries. Many structural factors lead to the high sensitivity and exposure of African economies to exogenous shocks, whether it is small size, geographic location, or simply low level of development resulting in a lack of infrastructure and low diversification of activities. It is the responsibility of national policies to mitigate the consequences of exogenous shocks, however, while resilience to vulnerability

depends largely on the will of governments, there are also structural factors which condition resilience. A low level of development of any African country is usually accompanied by a low level of education and health, an age structure of the population which has a high proportion of young people, and often the presence of refugees from other vulnerable African countries. These characteristics of African economies weigh on their public finances and make counter-cyclical fiscal policies difficult to implement. In addition, low human capital reduces the capacity of the public and private sectors, factors which are critical to resilience. The common history of many African countries has shown how economic growth and human development are threatened by exogenous shocks of various origins.

The book explains that for this reason the fight against vulnerability must be at the heart of international aid policy for African countries (and as well so for other similar developing countries). This requirement is all the stronger because nearly half of international aid goes to the African continent and its effectiveness depends largely on its suitability for Africa's characteristics. The book explains that there are many aid donors in Africa, but most international aid is concentrated in a few donors. Among those which formally reported donations to the OECD's Development Assistance Committee (DAC) in 2017, multilateral aid was 43%. The biggest of the multilateral aid agencies is the World Bank through the International Development Association (IDA) with 14.3%, followed by the European Commission, although often considered as a bilateral donor, with 9.5%, and then the African Development Bank (AfDB) with 4%.

The book is of interest for all those experts who think that aid to Africa can be improved; it may be possible to consider more indicators, factors, and criteria for aid to give a better base towards recognizing the structural vulnerabilities of African countries.

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Roberts, T. and Hernandez, K. (2021), *Open Data for Agriculture and Nutrition: A Literature Review and Proposed Conceptual Framework*, The Institute of Development Studies (IDS) Working Paper Volume 2021, Number 545, January 2021, Brighton, UK: Institute of Development Studies (IDS), 39 pages, DOI: 10.19088/IDS.2021.018. Access for Download: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/15928/IDS_Working_Paper_545.pdf?sequence=1&isAllowed=y

This working paper reviews the existing literature on Open Data for Agriculture and Nutrition (ODAN). The review was commissioned as a background paper for a performance evaluation of the Global Open Data for Agriculture and Nutrition programme (GODAN). This working paper was produced as part of the Global Open Data for Agriculture and Nutrition (GODAN) initiative. The

structure of the paper includes seven sections. Section 1 presents an introduction, Section 2 explains Open Data, Section 3 discusses Global Open Data for Agriculture and Nutrition (GODAN), Section 4 discusses barriers to Open Data use, Section 5 examines Gender barriers to Open Data, Section 6 discusses Open Data for Agriculture and Nutrition, and finally, Section 7 provides the Conclusions and Recommendations.

This paper begins by locating the Global Open Data for Agriculture and Nutrition project (GODAN) in the context of wider debates in the Open Data movement by first reviewing the literature on Open Data (OD) and on Open Data for agriculture and nutrition (ODAN). The review identifies various important gaps and limitations in the existing literature. There has been no independent evaluation of who most benefits or who is being left behind regarding ODAN. There has been no independent evaluation of gender or diversity in ODAN or of the development outcomes or impacts of ODAN. The existing research on ODAN is over-reliant on key Open Data organisations and on Open Data insiders who produce most of the research. This creates a bias in the data and analysis. The authors recommend that these gaps are addressed in future research.

The paper contributes a novel conceptual ‘SCOTA’ framework for analysing the barriers to and drivers of Open Data adoption, which could be readily applied in other domains. Using this framework to review the existing literature highlights the fact that ODAN research and practice has been predominantly supply-side focused on the production of open data. The authors argue that if Open Data is to ‘leave no one behind’, greater attention now needs to be paid to understanding the demand-side of the equation and the role of intermediaries. The paper argues that there is a compelling need to improve the participation of women, people living with disabilities, and other marginalised groups in all aspects of open data for agriculture and nutrition. The authors see a need for further research and action to enhance the capabilities of marginalised people to make effective use of Open Data.

The paper concludes with the recommendation that an independent strategic review of Open Data in agriculture and nutrition is overdue. Such a review should encompass the structural factors shaping the process of ODAN, include a focus on the intermediary and demand-side processes, and identify who benefits and who is being left behind.

The discussion on Open Data for Agriculture and Nutrition is of great importance, as this sector is so relevant for the global society when implementing key SDGs (on poverty, hunger, women empowerment, peace, etc.) Many platforms on Open Data exist, related also to agriculture and nutrition, but their scope is different, and their value is often limited.

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6 Africa, Digitalization, and the Sustainable Development Goals

Sachs, J., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. (2021), for the Sustainable Development Solutions Network (SDSN), **Sustainable Development Report 2021, The Decade of Action for the Sustainable Development Goals; Includes the SDG Index and Dashboards**, Cambridge, UK: Cambridge University Press. First published 2021, ISBN 978-1-009-09891-5 Hardback/ISBN 978-1-009-10289-6 Paperback; 518 pages; Access for Download:

<https://s3.amazonaws.com/sustainabledevelopment.report/2021/2021-sustainable-development-report.pdf>, and the Press Release: <https://www.sdgindex.org/news/press-release-sustainable-development-report-2021/>

The report is introduced in the press release by the authors in the following way: “New Report shows COVID-19 Reversed Progress on the UN Sustainable Development Goals, Calls for Increased Fiscal Space in Developing Countries

New York, 14 June 2021 - Today, the Sustainable Development Report (SDR), including the SDG Index and Dashboards to track progress on the Global Goals for 2030, was released. For the first time since Heads of State of all 193 UN member countries agreed on these universal goals at a historic summit in 2015, the annual report shows a reversal in progress. The report was written by a group of authors led by Prof. Jeffrey Sachs, President of the Sustainable Development Solutions Network (SDSN). Published by Cambridge University Press, the publication outlines the short-term impacts of COVID-19 on the SDGs and describes how the SDGs can frame the recovery.”

Jeffrey D. Sachs, President of the SDSN and first author of the report, says about the importance of the report:

“For the first time since the SDGs were adopted in 2015, the world lost ground on the SDGs in 2020. The Covid-19 pandemic has created not only a global health emergency but also a sustainable development crisis. To restore SDG progress, developing countries need a significant increase in fiscal space, through global tax reform and expanded financing by the multilateral development banks. Fiscal outlays should support the six key SDG transformations: quality education for all, universal health coverage, clean energy and industry, sustainable agriculture and land use, sustainable urban infrastructure, and universal access to digital technologies.”

Two key elements are mentioned: first, a significant increase of the fiscal space is needed to restore SDG progress and second, the six key SDG transformations need finance. The Report is consisting of five (5) parts. Part 1 is on increasing the Fiscal Space of developing countries to achieve the SDGs; Part

2 is on the SDG Index and Dashboards; Part 3 is on Policy Efforts and Monitoring Frameworks for the SDGs; Part 4 gives a Methods Summary and Data Tables; and Part 5 is on Country Profiles. Most important is the country evidence. Based on the country data one can look at gaps, challenges, and progress already achieved. The country tables are highly informative, and so for developing and developed countries like Ghana and Germany we see the challenges, the trends, the available data collected for a particular year, and we see more specific information, such as on international spillover index, as well as most relevant information for all the 17 SDGs. The data coverage for countries is great, so that we get first-hand information on all relevant issues covered by the 17 goals and targets. This coverage allows it to compare values and scores for groups of countries, for groups of SDGs, and for specific analytical purposes. Two further messages are important: Enhancing international cooperation, along SDG 17, and overcoming the negative spillover effects, such as following from unsustainable supply chains which are managed by high-income countries, are a global responsibility. A stronger multilateral system is recommended by the report, but the opposite trends is occurring now; the aggression of Russia against Ukraine is devastating further the multilateral system and reduces the ability of so many countries to follow the SDGs. Germany has a rather low international spillover index, compared to the much higher and better index values of Africa, Asia, and Latin America. It is even far worse than the average of OECD members. Thereby such countries as Germany undermine the ability of other countries to reach the goals and targets of the SDGs. And the report also argues that too many countries do not use the SDGs in their budget planning, and too many countries are not active enough to eliminate the statistics gaps which are still limiting policy advances (what is especially the case for SDG 4-quality education, SDG 5-gender equality, SDG 12-responsible consumption and production, SDG 13-climate action, and SDG 14-life below water). The COVID-19 pandemic has also underlined the need to accelerate progress towards universal access to key infrastructure, especially to digital infrastructure. This is a global concern, a global public good, not a task to be left to global tech companies.

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UNECA/United Nations Economic Commission for Africa/AU/African Union/AfDB/African Development Bank/UNDP/United Nations Development Programme (2022), 2020 Africa Sustainable Development Report, Towards Recovery and Sustainable Development in the Decade of Action, 116 pages, Access for Download:

<https://repository.uneca.org/bitstream/handle/10855/47554/2020%20Africa%20sustainable%20development%20%20report.pdf?sequence=1&isAllowed=y>

The report has nine chapters. Chapter 1 is the Introduction; chapter 2 is on COVID-19 impacts on the 2030 Agenda and the Agenda 2063; chapter 3 is presenting a synopsis of Sustainable Development Goal progress and challenges; chapter 4 is on Pillar One (People); chapter 5 is on Pillar Two (Prosperity); chapter 6 is on Pillar Three (Planet); chapter 7 is on Pillar Four (Peace); chapter 8 is on Pillar Five (Partnerships); and chapter 9 is on Conclusions and Recommendations. Grouping the SDGs into Pillars 1-5 is useful, as the specific focus on the progress of the SDGs becomes quite clear. And the interaction of the five pillars for policy responses is becoming very transparent.

Concerning the People Pillar (Pillar One) it is argued that poverty reduction is the key element to solve the many other problems of Africa (hunger, health, education, and gender). Poverty is seen as the most important “proxy indicator” for assessing the progress regarding the People Pillar. The trend in Southern Africa with an increase of the poverty headcount ratio from 44 percent in 2010 to 47 percent in 2019 is considered as unexpected, while the very high poverty headcount ratio of Central Africa with around 60% is not a surprise, but signals that this region has the highest rate extreme poverty, when measured by the headcount ratio. COVID-19 will hinder the requested multiplication of efforts to combat poverty. The progress on the Prosperity Pillar (Pillar Two), with economic growth, energy access, and Internet access, has not yet reached the “critical take-off point” for Africa, as argued in the report. An acceleration of inclusive prosperity was not reached, so that households, small enterprises, and large industries are negatively affected. The Prosperity Pillar and the People Pillar are connected, so that advances on both sides are needed to take off in regard of the goals and targets of the Sustainable Development Agenda 2030 and the African Union Agenda 2063.

Concerning the Planet Pillar (Pillar Three), the Environmental Performance Index (EPI) shows that only seven (7) countries are placed among the top 100 out of 180 ranked countries (Seychelles, Egypt, Gabon, Mauritius, Morocco, South Africa, and Tunisia). This means that the slow progress regarding the Planet Pillar adds to the problems which are emphasized for the People Pillar and the Prosperity Pillar. Increasing resource flows for environmental protection may be useful but will be most effective if coordinated with the People Pillar and the Prosperity Pillar. The slow progress of the Peace Pillar (Pillar Four) will require substantial governance and security sector reforms in most of Africa; the perspectives are poor because of the rising gap between democratic and authoritarian states. Again, the progress regarding the People Pillar and the Prosperity Pillar are dependent on progress of the Peace Pillar, as good governance, rule of law, and improved security are the base of progress with regard of the other pillars. The Partnerships Pillar (Pillar Five) is revealing severe gaps in mobilizing domestic resources, in channelling foreign resources to key projects, and in consolidating debt management. Too many African countries

fail in terms of taking full responsibility for financing their development goals. Fiscal capacity is even weakened because of COVID-19. So, the progress of the People Pillar and the Prosperity Pillar will require a close coordination with the other three pillars to become accelerated. Therefore, most of the African states are not on track to meet the goals and the targets of the Sustainable Development Agenda 2030 and the African Union Agenda 2063. A full redirection of strategies and policies is needed to make this turn possible. A solution can be found according to the report in “higher-order” strategy approaches (strategic planning, budgeting, and implementation; strengthening adaptive policies and institutional capacities; and identifying and implementing accelerators that are linked to recovery and renewal). But the reviewer of the report is not accepting the argument of the editors (p. 13) that the highest priority pillars are the People, the Prosperity, and the Peace Pillars. The five mentioned accelerators ignore the accelerators from the side of climate protection and domestic fiscal mobilization. But the report is useful as the pillars are tools to focus on a new policy orientation towards realizing the SDG Goals of the Agenda 2030 and the Goals from the African Union Agenda 2063.

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Pathways Network (2022), “Transformative Pathways To Sustainability: Learning Across Disciplines, Cultures and Contexts”, The Pathways Network, London; New York: earthscan from Routledge, 2022. Series: Pathways To Sustainability. ISBN: 978-0-367-35522-7 (hbk)/ISBN: 978-0-367-35523-4 (pbk)/ISBN: 978-0-429-33193-0 (ebk)/DOI: 10.4324/9780429331930; Download for Access of the Open Access Publication: <https://www.taylorfrancis.com/books/oa-edit/10.4324/9780429331930/transformative-pathways-sustainability-pathways-network>

This book series addresses core challenges around linking science and technology and environmental sustainability with poverty reduction and social justice. This volume of the book series discusses transformative pathways to sustainability, with particular focus on learning across disciplines, cultures, and contexts. This book argues that, as with Covid-19 and, earlier, the Millennium Development Goals (MDGs), the current international development agenda poses important questions for the global research community. The book discusses the following questions: How are transformations to sustainability conceptualised across different theoretical and scholarly traditions, and how does this influence the organisation of transdisciplinary research? How can researchers understand and help to bring about the kinds of transformative change that the 2030 Agenda calls for? What broader lessons are drawn

regarding the role of research in these transformations – specifically the research that is rooted within the social sciences but extends to incorporate other disciplinary and practice-based inputs?

This book addresses these questions in detail. The research detailed in this volume (which took place pre-Covid-19) engages with the specificities of different contexts around the world, while seeking general lessons that can be drawn about transformations to sustainability and the role of research within them. It thus documents a new approach (or approaches) that contribute to the enterprise of “transdisciplinary” research, in which collaborations between academic and non-academic partners attempt not only to understand the world and to diagnose systemic challenges of sustainability, but also to contribute to overcoming them. This book represents an effort to bridge the internationally shared normative agenda for sustainable development with concrete action research initiatives in a set of specific contexts across the world. It generates fresh insights into the role that social science can play in these initiatives and provides lessons for future transdisciplinary research that aims to connect the global and the local. It offers an important resource for future efforts that strive towards a collective and shared understanding of ways in which humanity can respond to the multiple challenges of sustainable development.

As for the organization of the book, this volume appeals to multiple different types of readers, from academic researchers in the social and natural sciences to transdisciplinary scholars with a history of engaged, problem- and solution-oriented research. It will be of use to policymakers or research funders with an interest in how knowledge can contribute to sustainable development initiatives. It will also appeal to practitioners – whether they find themselves within the private sector, in non-government organisations, or indeed in communities around the world, striving to solve their own sustainability challenges. The book has four sections with 12 chapters included.

Section 1 has two chapters. Chapter 1 provides an Introduction, Chapter 2 describes the ‘Pathways’ Transformative Knowledge Network, its genesis, hub partners, and their distinctive disciplinary and contextual backgrounds.

The *Section 2* of the book with the chapters 3 and 4 explores some of the tools and approaches that were applied throughout the project, as well as some of the conceptual insights that have emerged as the work has progressed. Chapter 3 provides a detailed overview of searching for transformations to sustainability as a background to some of the conceptual approaches that have been applied in the different hubs of the ‘Pathways’ network. It draws upon multiple disciplines, including classical sociology and political economy and more recent notions of socio-technical system transitions and social ecological resilience. Drawing together these bodies of literature and the analytical and normative commitments of the ‘pathways approach’ for grass-roots empowerment, the book provides a new synthesis of knowledge around ‘social transformations to sustainability’.

The book explains a new approach to conceptualising ‘transformative pathways to sustainability’. The chapter extends the description by beginning to analyse the different approaches to theory adopted in the project as a whole and in each of the hubs. In view of the book’s focus on transformative change – a search for profound and long-term reconfiguration of systems and structures – the chapter reviews some of the theoretical literature in this area and how it has been applied in the ‘Pathways’ Transformative Knowledge Network (TKN). Chapter 4 describes the TKN’s approach to Transformation Labs, positioning it alongside earlier work on social innovation labs and exploring some of the insights that have emerged from applying this approach in very diverse contexts.

Section 3 has six chapters 5 -10 and presents insights from different international contexts, and it then focuses on six international cases. The chapters outline the experiences of each hub in the Transformative Knowledge Network (TKN) and draw from process documentation and reflection by the teams who were responsible. These relate back to some of the concepts outlined in Chapters 2–4 and explore how they “played out” in different contexts, each characterised by varying disciplinary traditions and socio-political cultures. The section 3 includes a Chapter 5 that focuses on a more sustainable food system in Brighton and Hove, UK, a Chapter 6 that focuses on Bioleft, a collaborative, open source seed breeding initiative for sustainable agriculture, a Chapter 7 that discusses making mobile solar energy inclusive in Kenya, a Chapter 8 that explains for China the economic shock of a green transition in Hebei, a Chapter 9 on Wetlands under pressure with the experience of the Xochimilco T-Lab in Mexico, and a Chapter 10 that focuses on enabling transformations to sustainability by rethinking urban water management in Gurgaon, India.

Section 4 has two chapters on Conclusion. Chapter 11 focuses on one specific area of application of the ‘pathways’ approach – that associated with the notion of framing and the contribution that “reframing sustainability challenges” can make to transformative change. Chapter 12 draws on the work in all of the six hubs and identifies further conceptual contributions and comparative insights. Building on the theoretical foundations in Chapter 3 and the intervening chapters, it pulls together the lessons from the transdisciplinary research in each hub and then develops a synthesis on ‘transformative pathways to sustainability’. The study is a great teamwork with a high theoretical and practical relevance for applying sustainability concepts.

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Bissinger, K., Brandi, C., Cabrera de Leicht, S., Fiorini, M., Schleifer, P., Fernandez de Cordova, S., Ahmed, N. (2020), Linking Voluntary Standards to Sustainable Development Goals, International Trade Centre (ITC), Geneva, Switzerland. 73 pages. ITC Document Number: SIVC-20-53.E; Access for Download:

https://www.intracen.org/uploadedFiles/intracenorg/Content/Publications/Linking%20Voluntary%20Standards%20to%20Sustainable%20Development%20Goals_Final.pdf

The report on linking voluntary standards to sustainable development goals aims to investigate the link between the voluntary standards and the sustainable development goals. The report indicates that the voluntary sustainability standards (VSS) were developed by business, civil society organizations, and by multi-stakeholder initiatives. The VSS are widely used to govern environmental, social, and ethical issues in global supply chains. The report builds on two previous reports, on the ITC Report ‘Social and Environmental Standards: Contributing to More Sustainable Value Chains’ (ITC 2016)¹² and on the Third UNFSS (United Nations Forum on Sustainability Standards) Flagship Report: ‘Voluntary Sustainability Standards (VSS), Trade and Sustainable Development’ (UNFSS 2018)¹³.

The structure of the report includes four chapters organized as follows. Chapter 1 focuses on linking business to the development agenda via standards; Chapter 2 discusses bridging two worlds together – standards and development goals, the landscape of voluntary sustainability standards and connecting requirements in standards to SDG targets; Chapter 3 is on identifying connections between standards and goals, links at SDG level, links with SDG targets, links at country and sector levels; and finally, Chapter 4 is charting the way forward.

According to the Standards Map of the International Trade Centre (ITC), there are more than 2702 VSS in 600 product groups, 15 industries, and 180 countries. The report indicates that over the past decade, market coverage of these standards has grown considerably. For example, in the agriculture sector, commodities with a significant share of global production certified by a sustainability standard include cocoa (25%), coffee (23%), cotton (16%), tea (16%) and oil palm (12%). The report indicates that the use of such standards is also widespread in other industries, such as forestry, fisheries, electronics, and textiles and garments. Private sustainability standards now apply to millions of farms, plantations, and factories worldwide. The report indicates that given their pervasiveness in the global economy, it is surprising that voluntary standards

¹² See on this report:

https://www.intracen.org/uploadedFiles/intracenorg/Content/Publications/IITC-EUI_Social_environmental_standards_Low-res.pdf

¹³ See on the Third Flagship Report of the United Nations Forum on Sustainability Standards (UNFSS): <https://unfss.org/wp-content/uploads/2018/09/UNFSS-3rd-Flagship-Report-FINAL-for-upload.pdf>

have received little attention in the effort to reach the Sustainable Development Goals (SDGs). Under the 2030 Agenda for Sustainable Development, the United Nations has called on the private sector to contribute more to achieving the SDGs. While the United Nations and its Member States have long promoted the involvement of business and civil society through partnerships for delivering the SDGs, voluntary standards have not yet played a prominent role in discussions on implementing the sustainable development agenda.

The significance of the report is demonstrated from the fact that it fills the gap in the literature by informing the policy debate on the potential and the limits of the voluntary sustainability standards landscape. To this end, it conducts a systematic mapping of 232 private VSS and examines how the content of these standards corresponds to the 17 SDGs and the 169 targets they contain. Based on a rigorous coding and mapping exercise, the report describes the ‘area of interlinkage’ between the voluntary sustainability standards (VSS) and the United Nations 2030 Agenda for Sustainable Development. In addition, the report helps decision makers in the public and private sectors to identify the areas in which VSS are best placed to contribute to the SDGs. Through the mapping, it is possible to identify with clarity the pool of VSS that is relevant to each SDG and its targets. The importance of this study is demonstrated from the fact that it is the first empirical study to examine connections between voluntary sustainability standards and the SDGs at such level of detail.

The report argues that nonetheless, if voluntary standards are to contribute to the SDGs, it will be necessary to take into consideration factors other than connection and overlap. Decision makers aiming to create synergies with VSS need to assess with care the design of these programmes, including the robustness of verification procedures and the level of stakeholder engagement, and to consider the implementation context, such as the existence of a supportive public policy environment and the access to finance. These elements have been shown to be essential for the effectiveness of voluntary standards.

The report’s main findings are that the three SDGs most widely covered by voluntary sustainability standards are SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production) and SDG 2 (Zero Hunger). There are more than 200 VSS linked with each of these goals. As a result, there is a great number of relevant voluntary sustainability standards available for policymakers aiming to create synergies in these areas. The report argues that the three SDGs with few or no links to voluntary sustainability standards are SDG 17 (Partnerships for the Goals), SDG 14 (Life Below Water) and SDG 13 (Climate Action). This reflects the fact that they are formulated in a state-centric way that leaves little room for private governance action, or that they cover issues for which fewer voluntary standards exist. The report explains that connection with individual targets varies widely, for example, while SDG 8 (Decent Work and Economic Growth) is the goal with the highest number of

VSS linked to it (222), it contains targets that are not covered by a single voluntary standard. This is mainly due to the nature of the targets. For example, strengthening the capacity of domestic financial institutions (target 8.10) is not within the scope of voluntary standards. The report shows that coverage is greater in some countries and regions, as for SDG 8 (Decent Work and Economic Growth) the number of linked voluntary sustainability standards is high in North America and Western Europe. Parts of South America and Asia also have a high density of standards that are relevant to SDG 8. In contrast, there are significantly fewer voluntary standards relevant to this goal operating in Africa and the Middle East (but there are no intentions to change this bias). The report indicates that agriculture is the sector which is most covered by voluntary standards, and this by a significant margin. This is followed by textiles and garments, consumer products, and processed foods. Within these sectors, coverage of certain products is particularly strong, such as for soy, coffee, and cocoa in agriculture. The often state-centric formulation of the SDGs and the variation in the geographical and sectoral scope of voluntary standards serves as a constraint on private governance action for the sustainable development goals. At the same time, this report shows that significant linkages exist between voluntary sustainability standards and the 2030 Agenda for Sustainable Development. The report argues that this opens the way for standards to contribute to a stronger governance ecosystem (centred on public and private actors) that can help deliver the SDGs.

The report indicates that voluntary sustainability standards (VSS) are currently at the centre of the approach of mobilizing businesses to support sustainability standards. Going beyond minimum legal standards established by governments, VSS focus on reducing adverse environmental and social effects, and are responding to the demands of various stakeholders, including the consumers. Using original data, the present report tracks the extent to which sustainable practices promoted by voluntary standards align with the SDGs. The report presents innovative research by providing a clear picture of how the private sector can work towards the SDG goals and targets by adopting voluntary sustainability standards. It documents the overlap between existing VSS standards and the SDG goals and targets and identifies further potential to better align VSS with additional sustainable development goals (SDGs). The report demonstrates that policymakers can select from a considerable number of relevant voluntary sustainability standards – at country and sectoral levels – to contribute to the SDGs. These insights are especially valuable for developing countries in their drive to move in the direction for a future growth trajectory that is more sustainable and inclusive. Understanding the links between voluntary standards and the SDGs contributes to efforts to build a more resilient business ecosystem, to create greener jobs, and to build the business case for micro, small and medium enterprises (MSMEs) to adopt greener technologies. The report

supports and builds on the United Nations approach that emphasized the alignment between competitiveness, sustainability, and inclusiveness as an instrument to maximize the economic and the development impact. The report increases the understanding of how voluntary sustainability standards can connect with the 2030 Sustainable Development Agenda; it makes it possible to widen and to advance the effort to meet the SDGs, especially given that the world has just under ten years to reach the SDGs.

According to the report, the findings in the report will be a useful resource for standard-setting organizations, policymakers, suppliers, and lead firms as they strive to bring together the public and private sectors and to promote sustainable and responsible supply chains in pursuit of the Sustainable Development Goals. So, the report is of value for policymakers and for the associations of employers and workers at regional and global levels. The great number of multinational firms in the world can benefit from these arguments about VSS and SDGs.

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**Helliwell, John F., Richard Layard, Jeffrey Sachs, Jan-Emmanuel De Neve, Lara B. Aknin, and Shun Wang (eds.) (2021), World Happiness Report 2021, New York: Sustainable Development Solutions Network (SDSN). 212 pages. Access to study:
<https://happiness-report.s3.amazonaws.com/2021/WHR+21.pdf>**

The report benefitted from new data and important data sources made available. The World Happiness Report is a publication of the Sustainable Development Solutions Network; it is powered by data from the Gallup World Poll and Lloyd's Register Foundation, who provided access to the World Risk Poll; the 2021 Report includes data from the ICL (Imperial College London)-YouGov Behaviour Tracker as part of the COVID Data Hub. The World Happiness Report (2021) is the ninth World Happiness Report, and the whole report focuses on the effects of COVID-19 and how people all over the world have fared. The aim of the report was two-fold, first to focus on the effects of COVID-19 on the structure and quality of people's lives, and second to describe and evaluate how governments all over the world have dealt with the pandemic. In particular, the report tries to explain why some countries have done so much better than others.

The report is composed of eight chapters, Chapter 1 provides an overview: Life under COVID-19; Chapter 2 discusses happiness, trust, and deaths under COVID-19; Chapter 3 examines the COVID-19 prevalence and well-being, with particular focus on the lessons learned from East Asia. Chapter 4 discusses the reasons for Asia-Pacific's success in suppressing COVID-19. Chapter 5 focuses on mental health and the COVID-19 pandemic. Chapter 6 discusses social

connection and well-being during COVID-19. Chapter 7 investigates work and well-being during COVID-19, with particular focus on the impact, inequalities, resilience, and the future of work. Finally, Chapter 8 discusses living long and living well: The WELLBY (Well-Being-Adjusted Life-Years) approach (the most plausible way to combine well-being with the length of life).

According to the report, the pandemic's worst effect has been the number of 2 million deaths from COVID-19 in 2020. A rise of nearly 4% in the annual number of deaths worldwide represents a serious social welfare loss. According to the report, for the living people there has been greater economic insecurity, anxiety, disruption of every aspect of life, and, for many people, stress, and challenges to mental and physical health. Chapter 1 gives an overview on life under COVID-19

Chapter 2 of the report focuses on happiness, trust, and deaths under COVID-19. The report indicates that there has been surprising resilience in how people rate their lives overall. The change from 2017-2019 to 2020 varied considerably among countries, but not enough to change rankings in any significant fashion materially. The same countries remain at the top. Emotions changed more than did life satisfaction during the first year of COVID-19, worsening more during lockdown and recovering faster, as illustrated by large samples of UK data. For the world, based on the annual data from the Gallup World Poll, there was no overall change towards a positive effect, but there was a roughly 10% increase in the number of people who said they were worried or sad the previous day. The report argues that trust and the ability to count on others are major supports to life evaluations, especially in the face of crises. Trust is even more important in explaining the very large international differences in COVID-19 death rates, which were substantially higher in the Americas and Europe than in East Asia, Australia, and Africa,

These differences were almost half due to differences in the age structure of populations (COVID-19 much more deadly for the old), whether the country is an island, and how exposed each country was, early in the pandemic, to large numbers of infections in nearby countries. Whatever the initial circumstances, the most effective strategy for controlling COVID-19 was to drive community transmission to zero and to keep it there. Countries adopting this strategy had death rates close to zero, and were able to avoid deadly second waves, and ended the year with less loss of income and lower death rates. Factors supporting successful COVID-19 strategies include confidence in public institutions. Trusted public institutions were more likely to choose the right strategy and have their populations support the required actions.

For example, Brazil's death rate was 93 per 100,000, higher than in Singapore, and of this difference, over a third could be explained by the difference in public trust. Income inequality, acting partly as a proxy for social trust, explains 20% of the difference in death rates between Denmark and

Mexico. A second measure of social trust, whether there was a high expected return of lost wallets found by neighbours or strangers, was associated with far fewer deaths, whether the country had, or learned from, the lessons from SARS and other earlier pandemics, and whether the head of the government was a woman.

Chapter 3 of the report examines COVID-19 prevalence and well-being, with particular focus on the lessons learned from East Asia mainly, but also from Australia and New Zealand; success factors are explained in detail. The report describes, country by country, the workings of test, trace, isolate, and of travel bans to ensure that the virus never got out of control. It also analyses citizens' responses, stressing that policy can be effective when citizens are compliant (as in East Asia) and more freedom-oriented (as in Australia and New Zealand). In East Asia, as elsewhere, the evidence shows that people's morale improves when the government acts. The success of the Asia/Pacific countries in controlling deaths has not been at the cost of greater economic losses. In fact, countries with the highest deaths also had the greatest falls in GDP per head. Thus, in 2020, there was no choice between health and a successful economy. The route to success on both scores came from rapid, decisive intervention wherever cases appeared (test and trace, and quarantining of those at risk) as well as from personal hygiene (including masks) and quarantining of international travellers. The rise in the daily number of new confirmed cases was found to be associated with a lower level of the publicly expressed happiness in mainland China, and with a higher level of negative affect in the other four East Asian regions. However, having stricter mobility control and physical distancing policies considerably offset the decrease in happiness caused by the rise in the daily new confirmed cases.

The report indicates that in early 2020, East Asian countries were better prepared to act because of their previous pandemics experience. However, by mid-2020, the international evidence was clear – people need to suppress the virus. But in the summer, the West had liberalized the measures and had a second wave of infections that was as bad as the first.

Chapter 4 of the report discusses the reasons for the Asia-Pacific success in suppressing COVID-19. The report argues that the Asia-Pacific region has achieved notable success compared to the North Atlantic region in controlling the pandemic, with far lower mortality rates and a successful implementation of Non-Pharmaceutical Interventions (NPIs) to stop the spread of the disease, such as border controls; face-mask use; physical distancing; and widespread testing, contact tracing, and quarantining (or home isolation) of infected individuals. The successes of NPI implementation in the Asia-Pacific region resulted from measures that were both top-down, with governments setting strong control policies, and bottom-up, as the public was supporting governments and complying with government-directed public health measures. The more

individualistic culture of the North Atlantic countries compared to countries in the Asia-Pacific region and the relative looseness of social norms may also have contributed to lower public support for NPIs. Assertions of “personal liberty” and demands for privacy in the North Atlantic contributed to the reluctance of individuals in the North Atlantic countries to comply with public health measures such as contact tracing. A lack of sufficient scientific knowledge among the population of the North Atlantic countries has also contributed to the failure of effective pandemic control due to the public’s lack of understanding of the epidemiology of the pandemic and susceptibility to false information and fake news.

Chapter 5 of the report focuses on mental health in the COVID-19 pandemic. The report indicates that mental health has been one of the casualties both, of the pandemic and of the resulting lockdowns. As the pandemic struck, there was a large and immediate decline in mental health in many countries worldwide. Estimates vary depending on the measure used and the country in question, but the findings are remarkably similar. In the UK, in May 2020, a general measure of mental health was 7.7% lower than predicted in the absence of the pandemic, and the number of mental health problems reported was 47% higher. The early decline in mental health was higher in groups that already had more mental health problems – women, young people, and poorer people. It thus increased the existing inequalities in mental well-being. However, after the sharp initial decline in mental health, there was a considerable improvement in average mental health, though not back to where it started. But a significant proportion of people (22% in the UK) had mental health problems that were persistently and significantly lower than before COVID-19. At the same time, as mental healthcare needs have increased, mental health services have been disrupted in many countries. This is serious when we consider that the pandemic is likely to leave a lasting impact on the younger generation. On the positive side, the pandemic has shown a light on mental health problems as never before. This increased public awareness bodes well for future research and better services that are so urgently needed.

Chapter 6 of the report discusses social connections and well-being during COVID-19. The report indicates that one major element in COVID-19 policy has been physical distancing or self-isolation, posing a significant challenge for people’s social connections, vital for their happiness. People whose feeling of connectedness fell had decreased happiness, as did people whose sense of loneliness has increased and whose social support was reduced. Many positive features of a person’s life helped to protect their sense of connectedness. These included gratitude, grit, prior connections, volunteering, taking exercise, and having a pet. It also helped to have activities that provided ‘flow.’ Likewise, there were negative features that weakened a person’s protection. These included prior mental illness, a sense of uncertainty, and a lack of proper digital

connections. Clearly, digital connection is vital, and many people have been helped by digital programmes promoting mental health.

Chapter 7 of the report discusses work and well-being during COVID-19: impact, inequalities, resilience, and the future of work. The chapter indicates that the Global GDP is estimated to have shrunk by roughly 5% in 2020, representing the largest economic crisis in a generation. In many countries, job vacancies remained approximately 20% below normal levels by the end of 2020. Young people, low-income, and low-skill workers have also been more likely to lose working hours or lose their jobs entirely. The report indicates that not being able to work has had a negative impact on well-being. Unemployment during the pandemic is associated with a 12% decline in life satisfaction and a 9% increase in negative affect. For labour market inactivity, these figures are 6.3% and 5%, respectively. While young people report lower levels of well-being than other age groups, the effect of not being able to work is less severe for younger than for older cohorts, suggesting that they may be more optimistic about future labour market opportunities post-COVID-19.

The report indicates that countries that have introduced more substantial labour market protection systems for workers have generally seen less severe declines in well-being. For those who have remained at work, the impact is mixed. In the United States, workplace happiness declined just before the federal emergency declaration of 12 March 2020 but was followed by a quick recovery. Suggested is that (a) happier workers may have been more likely to retain their jobs, (b) workers' reference groups may have changed, or (c) workers remaining employed may have been more able to work from home in the first place, and therefore have been less negatively affected. The report indicates that supportive management and job flexibility have become even more important drivers of workplace well-being during the pandemic. Purpose, achievement, and learning at work have become less important. However, other drivers' importance (trust, support, inclusivity, belonging, etc.) have remained unchanged, suggesting that what makes workplaces supportive of well-being in normal times also makes them more resilient in hard times. The report argues that social support can protect against the negative impact of not being able to work. In the United Kingdom, the negative effect of not working on life satisfaction was 40% more severe for lonely workers to begin with. Furloughing helps but may not fully compensate for the negative impact of not working. Furloughed workers, even those without any income loss, still experienced a significant decline in life satisfaction relative to those who continued working. The report indicates that the impacts of the pandemic on the world of work are likely to endure. Evidence from past recessions and from early research on the COVID-19 pandemic suggests that young people who come of age in worse macroeconomic conditions are more likely to be driven by attaining financial security in adulthood. The report argues that the shift to remote working is likely to last long

after the crisis has subsided. The report indicates that providing future workers with more flexibility and control over their working lives is welcome, but at the risk of undermining social capital at work.

Chapter 8 of the report focuses on living long and living well: the WELLBY approach. The report indicates that to evaluate social progress and to make effective policy, people need to consider both, the quality of life and the length of life. The report indicates that health economists use the concept of Quality-Adjusted Life Years to do this, but they only count the individual patient's health-related quality of life. The World Happiness Report (WHR) indicates that in the well-being approach, people consider total well-being, whoever experiences it, and for whatever reason: All policymakers should aim to maximise the Well-Being-Adjusted Life-Years (or WELLBYs) of all who are born and should include the life-experiences of future generations (subject to a small discount rate). The well-being approach puts a lower value than is customary upon money wealth relative to length of life. The report argues that the WELLBY approach also provides a more complete way of measuring human progress and comparing the performance of different countries. It does this by multiplying average well-being by life expectancy. On this basis, the number of WELLBYs per person rose by 1.3% between 2006-08 and 2017-19, due to higher life expectancy, especially in the less healthy countries. This was a significant reduction in fundamental inequality across the world, and inequality remains lower in 2020 despite COVID-19.

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7 African Studies

Africa SDG Index And Dashboards Report 2020 (2020), Leave No One Behind to Achieve the SDGs in Africa, by Sustainable Development Goals Center For Africa and Sustainable Development Solutions Network; July 2020; Kigali and New York: SDG Center for Africa and Sustainable Development Solutions Network; access for download: <https://www.sdgindex.org/reports/2020-africa-sdg-index-and-dashboards-report/>, and: https://s3.amazonaws.com/sustainabledevelopment.report/2020/2020_africa_index_and_dashboards.pdf

The editors of the study describe the report in the following words: “The 2020 Africa SDG Index and Dashboards Report provides an assessment of where African countries stand with respect to the SDGs and their progress toward the goals, with the additional lens of “leave no one behind.” The report also includes

a preliminary analysis of the impact of COVID-19 on the SDGs in Africa. The interactive dashboard provides a visual representation of countries' performance by SDGs to identify priorities for action.”

The editors mention the key findings of the report in the following words: “Overall, North Africa is the best-performing region on average, while Central Africa is the worst-performing. Tunisia has replaced Mauritius as the top-ranking country. Serious challenges exist and the greatest number of African countries are currently performing very poorly. As in last year's report, no country scored green for 13 of the 17 goals. The Leave No One Behind (LNOB) results show that all African countries are currently struggling to tackle all kinds of inequalities. The goals facing the greatest challenges are SDG 3 (good health and wellbeing), SDG 9 (infrastructure), and SDG 16 (peace, justice, and strong institutions). The goals where the continent is performing better are SDG 13 (climate action) and SDG 12 (responsible consumption and production). Across all countries and goals, the most frequently observed trends are stagnation and moderate improvement, which is a positive development as compared to the 2019 analysis which was overwhelmingly stagnant. The only goal for which the greatest number of African countries are on track is SDG 13 on Climate Action.”

It should be observed that the COVID-19 event is not included in the measured findings, so that we have to wait for the Africa SDG Index And Dashboards Report 2021 to reveal the new developments.

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SDGC/A (July 2021), Africa 2030: SDGs Within Social Boundaries, Leave No One Behind Outlook, 223 pages; The Sustainable Development Goals Center For Africa (SDGC/A): Kigali, Rwanda; Access for Download: https://sdgcafrica.org/wp-content/uploads/2021/07/20210721_Full_Report_Final_Web_En.pdf, and the Summary Report: https://sdgcafrica.org/wp-content/uploads/2021/07/20210721_English_Summary_Final_Print.pdf, and the information for the Press: https://sdgcafrica.org/wp-content/uploads/2021/07/Press_Release_Africa_2030_SDGs_Within_Social_Boundaries.pdf

This report is highly informative and is based in Chapter 1 and Chapter 2 on a new frame of measuring social inclusion/social exclusion, related to the United Nations 2030 Sustainable Development Agenda and to the African Union Agenda 2063. This new set of constructs and indicators is related in Chapter 3 to progress in Africa on inclusiveness in the macro landscape, in Chapter 4 on an inclusive agricultural sector, in Chapter 5 on the inclusive health sector (SDG 3), in Chapter 6 on inclusive education (SDG 4), in Chapter 7 on inclusiveness in basic services (water, sanitation, energy), in Chapter 8 on inclusive

infrastructure, in Chapter 9 on inclusiveness in accessing financial services in Africa, while in Chapter 10 there is emphasis on policy options and on pragmatic pathways. The findings on social inclusiveness are revealing as the great gaps in many countries, in all sectors, and for many indicators are becoming obvious. The available data for Africa are summarized in a new form, so that the message of social inclusiveness and social exclusiveness is coming out very clearly. Most important is the fact that policy conclusions are drawn how to increase the inclusion rates (for health, education, infrastructure, financial access, digital access, food availability, inputs for producers, etc.) in urban and rural areas. The short Summary Report (an independent publication) highlights the results and the recommendations in a short but very instructive synopsis.

Although COVID-19 pandemic is considered in the report, new events such as the war in Europe since 24 February 2022 between Russia and Ukraine may have further effects on social exclusion in Africa, especially via food insecurity, uncertainty for investors, and energy price explosions. It is also useful to find in the report a comparison of social inclusion/exclusion concepts between UN Agenda 2030 and AU Agenda 2063.

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International Call for Papers:

Volume 24 (2024/25) of the African Development Perspectives Yearbook with the title “Fiscal Capacity and Resource Mobilization in Africa – New Strategies and New Instruments”

Invited are contributions for Volume 24 (2024/25) of the African Development Perspectives Yearbook with the title “**Fiscal Capacity and Resource Mobilization in Africa – New Strategies and New Instruments**”. The theme is of great importance for Africa as great effort is needed to increase the tax revenues and the non-tax revenues in Africa. Recent crises (COVID-19, War against Ukraine, Climate Crisis, Food and Energy Crises) request new macroeconomic and sectoral policies to continue the path towards inclusive growth in Africa. New strategies and policies are requested at national, regional, and global levels to address these problems. The volume will consider how the fiscal capacity can be raised and how resource mobilization strategies can become more effective. It is estimated that the potential for the fiscal capacity is much higher in Africa; the fiscal revenue capacity can be raised by more than 10% of the GDP - by mobilizing tax and non-tax revenues, by reducing tax evasion and tax avoidance, by e-taxation, by implementing countercyclical fiscal policies, and by a more effective fiscal administration. New strategies and new instruments will be considered, also in the context of country case studies. The contributions should be evidence-based and policy-oriented. High academic standards are requested and will be reviewed by referees. Non-technical papers with deep analysis, which are readable by practitioners in development cooperation and by media people, have a high priority in the selection process. The analytical concept of the proposed contribution and the methodological framework of analysis should be outlined in the Abstract which is submitted to the Editors.

Upon acceptance of the paper, the *Contributors* will receive Editorial Guidelines and a Template. Accepted papers will be grouped into Thematic Units, and the respective Unit Editors will contact the contributors quite regularly during the process of finalization to discuss the drafts. The contributions are peer-reviewed, and the publication is released in the form of a hardcopy, a PDF, and via Open Access.

Guest Editors for various Thematic Units are also invited to apply. Editors of Thematic Units are also named as Volume Editors. Guest Editors are responsible for a Thematic Unit with three to five (3 – 5) contributions and an Introduction. For specific themes see below the Main Issues which are proposed by the Editors for Volume 24 (2024/25). These proposed themes are only examples and give the

questions which are of interest in the Units. The Editors are open to present and to accept further suggestions for Units. The Festschrift at the occasion of “Thirty Years (1989 - 2019) of the African Development Perspectives Yearbook” was released in 2020 and has recommended various changes of the format for the Yearbook editions. Guest Editors and Contributors will get a copy of the Festschrift (Second Edition), as it contains valuable suggestions for further improvements of the *African Development Perspectives Yearbook*. Access to the Festschrift is also via: <https://media.suub.uni-bremen.de/handle/elib/4652>, and to the PDF: <https://media.suub.uni-bremen.de/bitstream/elib/4652/1/Wohlmuth-Festschrift.pdf>

See about the *Context* of the *African Development Perspectives Yearbook* and about the activities of the Africa Research Programme of the *Research Group on African Development Perspectives Bremen* at IWIM (Institute for World Economics and International Management), University of Bremen the following websites: <http://www.iwim.uni-bremen.de/africa/africanyearbook.htm>, and: [http://www.iwim.uni-](http://www.iwim.uni-bremen.de/afrikanische_entwicklungsperspektiven_research_group/)

[bremen.de/afrikanische_entwicklungsperspektiven_research_group/](http://www.iwim.uni-bremen.de/afrikanische_entwicklungsperspektiven_research_group/). The *African Development Perspectives Yearbook* is published since 1989 and is now a peer-reviewed Open Access publication. The volumes 20 and 21 (for the years 2018 and 2019) were on the theme “*Science, Technology and Innovation Policies for Inclusive Growth in Africa*”. In 2019, the Research Group celebrated the event of 30 years of publishing the *African Development Perspectives Yearbook*, and in 2020 a Festschrift was published at this occasion. The volume 22 (2020/21) was on “*Sustainable Development Goal Nine (Infrastructure, Industrialization, Innovation) and African Development – Challenges and Opportunities*”, while the volume 23 (2022/23) on “*Business Opportunities, Start-ups and Digital Transformation in Africa*” is now finalized. It will be released in the next few months. The timetable for volume 24 (2024/25) on “**Fiscal Capacity and Resource Mobilization in Africa – New Strategies and New Instruments**” is presented below.

The Editors also invite publishers, agencies, and institutes to send books and issues of periodicals as well as research discussion papers and strategy documents which are of relevance to the theme of volume 24 for review and information in the *Book Reviews/Book Notes Section* of the *African Development Perspectives Yearbook*. The *Book Reviews/Book Notes Editor* is Professor Dr. Samia Satti Osman Mohamed Nour (Ph.D.), Full Professor of Economics, Economics Department, Faculty of Economic and Social Studies, Khartoum University, P. O. Box 321, Khartoum 11115, Sudan, E-mail: samiasatti@yahoo.com; alternative E-mail addresses are: samia_satti@hotmail.com and samiasatti78@gmail.com. You can start now to send material for review directly to her. Collections of relevant books

can be reviewed in the form of review essays. We encourage young researchers on Africa and on development studies to take over the job as a reviewer.

The theme for volume 24 (2024/25) on **“Fiscal Capacity and Resource Mobilization in Africa – New Strategies and New Instruments”** is related to the following questions: How can the fiscal capacity of African countries be assessed, and what do we know about the resource mobilization trends? What do we know about new trends for tax revenues and non-tax revenues in African countries? What do we know about the fiscal capacity of different governance levels (nation state, provinces, local communities, and municipalities)? How will the implementation of the African Continental Free Trade Area (AfCFTA) impact on the fiscal capacity and the resource mobilization trends? How to react to the fiscal consequences of the recent crises (COVID-19, Disruption of Global Supply Networks, Increasing Inequality, War of Aggression against Ukraine, Climate Crisis, Food and Energy Crises) which are affecting Africa by impacting on the paths towards inclusive growth and on the efficacy of macroeconomic policies. How can global and regional actors support Africa’s resource mobilization policies and its institutions? Which fiscal institutions need change in Africa, and which change models are proposed?

The volume 24 (2024/25) of the African Development Perspectives Yearbook will cover three main issues:

First, the trends of fiscal revenues (taxes and non-tax revenues) and expenditures will be assessed in the context of the domestic resource mobilization (DRM) strategies. This is done by referring to the debate on the fiscal state and the fiscal capacity in Africa. This can be in the form of Africa-wide projections and analyses but also in the form of case studies for countries and public income categories. Also, the capacity of fiscal institutions should be investigated.

Second, the impact of recent crises on the fiscal capacity and the situation of the fiscal state in Africa are of interest. Inflation dynamics and debt accumulation are related to the food and energy crises, and to the other crises. This research can be done by country case studies and via analyses of macroeconomic policy instruments to address domestic resource mobilization (DRM). Also, fiscal capacity analyses for regional economic communities (RECs) are of interest.

Third, policy prescriptions and policy recommendations concerning the fiscal capacity are of interest. This can be done in the form of analyses how national, regional, and global actors can support the resource mobilization strategies of African countries at various governance levels. New tools and instruments (such as digitalization efforts, governance reforms, and transparency measures) are gaining further importance. Country case studies and analyses of specific regional African and global strategies are proposed.

It is an intention to publish in volume 24 (2024/25) country-specific, actor-specific, and issue-specific cases of resource mobilization, but successful cases of how to raise and to use the fiscal capacity are of greatest interest, as it is necessary to learn from African success stories.

Main Issues proposed by the Editors for the Thematic Units of Volume 24 (see below some suggestions of themes for Contributions and Units):

Fiscal States in Africa – Which new strategies are observed to increase the fiscal capacity and to accelerate the domestic resource mobilization?

- *The debate about the fiscal states in Africa – Relevance for fiscal policy reforms?*
- *Defining and measuring fiscal capacity in Africa – new approaches?*
- *Examples of successful domestic resource mobilization strategies in Africa – which countries are leading?*
- *The fiscal state and the rentier state – how important are these categories for Africa?*
- *Fiscal Policy Reforms in fiscal states – which reforms matter?*

Trends of fiscal revenues and expenditures – Why is the share of taxes in GDP stagnating and the share of non-tax revenues declining in Africa?

- *What do we know about the average picture of domestic resource mobilization (DRM) in Africa?*
- *Which African countries have improved their management of DRM, and how was this achieved?*
- *Which fiscal rules have worked in African countries – what about expenditure rules, taxation rules, debt rules, and balanced budget rules?*
- *Which fiscal policy reforms have made the African countries more resilient to shocks?*
- *How did fiscal policy reforms impact on the implementation of the sustainable development goals (SDGs)?*

Inflation Dynamics and Macroeconomic Management in Africa – How effective is the Fiscal Policy/Monetary Policy Response to the Global and Continental Crises?

- *Many crises affect the fiscal situation of African countries – How do countries react to the fiscal implications of the multiple crises (Covid-19 Health Crisis, Disruption of Supply Chains, Energy Crisis, Food Crisis, Climate Change, Security Crisis, Inequality Crisis, etc.)?*
- *How effective was the fiscal policy/monetary policy response to the COVID-19 crisis?*

- *How do countries in Africa react to the inflation pressure which is caused by energy and food price escalation?*
- *Which countries could establish a more resilient system of macroeconomic management, and how was this achieved?*
- *Which measures to deepen the regional integration in Africa have the greatest effect on the efficacy of fiscal and monetary policy coordination?*

Are new tools and instruments available to increase the fiscal capacity and to enhance domestic resource mobilization (DRM) in Africa?

- *How effective are digital tools to improve the transparency and accountability of the fiscal state?*
- *Which new planning tools are leading to a more effective fiscal policy management?*
- *Which tools are available to analyse the fiscal policy implications of implementing the sustainable development goals (SDGs)?*
- *Which African countries are successful in raising the fiscal capacity through anti-corruption measures, and how do these successes come about?*
- *What have fiscal policy reforms achieved to impact in a developmental way on the informal sectors and on the large multinational enterprises (in mining, oil and gas, agriculture, manufacturing, media, trade, etc.)?*
- *Were the reforms of administration systems (for taxes, non-tax revenues, current and investment expenditures, debt stock and interest payments) really progressing in recent years?*

Are Fiscal States in Africa innovative in the design of efficient and resilient social safety nets?

- *Some African countries are successfully responding to poverty, vulnerability, and inequality with social cash transfers - How are these systems designed and integrated into the fiscal policy architecture?*
- *How effective were the fiscal policy adjustments to the Covid-19 health crisis, and what were the impacts on the health situation and on the economic resilience of the households?*
- *What can we learn for fiscal policy reforms from the national country reports about the implementation of sustainable development goals (SDGs)?*
- *Country cases of financing and allocating social cash transfers - how are these social safety instruments monitored and evaluated?*

Fiscal Capacity of Local and Municipal Governments – Are more own resources mobilized at these governance levels?

- *What do we know about the local fiscal capacity, and how can it be measured?*

- *Who is deciding about the generation and the use of the local fiscal capacity, and how are these decisions made?*
- *What do we know about the trends in local public revenues and expenditures?*
- *Which African countries (and their states and provinces) have successful developments in regard of raising the local fiscal capacity?*
- *Country cases of local fiscal capacity – what are the lessons for local transparency and accountability?*

How are the Voting Behaviour, the Party Structure, and the Parliamentary System determining the level and the use of the fiscal capacity in Africa?

- *Through which channels is local voting behaviour influencing the allocation of state subsidies and the granting of tax privileges to large (domestic and foreign) firms in the area?*
- *Which regime characteristics and regime changes determine the fiscal capacity and its components?*
- *Which sectoral interest group associations (import-related, export-related, domestic economy-related, related to public utilities) impact on the overall level and the structure of the fiscal capacity?*
- *What do we know about the interrelations between the activities of the multinational mining, oil, and gas companies and the political processes of transition from rentier states to fiscal states (and vice versa)?*

What do we know about the sectors and the areas which are not effectively taxed and do not contribute adequately to the fiscal capacity?

- *How are the severe policy problems addressed that some sectors (large/rich/international sectors and micro/small/informal sectors) are not effectively taxed and that some geographical areas (large low-populated areas and areas in violence and conflict) are explicitly or implicitly overtaxed?*
- *Are there new operational approaches available to tax effectively multinational corporations and large domestic firms, especially of the mining and energy sectors?*
- *How can better governance systems overcome the overtaxing of ordinary people through informal taxes and fees?*
- *What is known about the taxation of large geographical areas, such as Sahel, and about the taxation of areas which are affected by internal and/or cross-border armed conflict (such as taxes at roadblocks)?*

Further Information for Contributors, Reviewers, and Guest Editors:

To the Contributors of Volume 24:

Please send an *Abstract* and a *short CV* not later than **November 15, 2022**, to the Volume Editor (see below). Questions concerning organizational matters should be directed to the Managing Editor (see below). The Editors will respond within 4 weeks to your proposal. If you have already contributed to a former volume of the Yearbook, please send only an Abstract.

To the Guest Editors of Volume 24:

Please send a *short CV* and a *Proposal* for one of the *Thematic Units* mentioned above or for a *Thematic Unit* which is chosen by yourself not later than **October 15, 2022**. If you have already contributed to a former volume of the Yearbook, please send only the Proposal.

For the review of books, journals, reports, strategy papers, discussion papers, and other material for Volume 24:

Please send your material directly to the Book Reviews/Book Notes Editor (*see below*).

Timeline for Volume 24 (2024/25):

Deadline for Abstracts by Contributors: November 15, 2022

Proposals for Thematic Units by Guest Editors: October 15, 2022

Acceptance or Rejection of the Proposed Contributions: December 15, 2022

Acceptance or Rejection of the Proposed Thematic Units by Guest Editors: November 15, 2022

First Draft of the Contributions submitted: May 15, 2023

Review Process: up to July 15, 2023

Second Draft of the Contributions submitted: October 15, 2023

Final Draft of the Contributions submitted: December 15, 2023

Introduction by the Unit Editors submitted: March 15, 2024

Full Manuscript to the Publisher: June 15, 2024

Hardcopy, PDF, and Open Access Edition available: November 15, 2024

Launch Meetings: December 2024 and January 2025

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African Development Perspectives Yearbook

Research Group on African Development Perspectives University of Bremen

Tobias Knedlik; Samia Satti Osman Mohamed Nour; Anthony Ifeanyi Ugulu;
Karl Wohlmuth (Eds.)

Sustainable Development Goal Nine and African Development

Challenges and Opportunities

vol. 22, 2021, 556 pp., 89,90 €, pb., ISBN-CH 978-3-643-91404-0

Reuben A. Alabi; Achim Gutowski; Nazar Mohamed Hassan;
Samia Satti Osman Mohamed Nour; Karl Wohlmuth

Science, Technology and Innovation Policies for Inclusive Growth in Africa

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Achim Gutowski; Tobias Knedlik; Patrick N. Osakwe; Isabelle Ramdoos;
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Africa's Progress in Regional and Global Economic Integration – Towards Transformative Regional Integration

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Macroeconomic Policy Formation in Africa

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Macroeconomic Policy Formation in Africa – General Issues

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Reuben Adeolu Alabi; Joy Alemazung; Hans H. Bass; Achim Gutowski;
Robert Kappel; Tobias Knedlik; Osmund Osinachi Uzor; Karl Wohlmuth (Eds.)

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Karl Wohlmuth; Reuben Adeolu Alabi; Philippe Burger; Achim Gutowski; Afeikhena Jerome; Tobias Knedlik; Mareike Meyn; Tino Urban (Eds.)
New Growth and Poverty Alleviation Strategies for Africa – Institutional and Local Perspectives

vol. 14, 2009, 576 pp., 69,90 €, pb., ISBN 978-3-8258-1966-8

Karl Wohlmuth; Reuben Adeolu Alabi; Philippe Burger; Achim Gutowski; Afeikhena Jerome; Tobias Knedlik; Mareike Meyn; Tino Urban (Eds.)
New Growth and Poverty Alleviation Strategies for Africa – International and Regional Perspectives

vol. 13, 2008, 648 pp., 69,90 €, pb., ISBN 978-3-8258-1542-4

Karl Wohlmuth; Chicot Eboué; Achim Gutowski; Afeikhena Jerome; Tobias Knedlik; Mareike Meyn; Touna Mama (Eds.)
Africa – Commodity Dependence, Resource Curse and Export Diversification

vol. 12, 2007, 664 pp., 69,90 €, pb., ISBN 978-3-8258-0256-1

Karl Wohlmuth; Philippe Burger; Achim Gutowski; Mohammed N. Hussain (†), Tobias Knedlik; Mareike Meyn (Eds.)

Africa – Escaping the Primary Commodities Dilemma

vol. 11, 2006, 576 pp., 69,90 €, pb., ISBN 3-8258-7842-2

Karl Wohlmuth; Achim Gutowski; Tobias Knedlik; Mareike Meyn; Samuel Ngogang (Eds.)

Private and Public Sectors: Towards a Balance

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