



African Development Perspectives



Yearbook 2020/21

SUSTAINABLE DEVELOPMENT GOAL NINE AND AFRICAN DEVELOPMENT – CHALLENGES AND OPPORTUNITIES

EDITED BY

TOBIAS KNEDLIK, SAMIA SATTI OSMAN MOHAMED NOUR,
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Tobias Knedlik, Samia Satti Osman Mohamed Nour,
Anthony Ifeanyi Ugulu, Karl Wohlmuth (Eds.)

**Sustainable Development Goal Nine
and African Development –
Challenges and Opportunities**

African Development Perspectives Yearbook

Edited by the

Research Group on African Development Perspectives Bremen:
Tobias Knedlik, Samia Satti Osman Mohamed Nour,
Anthony Ifeanyi Ugulu, Karl Wohlmuth

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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 conceptional 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. Also, the issues of revitalizing development planning in Africa, of managing 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 media are becoming more important and as African sources get a greater 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 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. 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 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 *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.

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 submitted as the result of international and regional African conferences. Important documents of African regional organisations, of regional economic communities, of individual African states, and of important programmes, projects and initiatives of African civil society organisations, African cooperatives, and 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 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.

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, local development initiatives and NGOs, which could serve as models for other regions,
- innovative strategies for 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, discussion, and research, i. e. from international, regional, and national organisations and institutions, committees, working groups, and NGOs, but of key relevance are those ideas and approaches which are originating from Africa.

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Foreword and Acknowledgements

This Volume 22 of the *African Development Perspectives Yearbook* with the title “Sustainable Development Goal Nine and African Development – Challenges and Opportunities” 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 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 and 21 had a focus on Science, Technology, and Innovation (STI) Policies, the volume 22 is related to the Sustainable Development Goal (SDG) 9 and the achievements of Africa in this regard. It is of great importance to inform the public about the anniversary ceremony of *Thirty Years (1989-2019) African Development Perspectives Yearbook*, an event which took place in 2019. A great number of former and still active contributors and editors have contributed to this Festschrift. Volume 22 for 2020/2021 is now the start of a further decade of this important publication on African development.

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: 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 volume 22, UNCTAD had a great role, as two key experts presented contributions. On the side of the universities, scientific academies, scientific governance institutions, and research institutes the following partners should be mentioned: the Department of Economics, University of Khartoum, Sudan; the African Technology Policy Studies Network Nairobi, Kenya; the Department of Agricultural Economics, Ambrose Alli University, Ekpoma, Edo State, Nigeria; the Fraunhofer-Institut für Fabrikbetrieb und -automatisierung (IFF), Magdeburg, Germany; Tilburg University, TiSEM/Tilburg School of Economics and Management, Department Management; Graduate School of Technology Management (GSTM), Department of Engineering and Technology Management, University of Pretoria; Global Change Institute (GCI), University of the Witwatersrand, Johannesburg, South Africa; Department of Construction Management and Quantity Surveying, Faculty of Engineering and the

Built Environment, University of Johannesburg, South Africa; Department of Agricultural and Resource Economics, Federal University of Technology, Akure, Nigeria; Industrial Economics Research Institute, Industrial Research and Consultancy Centre (IRCC), Khartoum, Sudan; Sudan Chapter, African Technology Policy Studies (ATPS) Network; the University of Maroua, Maroua, Cameroon; the Laboratory of Analysis and Research in Mathematical Economics (LAREM), University of Yaounde 2, Soa, Yaounde- Cameroon; also independent researchers from the Sudanese Consulting business and related to the Afrika-Verein der deutschen Wirtschaft e. V. in West Africa have contributed; and many others.

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, and to Dr. Anthony Ifeanyi Ugulu, from the Department of Construction Management and Quantity Surveying, Faculty of Engineering and the Built Environment, University of Johannesburg, South Africa. Both experts have given advice from the first phase of planning this publication project, and both 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 (2020/2021), while Dr. Anthony Ugulu accepted the position as Unit Editor for Unit 2 of volume 22 (2020/2021). 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. She will also cooperate with the Research Group on volume 23 (2022) on digital transformation in Africa. The volume editor of volume 22 (2020/2021), Professor Karl Wohlmuth (from IWIM/Institute for World Economics and International Management and the Research Group on African Development Perspectives Bremen), is indebted to these two experts for their encouragement, ideas, concepts, and the valuable contributions to this volume of the *African Development Perspectives Yearbook*.

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), 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 22 (2020/2021) of the *African Development Perspectives Yearbook* the Editors of the Yearbook took up the issues of Sustainable Development Goal (SDG) 9 as this is a key goal for industrialising and innovating Africa

and for a continent which is developing now its soft and hard infrastructure. These issues are so important for the much-needed redirection of economic and social policies in Africa as all the social, economic, political, and ecological dimensions of the Sustainable Development Agenda 2030 are involved. The volume 22 (2020/2021) considers the fact that structural reforms and structural transformation processes in Africa request policies which directly support structural change. SDG 9 is giving with its 8 targets and its 12 indicators a guideline for action. All the essays and book reviews contained in the volume fulfil this task of taking stock of realising SDG 9 in Africa by achieving its targets.

While volume 20 presented a general strategy on “STI policies for inclusive growth in Africa”, the volume 21 was focussing on “human capacity building and STI policies in Africa”. Volume 22 can build on this basis by analysing the three elements of advancing industrialisation, building innovation capacity, and developing infrastructure in Africa. Unit I of volume 22 elaborates on continent-wide issues. There is a discussion of developing productive capacities for industrial growth, a discussion about innovation strategies, which are based on frugal innovations to empower the people in bottom-of-the pyramid households, a discussion about commodity-based industrialisation enabled by the African Continental Free Trade Agreement (AfCFTA), and there is a discussion on making foreign direct investment to facilitate a sustainable industrialisation. Specific strategies to speed up industrialisation, to create innovation capacities, and to develop infrastructure development are presented in these essays of Unit 1, and important policy recommendations are provided. Country specific examples are presented in these continent-wide analyses of Unit 1 as well. In Unit 2 the eight targets of SDG 9 are considered in the form of exemplary cases, such as the role of financial innovations for strengthening agricultural value chains and the role of new strategies for agro-based industries; other cases refer to issues of renewable energy promotion in rural and urban areas to address local inclusive growth and sustainable development; finally, there are cases which highlight the role of modern integrated roads systems and the significance of social development and infrastructure projects which are attached to mining activities. In this Unit 2 there are found country cases on Nigeria, Sudan, Cameroon, Zimbabwe, and South Africa. There is a tradition in the work for the *African Development Perspectives Yearbook* to focus with great priority on country studies, and Sudan, Nigeria, and South Africa have always played a great role to exemplify the themes of Yearbook volumes that were selected. This has also to do with the great research projects which are ongoing on these three countries. Unit 3 is on Book Reviews and Book Notes, and the Unit is rich in entries which are based on a classification system according to the 17 SDGs and the 8 targets of SDG 9. Unit 3 is also highlighting those publications which discuss the key linkages of SDG 9 with other SDGs. Also, global reports on economic perspectives and reports on the development options and perspectives of the African continent play a great role in this Unit, but also the reviews for the African

Studies section of Unit 3 should be mentioned. This Unit 3 is presenting numerous review articles, book reviews and book notes on the core theme of volumes 22. This strong Unit 3 is facilitated by the fact that most of these reports, books and documents which are reviewed are under an open access publication status.

Many institutions have over the three decades up to now 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, with documents about declarations and agreements, and with research papers, also at their early stage. So, the editors of the *African Development Perspectives Yearbook* can grasp new events and developments in Africa very early, what helps in inviting contributors who are then key persons of expertise for specific units (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 effort by sending us materials and by making available - always timely - new strategy documents and drafts of their research papers for our publication series, especially the Book Reviews and Book Notes Unit of the *African Development Perspectives Yearbook*. For volumes 20 and 21, UNESCO (United Nations Educational, Scientific and Cultural Organisation) and ACBF (African Capacity Building Foundation) stepped in as key partners, and for volume 22 this role is taken by UNCTAD (United Nations Conference on Trade and Development). But it is also true that individual persons in these important organizations are of great help; 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 conferences and 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, publicising our endeavour of continuously publishing 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".

We would also like to express our gratitude to those researchers 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. 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 for the volumes 20 and 21 at that time, Dr. Nazar Mohamed Hassan, Senior Regional Adviser, UNESCO Regional Office in Cairo, were presenting the two issues 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 and 19 of the *African Development Perspectives Yearbook*. We are planning to hold such events in the future more regularly. Dr. Nazar Mohamed Hassan has presented the two volumes 20 and 21 of the *African Development Perspectives Yearbook* at meetings in UNESCO offices (in Cairo and Paris). 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. We hope that we can realise such launch and information meetings also with volume 22 of the *African Development Perspectives Yearbook*.

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 Volume Editor, are also thankful to Professor Dr. Achim Gutowski for his continuous work as the Book Reviews/Book Notes Editor of the *African Development Perspectives Yearbook*; he has over many years prepared, in cooperation with Professor Karl Wohlmuth, the Unit on Book Reviews and Book Notes. Now Professor Samia Satti Osman Mohamed Nour from the University of Khartoum in Khartoum, Sudan has taken over this function. She is associated with important global and regional research institutions and has numerous advisory functions. The Unit on Book Reviews and Book Notes provides detailed assessments of a great number of books, journals, series, research papers and documents being related to the specific theme of the volume; but also, global reports on the world economy and on African development and specialised publications on Africa’s development perspectives are reviewed. The Unit on Book Reviews and Book notes is based on a

detailed list of subjects/classifications which is filled with many 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 at this occasion has motivated a great number of former contributors and supporters to continue with their work for the Yearbook project. 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.

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 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 related research projects have helped us to intensify the research activities on African development issues, 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. Professor Reuben A. Alabi from the Department of Agricultural Economics and Extension, Ambrose Alli University, Ekpoma, Edo State, Nigeria has cooperated with us for many years; he is now back to his home university. Professor Alabi has supported the Yearbook project as editor/co-editor, as a contributor, and he was a research collaborator in various projects. The Research Group is happy about a significant number of long-term partners of the Yearbook project. We are thankful for all

these contributions and donations to the research activities on African development perspectives which are taking place in Bremen; 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 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. Past volumes, like the volumes 19 and 21, and now volume 22 give evidence of this important part of the work of the *Research Group on African Development Perspectives Bremen*.

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 22 for the year 2020/2021 with the title “*The Sustainable Development Goal Nine (Infrastructure, Industrialization, Innovation) and African Development*”, the work has already started for volume 23 (for the year 2022) with the title “*Business Opportunities, Start-Ups, and Digital Transformation in Africa*”. An International Call for Papers was released to increase participation and collaboration. The theme is related to important research and cooperation programmes of the *Research Group on African Development Perspectives Bremen* on digital transformation and reindustrialisation in Africa.

In the name of the Editorial Team:

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List of Abbreviations and Acronyms

4IR	Fourth Industrial Revolution
AAAE	Assoc Association of African Agricultural Economists (Nairobi, Kenya)
AAS	African Academy of Sciences
ACBF	African Capacity Building Foundation
ACET	African Center for Economic Transformation
ACG	Arab Coordination Group
ACGS	Agricultural Credit Guarantee Scheme
ACINTaD	Africa Centre For International Trade And Development
ACP	African, Caribbean and Pacific (trade)
ADB	African Development Bank
ADF	Augmented Dickey-Fuller (test)
AEA	African Economic Outlook
AEC	Atomic Energy Commission
AEO	Africa Economic Outlook
AERC	African Economic Research Consortium
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
AfDBG	African Development Bank Group
AFF	African Fashion Foundation
AFP	Agence France-Presse
AGOA	African Growth and Opportunity Act
AGRODEP	African Growth and Development Policy (Modelling Consortium)
AGRODEP	African Growth and Development Policy Modeling Consortium (Facilitated By IFPRI/International Food Policy Research Institute)
AI	Artificial Intelligence
AIC	Akaike information criterion
AICD	Africa Infrastructure Country Diagnostic
AIDA	Action Plan for Accelerated Industrial Development of Africa
AIDI	Africa Infrastructure Development Index
ANAFOR	National Forestry Development Agency/Agence Nationale D’Appui Au Développement Forestier

AOI	Agriculture Orientation Index
ARC	Agricultural Research Corporation
ARCH	Autoregressive Conditional Heteroskedasticity
ARDL	Auto-Regressive Distributed Lag
ARRC	Animal Resources Research Corporation
ARSEL/	Agence de Régulation du Secteur de l'Electricité/Electricity
ESRA	Sector Regulatory Agency
ART	anti-retroviral treatment
ASTI	Agricultural Science and Technology Indicators
ATM	Automatic Teller Machine
ATPS	African Technology Policy Studies (Network)
AU	African Union
AUC	African Union Commission
AVCs	Agricultural Value Chains
BBC	British Broadcasting Corporation
BCtA UN	Business Call to Action United Nations
BEN Namibia	Bicycling Empowerment Network Namibia
BHP	Broken Hill Proprietary Company Limited
BIAT	Boosting Intra African Trade (Action Plan)
BIC	Bayesian/Schwartz information criterion
BITs	Bilateral Investment Treaties
BOP	Base / bottom of the [income] pyramid
BOT	Build-Operate-Transfer (contract on construction and management)
BTA	Bounds Testing Approach (to Cointegration)
CA	Comparative Advantage
CAADP	Comprehensive Africa Agriculture Development Programme
CAC	Commercial Agricultural Credit (Scheme)
CAGR	Compounded Annual Growth Rate
CAR	Central African Republic
CBI	Centre for the Promotion of Imports from developing countries, The Hague, Netherlands
CBK	Central Bank Kenya
CBN	Central Bank of Nigeria

CBOS	Central Bank of Sudan
CBoS _t	Central Bureau of Statistics
CC of WEC	Cameroon Committee of the World Energy Council
CCSD	Columbia Center on Sustainable Development
CDP	Committee for Development Policy (of ECOSOC, United Nations)
CEDIMES	Coordination d'Etudes du Développement International et des Mouvements Economiques et Sociaux (Réseau Académique International Francophone)
CEMAC	Central African Economic and Monetary Community
CEN-SAD	Community of Sahel–Saharan States
CFA Francs	Franc de la Communauté Financière d'Afrique
CFTA	Continental Free Trade Area
CGAP	Consultative Group to Assist the Poor
CGE	Computable General Equilibrium (models)
CGEMs	computable general equilibrium models
CGIAR	Consultative Group on International Agricultural Research
CID	Center for International Development (at Harvard University)
CIF	Climate Investment Fund
CNN	Cable News Network
CO ₂	carbon dioxide
CO ₂ e	CO ₂ equivalent
Cocobod	Ghana Cocoa Board (in Accra, Ghana)
COMESA	Common Market for Eastern and Southern Africa
COMSATS	Commission on Science and Technology for Sustainable Development in the South
COVID	Corona Virus Disease
COVID-19	Corona Virus Disease 2019
CPA	Comprehensive Peace Agreement
CPR	Consumer Products and Retail (sectors)
CSOS	community share ownership schemes
CSOT	Community Share Ownership Trust
CSP	cross-sector partner
CSP	concentrated solar power
CSR	corporate social responsibility

CTA	Technical Centre for Agricultural and Rural Cooperation ACP-EU
CTC	crush, tear, and curl (black tea processing segment for passing the leaves through cylindrical rollers)
CU	Customs Union
CUF	Common User Facility
CWI	Core Welfare Indicators (Questionnaire, developed by the World Bank, also for Nigeria)
DAFF	Department for Agriculture, Forestry and Fisheries, Republic of South Africa, Pretoria
DAL Group	Sudan's Largest and Most Diversified Conglomerate
DBE	Department of Basic Education
DDPD	Doha Document for Peace in Darfur
DDS	Darfur Development Strategy
DEA	Department of Environmental Affairs (of South Africa)
DFID	Department for International Development (UK)
DI	domestic investment
DIDC	Darfur Internal Dialogue and Consultations
DMR	Department of Mineral Resources
DPBT	discounted payback time
DPDC	Dibamba Power Development Corporation
DRA	Darfur Regional Authority
DRC	Democratic Republic of Congo
DST	Department of Science and Technology
DTI	Department of Trade and Industry (Republic of South Africa)
EAC	East African Community
EACIP	East African Community Industrialization Policy
EBA	Everything But Arms
EBSC	Energy Balance Sheet of Cameroon
ECA	Economic Commission for Africa
ECAM 4/CHCS 4	Fourth Survey of Cameroon Enterprises and of Household Consumption of Cameroon/Enquête Camerounaise Auprès des Ménages (ECAM)/Fourth Cameroonian Household Consumption Survey (CHCS)
ECCAS	Economic Community of Central African States
ECOSOC	Economic and Social Council (of the United Nations)

ECOWAS	Economic Community of West African States
EDI	Energy Development Index
EDPRS	Economic Development and Poverty Reduction Strategy (development programme for Rwanda)
EFInA	Enhancing Financial Innovation and Access
EIA	US Energy Information Administration
EIAs	Environmental impact assessments
EMC	Energy Management Committee (of Cameroon)
EMRs	Environmental Management Reports
ENEO	Energy of Cameroon (electricity company)
EPAs	Economic Partnership Agreements
EPZA	Export Processing Zone Authority (in Mombasa, Kenya)
ERF	Economic Research Forum
ERP	economic reform programme (of Sudan)
ESA	Economic & Social Affairs (Department of the United Nations)
ESCWA	Economic and Social Commission for Western Asia (of the United Nations)
ESG	Environmental, Social and Governance (criteria for impact investments)
ESKOM	Electricity Supply Commission (founding name)
ESMAP	Energy Sector Management Assistance Programme
EU	European Union
EV	electric vehicles
eVA Fund	eVentures Africa Fund
EY	Ernst & Young
FAO	Food and Agriculture Organization (of the United Nations)
FAOSTAT	FAO Statistics database
FCT	Federal Capital Territory (Abuja, Nigeria)
FDI	Foreign Direct Investment
FERDI	Fondation Pour Les Etudes Et Recherches Sur Le Développement International
FFP2	Filtering Face Piece 2 (category mouth masks)
FGD	focus group discussions
FITs	Feed-in-tariffs
FMARD	Federal Ministry of Agriculture and Rural Development

FMAWR	Federal Ministry of Agriculture and Water Resources
FSD	Financial Sector Deepening
FSDT	Financial Sector Deepening Trust
FT	Financial Times
FTA	Free Trade Area
FTE	Full Time Equivalent
GAFFSP Fund	Global Agriculture & Food Security Program Fund
GCC	Gulf Cooperation Council
GCI	Global Change Institute, University of the Witwatersrand, Johannesburg, South Africa
GDP	Gross Domestic Product
GE	Green Economy
GEF	Global Environment Facility
GES	General Energy Systems (South Africa)
GESP	Growth and Employment Strategy Paper
GESEA	General Energy Systems South Africa
GFC	global financial crisis
GFCF	Gross Fixed Capital Formation
GFD	Global Findex Database
GHG	Greenhouse Gas
GI	Geographical Indicators (framework)
GIFF	Growth Identification and Facilitation Framework
GII	Global Innovation Index
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit, Bonn, Germany
GMM	Generalized Method of Moments
GoS	Government of Sudan
GPOBA	Global Partnership on Output-Based Aid
GrEEEn	Green Employment and Enterprise Opportunities (project in Ghana)
GSMA	Global System for Mobile Communications Association/Groupe Speciale Mobile Association
GSS	Ghana Statistical Service

GSTM	Graduate School of Technology Management, Department of Engineering and Technology Management, University of Pretoria
GVCs	Global Value Chains
GW	Giga Watt
GWh	Gigawatt hours, as a unit of energy, representing one billion (1 000 000 000) watt hours
HCC8	Human Choice and Computers (8th International Conference on Human Choice and Computers)
HIV	Human Immunodeficiency Virus
HIV-AIDS	Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome
HLMC	High-Level Ministerial Committee (of Ghana for implementing SDGs)
HQ	Hannan-Quinn criterion
HS	Harmonized System
I&P	Investisseurs et Partenaires
IBAN	Inclusive Business Action Network
IBILE	acronym for Ikeja, Badagry, Ikorodu, Lagos Island, and Epe
IBRD	International Bank for Reconstruction and Development (World Bank Group)
ICA	Infrastructure Consortium for Africa
ICC	Implementation Coordination Committee (for SDGs in Ghana)
ICCO	International Cocoa Organization
ICT	Information and Communication Technology
IDDA 3	Third Industrial Development Decade for Africa 2016-2025
IDPF	Industrial Development Policy Framework (of SADC)
IDPs	Internally Displaced Persons
IDRC	International Development Research Centre (in Ottawa, Canada)
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFF	Illicit Financial Flows
IFIP	International Federation for Information Processing, Technical Committee/TC 9
IFPRI	International Food Policy Research Institute

IGAD	Intergovernmental Authority on Development
ILO	International Labour Organization
IMF	International Monetary Fund
IMT	Information Management Technology
INDC	Intended Nationally Determined Contribution
INSEAD	Institut Européen d'Administration des Affaires (original name)
IOSR	International Organization of Scientific Research
IOSR-JHSS	IOSR Journal Of Humanities And Social Science
IoT	Internet of Things
IP	Intellectual Property
IP/FERDI	Investisseurs et Partenaires / Fondation pour les Etudes et Recherches sur le Developpement International
IPAI	I&P Africa Infrastructure
IPAP	Industrial Policy Action Plan
IPCC	Intergovernmental Panel on Climate Change
IPN	Interconnected Power Network
IPoA	Istanbul Plan of Action for Least Developed countries
IPP	Independent Private Producer
IPRs	Intellectual Property Rights
IRCC	Industrial Research and Consultancy Center
IRENA	International Renewable Energy Agency
IRR	Internal Rate of Return
ISI	Import substitution industrialization
IT	Information Technology
ITC	International Trade Centre
ITP	Industrial Transformation Programme (of Kenya)
IWIM	Institute for World Economics and International Management
JAM	Joint Assessment Mission (for Darfur)
KAM	Kenya Association of Manufacturers
KBE	Knowledge Based Economy
KEEI	Korea Energy Economics Institute
KEMRI	Kenya Medical Research Institute
KETEPA	Kenya Tea Packers Limited
KICOTEC	Kitui County Textile Centre (in Kenya)

KII	key informant interviews
KIPC	Kenya Investment Promotion Council
Km	Kilometres
KNOMAD	Global Knowledge Partnership on Migration and Development
KoTDA	Konza Technopolis Development Authority
KPDC	Kribi Power Development Corporation
KPLC	Kenya Power and Lighting Company
KPMG	Klynveld Peat Marwick Goerdeler
KSh	Kenya Shilling (Kenyan currency)
kVA	Kilovolt-amperes
kWh	kilowatt-hour
kWh/per capita	Kilowatt hour per capita
KWp	kilowatt peak
LAREM	Laboratory of Analysis and Research in Mathematical Economics, University of Yaounde 2, Cameroun
LCDA	Local Council Development Areas
LCOE	Levelized Cost of Electricity
LDC	Least Developed Country
LDCs	Least Developed Countries
LDE CFIA	Leiden University, Delft University of Technology, Erasmus
LDE	University Rotterdam, Centre for Frugal Innovation in Africa
LEC	Levelized Energy Cost
LED	local economic development
LGAs	Local Government Areas
LMCP	Last Mile Connectivity Project
LPI	Logistic Performance Index
LRRC	Livestock Resources Research Corporation
LSE	London School of Economics
LSHA	Lagos State House of Assembly
MDGs	Millennium Development Goals
MEPI	Minimum Energy Poverty Index
MEPL	Minimum Energy Poverty Line
MFEP	Ministry of Finance and Economic Planning (of Rwanda)
MFN	Most Favoured Nation (trade rule of GATT and WTO)

MHChW	Ministry of Health and Child Welfare
MIGA	Multilateral Investment Guarantee Agency
MINE	Made in Nigeria for Export
MINEE	Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy
MINEPIA	Ministry of Livestock, Fisheries and Animal Industries/Ministère de L'Elevage, Des Pêches Et Des Industries Alimentaires
MINFOW	Ministry of Forestry and Wildlife
MIT	Massachusetts Institute for Technology
MM	Mobile Money
MMT	mobile money technology
MNC	multinational corporation
MNOs	Mobile Network Operators (in Nigeria)
MoF	Ministry of Finance (of Sudan)
MOHE	Ministry of Higher Education and Scientific Research
MoT	Ministry of Transport (for Sudan)
MPC	marginal productivity of capital
M-PESA	M (for Mobile) and Pesa (in Swahili for money)
MPL	marginal productivity of labour
MPRA	Munich Personal RePEc Archive
MPRD	Minerals and Petroleum Resources Development
MSMEs	micro-, small-, and medium-sized enterprises
MVA	Manufacturing Value Added
MW	Megawatt
N	Naira (Nigerian Currency)
Na	not available
NBER	National Bureau of Economic Research
NBHS	National Baseline Household Survey
NBS	National Bureau of Statistics (Abuja, Nigeria)
NCR	National Center for Research
NEMA	National Environmental Management Authority (of Kenya)
NEP	National Energy Plan
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organizations

NHA	National Highway Authority
NIEs	Newly Industrialized Economies
NIMET	Nigerian Meteorological Agency
NIPF	National Industrial Policy Framework
NIR	New Industrial Revolution
NIRSAL	Nigeria Incentive-Based Risk Sharing System for Agricultural Lending
NIS	National Innovation System
NIS	National Innovation System
NISER	Nigerian Institute for Social and Economic Research
NPG	National Partnership Group (for implementing SDGs in Rwanda)
NPV	net present value
NRBC	National Roads and Bridges Corporation
NRIFS	National Research Institute for Food Science
NSE	New Structural Economics
NSSP	Nigeria Strategy Support Program (established by IFPRI)
NTSC	National Technical Steering Committee
NY	New York
OAU	Organization of African Unity
ODA	Official Development Assistance
ODI	Overseas Development Institute
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Square (test)
OTP	orthodox tea production
PAFTA	Pan Arab Free Trade Area
PAM	Policy Analysis Matrix
PAYG	pay as you go
PBT	Payback Time
PDER	Plan Directeur d'Electrification Rurale /Rural Electrification Master Plan
PDSE	Plan de Développement du Secteur de l'Electricité à l'Horizon 2030
PDSEN	Projet de développement du Secteur de l'Energie
PEN	Plan Energie National

PFA	Public Financing of Agriculture (in Nigeria)
PHCN	Power Holding Company of Nigeria
PIB	produit intérieur brut
PIDA	Programme for Infrastructure Development in Africa
PIM	Public Investment Management
PPPs	Public-private partnerships
PRI	Principles for Responsible Investment
PV	Photovoltaic
PVH Corporation	Phillips-Van Heusen (former name of the corporation)
PwC	PricewaterhouseCoopers
R&D	Research & Development
RBF	results-based funding (or financing mechanism)
RCA	Revealed Comparative Advantage
RCUWM	Regional Centre on Urban Water Management (in Tehran, Iran)
RDC	Rural District Council
RE	Renewable Energy
REACH	Results in Education for All CHildren
REC	Regional Economic Communities
REMP	Renewable Energy Master Plan
RePEc	Research Papers in Economics
RES	Renewable Energy Sources
RETScreen	Renewable Energy Technology Screen (a Clean Energy Management Software system for energy efficiency)
RMS	Regulatory, Monitoring and Supervisory (institutions)
RoC	Republic of Congo
RPS	Renewable Portfolio Standards
RVCs	regional value chains
RWTH	Rheinisch-Westfälische Technische Hochschule
RWU	Railways Workers Union
S&T	Science and Technology
SAC	Sudan Airways Company
SADC	Southern African Development Community
SAEC	Sudan Atomic Energy Commission

SAF	SOLAIR AFRIC SAR (solar company of Cameroon)
SARL	Société à responsabilité limitée
SC	Steering Committee (for implementing SDGs in Rwanda)
SCS	Sudan Comprehensive Strategy
SDG	Sustainable Development Goal
SDG	Sudanese Pound
SDGC	Sustainable Development Goals Centre (Africa)
SDGC/A	Sustainable Development Goals Center for Africa
SDSN	Sustainable Development Solutions Network
SE4All	Sustainable Energy for All initiative (of the United Nations)
SEED	Supporting Entrepreneurs for Environment and Development
SERG	Sudan Economy Research Group (at the University of Bremen)
SEs	smart energy systems
SEZs	Special economic zones
Shona EPZ	Shona Export Processing Zone
SICU	Sudanese Industrial Chambers Union
SIM	Subscriber Identity Module
SLP	social and labour plans
SMEs	Small & Medium Enterprises
SOA	Society Of Actuaries
SOCAPALM	palm oil company
SOSUCAM	Cameroon sugar company
SPGE	Strategy Paper for Growth and Employment (of Cameroon)
SRC	Sudan Railways Corporation
SRIC	Scientific Research and Innovation Commission
SSA	Sub Saharan Africa
SSATP	Sub-Saharan African Transport Policy (Programme)
SSL	Sudan Shipping Line
STC	Science and Technology Commission
STEER	Social, Technical, Economic, Environmental and Regulatory
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
STISA	Science, Technology and Innovation Strategy for Africa
SVAR	structural vector autoregressive (approach)

TAH	Trans-African Highways (network)
TB	Tuberculosis
TCSOT	Tongogara Community Share Ownership Trust
TEC	Thermomechanic Energy Cameroon (SARL)
TEG	total electricity generated
TEM	Transworld Energy and Minerals Resources
TiSEM	Tilburg School of Economics and Management
TMT	Telecommunications, Media, and Technology (sectors)
TNCs	Transnational companies (or corporations)
TOKTEN	Transfer of Knowledge through Expatriate Nationals
Tralac	Trade Law Centre (in Stellenbosch, Republic of South Africa)
TRDCC	Tongogara Rural District Council
TRI	Tea Research Institute (in Kenya)
TV	Television
TVET	Technical and Vocational Education and Training
TWh	TeraWatt-hour (1TWh is 1,000,000,000,000 Wh)
UK	United Kingdom
UMA	Arab Maghreb Union
UMIC	upper-middle-income country
UN	United Nations
UN	United Nations
UNAMID	United Nations Mission in Darfur/African Union-United Nations Hybrid Operation in Darfur
UNCTAD	United Nations Conference on Trade and Development
UNCTAD STAT	UNCTAD Statistics database
UNCTAD- TRAINS	UNCTAD - Trade Analysis Information System Database
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNEP FI	United Nations Environment Programme Finance Initiative
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNGC	United Nations Global Compact

UNIDO	United Nations Industrial Development Organization
UNO	United Nations Organization
UN-OHRLLS	UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States
UNOPS	United Nations Office for Project Services
UNSD	United Nations Statistics Division
UNSDGs	United Nations Sustainable Development Goals
UNU/ INTECH	United Nations University/Institute for New Technologies (Maastricht)
UNU/MERIT	United Nations University/Maastricht Economic and Social Research Institute on Innovation and Technology
UNU- WIDER	United Nations University/World Institute for Development Economics Research
US	United States
US\$	US Dollar
USAID	United States Agency for International Development
USD	US Dollar
VAR	Vector Auto-Regressive
VCs	Value Chains
VECM	Vector Error Correction Model
WB	World Bank
WDI	World Development Indicators (of World Bank)
WE	wind energy
WEF	World Economic Forum
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WIT	Wessex Institute of Technology
Wp	Watt peak (capacity)
WTO	World Trade Organization

Unit 1: Sustainable Development Goal Nine and African Development – Continental Perspectives

Sustainable Development Goal Nine (SDG 9) and Continental African Perspectives – An Introduction

Karl Wohlmuth¹

1 The Issues

How is SDG 9 defined with regard of targets and indicators?

In this introductory Unit 1 key issues are presented on the relevance of SDG 9 for Africa's development. "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"; this is the definition of Sustainable Development Goal Nine (SDG 9); it has three core elements (infrastructure, industrialisation, and innovation). The eight targets of SDG 9 which are of importance for the discussions in the volume are²:

- **Develop** quality, reliable, sustainable, and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all. Emphasize quality, accessibility, and fairness.
- **Promote** inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.
- **Increase** the access of small-scale industrial and other enterprises, especially so in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.
- **Upgrade**, by 2030, infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries being committed to act in accordance with their respective capabilities.
- **Enhance** scientific research, upgrade the technological capabilities of industrial sectors in all countries, especially so in developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

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² See the link on SDG 9: <https://sustainabledevelopment.un.org/sdg9>

- **Facilitate** sustainable and resilient infrastructure development in developing countries through enhanced financial, technological, and technical support to African countries, least developed countries, land locked developing countries and small island developing States.
- **Support** domestic technology development, research, and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.
- **Increase** significantly access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

SDG 9 is pertaining to industry development but is compartmented into three pillars (Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation). These three pillars are supposed to be attained via eight targets. Four of these eight targets (SDG 9.1, 9.3, 9.4 & 9.A) are concerned with optimizing the formation and the allocation of physical and financial capital, while three other targets (SDG 9. 5, 9.B & 9.C) emphasize the upgrading of human capital. Those seven targets are the drivers and the means to realize the central target SDG 9.2 of inclusive and sustainable industrialization. Target SDG 9.2 is the direct articulation of the core pillar of Sustainable Development Goal 9, read as: promoting inclusive and sustainable industrialization, so that by 2030 it is possible to significantly raise industry's share of employment and gross domestic product.

Why is sustainable development goal 9 so important for developing economies and for Africa?

Investing in infrastructure and innovation are drivers of economic growth and development. With more than half of the world population living in cities, mass transport systems and renewable energy systems are becoming over time more important. Supplying the world population in cities and in rural areas with consumer and investment goods and with services is a key task. New industries and information and communication technologies are therefore important for growth and development. Some figures give an answer to this question how relevant SDG 9 is for developing countries and for Africa³: More than 4 billion people do not have access to the Internet, and 90% of them are from developing countries; 2.3 billion people have not access to basic sanitation; the productivity of businesses in African countries is cut by 40% because of infrastructure constraints; 2.6 billion people in developing countries do not have access to uninterrupted electricity; 2.3

³ See some information about the importance of SDG 9 for developing countries from UNDP sources: <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-9-industry-innovation-and-infrastructure.html>

million people have jobs in renewable energy sectors, and this number could increase to 20 million by 2030 if adequate policies are followed; only 30% of agricultural products are undergoing industrial processing in developing countries compared to 98% in high-income countries. COVID-19 has considerably changed the situation for implementing SDG 9⁴: Only 35% of small industries have access to credit in developing countries; fewer than one in five people in Least Developed Countries (LDCs) used in 2019 the Internet; investment in R&D is growing but needs to accelerate, especially in developing countries and in Africa; the growth from 1,400 billion \$ in 2010 to 2,200 billion \$ in 2017 is impressive, but these are global figures. All these figures show that infrastructure is key for industrial development; similar indicators for technology and innovation and for industrialization show the unfavourable situation for Africa.⁵

What do we know about progress in regard of implementing SDG 9 in Africa?

Overview of progress shows weak results in recent years and low shares and data for indicators especially for Sub-Saharan African countries. United Nations (UN) is reporting:⁶ First example: “In 2019, 14 per cent of the world’s workers were employed in manufacturing activities, a figure that has not changed much since 2000. The share of manufacturing employment was the largest in Eastern and South-Eastern Asia (18 per cent) and the smallest in sub-Saharan Africa (6 per cent).” Second example: “According to surveys covering the period from 2010 to the present, in developing countries, 34 per cent of small-scale industries benefit from loans or lines of credit, which enable them to integrate into local and global value chains. However, only 22 per cent of small-scale industries in sub-Saharan Africa received loans or lines of credit, compared with 48 per cent in Latin America and the Caribbean.” Third example: “The number of researchers per 1 million inhabitants increased, from 1,018 in 2010 to 1,198 in 2017, ranging widely, from 3,707 in Europe and Northern America to only 99 in sub-Saharan Africa. In addition, women represented only 30 per cent of global researchers.” Fourth example, of relevance for the African LDCs: “The share of medium-high and high-technology goods in world manufacturing production reached nearly 45 per cent in 2017. Medium-high and high-technology products continued to dominate manufacturing production in developed regions, reaching 49 per cent in 2017, compared with 9 per cent in least developed countries.”

⁴ See: <https://sdgs.un.org/goals/goal9>

⁵ See the statement by the SDG Philanthropy Platform about Africa’s opportunities and challenges: <https://www.sdgphilanthropy.org/SDG-9-in-Africa-by-2030>

⁶ United Nations on SDG 9, Progress: <https://sdgs.un.org/goals/goal9>

The most recent Progress Report of April 2020 (including some first effects of the pandemic) from the United Nations General Secretary (UN 2020) is revealing also regarding the SDG 9 implementation.⁷ The General Secretary emphasizes (UN 2020, on page 3/19)⁸, when he is relating to each other the COVID-19 pandemics and the implementation of the 17 SDGs: “While the crisis is imperilling progress towards the Goals, it also makes their achievement all the more urgent and necessary. It is essential that recent gains be protected as much as possible and that a truly transformative recovery from COVID-19 be pursued, one that reduces the risk of future crises and brings much closer the inclusive and sustainable development required to meet the goals of the 2030 Agenda and the Paris Agreement on climate change, the first task of the decade of action.” While SDG 9 has important industry development indicators, such as manufacturing growth, manufacturing employment, medium and high technology manufactured goods exports, financing of small industries, etc.) the environmental indicators also matter in the context of industrial development, so that the level of emissions of Africa’s manufacturing sectors is of great importance for the future of its industrial development process: “After three years of stability, global carbon dioxide emissions from fuel combustion started to rise again in 2017, reaching 32.8 billion tons, underpinned by economic growth and a slowdown in efficiency improvements. However, the intensity of global carbon dioxide emissions has declined by nearly one quarter since 2000, showing a general decoupling of carbon dioxide emissions from GDP growth. The same trend was visible in manufacturing industries after 2010, with global manufacturing intensity falling at an average annual rate of 3 per cent until 2017”.⁹ Although these UN files give some new information, they hesitate to draw more general conclusions.

UNIDO is the custodian of the statistical recording for various targets of SDG 9. The recent report “Statistical Indicators of Inclusive and Sustainable Industrialization”, which was published in 2019 in Vienna by UNIDO (UNIDO 2019b), gives new information on manufacturing, small-scale industries, environmental sustainability, and technology upgrading in the form of specific indicators.¹⁰ Recent trends are also included for African countries, and for the Africa region and for the group of LDCs which includes so many African countries. As an example, there are figures for manufacturing employment as a share of total employment

⁷ Progress Report (UN 2020) on the 17 SDGs of 2020 released by the United Nations General Secretary: <https://undocs.org/en/E/2020/57>

⁸ See page 3/19 (UN 2020): <https://undocs.org/en/E/2020/57>

⁹ See on SDG 9 and the carbon dioxide emissions: <https://sdgs.un.org/goals/goal9>; and (UN 2020): <https://undocs.org/en/E/2020/57>

¹⁰ See on UNIDO as custodian of SDG 9 data in UNIDO 2019b:

https://www.unido.org/sites/default/files/files/2019-05/SDG_report_final.pdf, and the UNIDO statement about the report: <https://www.unido.org/news/progress-report-sdg-9-targets>

for Africa and for the Least Developed Countries (LDCs); the result is not giving room for optimism as there is no progress at all (the share is staying far below 10%, at around 8%).¹¹ Also important is the “Africa SDG Index and Dashboards Report 2019” (SDG Center for Africa and Sustainable Development Solutions Network, 2019).¹² The editors are free from UN rules of diplomacy and give evidence of the many weaknesses with regard of implementation of SDGs in Africa. There is a long list of weaknesses about the role of SDGs to be found in the report: SDGs became part of many government plans of the countries which were included in the survey (and 54 countries were included). There are many gaps in understanding the distance to the SDG targets, and there is a lack of understanding what the implementation of the SDGs means and how they will be financed when they are implemented. Only four countries have an online portal so that the citizens can see the progress toward the SDGs. Mauritius is ranked best, followed by Tunisia, Algeria, and Morocco. African countries perform relatively best in the SDG 12 (sustainable production and consumption) and in the SDG 13 (climate action), but they perform poorly in terms of SDGs which are related to human welfare (SDGs 1 to 7 and SDG 11). Five groups of countries are identified (continental leaders, growing countries, middle-of-the-pack countries, emerging countries, and distressed countries), but these five groups (see figure 19, cluster map) have a resemblance with the traditional sub-regions which we know from Africa. Concerning SDG 9, Algeria is the only country which is on track or maintaining its SDG achievement. Overall, the situation with SDG 9 is stagnation. These reports give some comparisons between countries, show some strengths and weaknesses of countries, and they show why countries move up to change the rank and even the group, such as Algeria. To learn more, the key policies need to be studied, such as industrial policies.

The SDG 9 targets and the focus of studies in Unit 1 of the volume 22 for 2020/2021

The four contributions touch most of the eight targets of SDG 9. The first contribution is on the linkages between industrialization, infrastructure development, and innovation capacity. The linkages are too often neglected in analyses and by policymakers. The second contribution is on frugal innovations to serve the Bottom of the Pyramid (BOP) households and consumers. This important field of in-

¹¹ Page 56 of UNIDO 2019b: https://www.unido.org/sites/default/files/files/2019-05/SDG_report_final.pdf

¹² See the “2019 Africa SDG Index and Dashboards Report”, which was edited in June 2019 by The Sustainable Development Goals Center for Africa and the Sustainable Development Solutions Network. A Global Initiative for the United Nations. Download: <https://www.sdindex.org/reports/2019-africa-sdg-index-and-dashboards-report/>

novation studies is neglected by researchers and policymakers because of the dominating focus on urban-based and large-scale companies and on markets for households/consumers of middle classes and upper classes. The third chapter is on commodity-based industrialization to focus on the benefits of processing the raw materials in Africa, but focus is also on the opportunities which are provided by the African Continental Free Trade Area (AfCFTA). It may be that the AfCFTA creates a new dynamic for industrialization in Africa. The fourth chapter is on foreign investment in Africa and the role it can play for sustainable and inclusive industrialization policies. In this context adaptations of investment policies and of investment acts in Africa are important policy measures. Looking ahead at the chapters which follow in Unit 2, we can see that also those targets of SDG 9 are covered which are related to issues of agriculture development and processing of agricultural raw materials, financing of value chains and of micro-, small- and medium-sized industrial firms, energy sector transitions towards renewable energies, inclusive and sustainable transport infrastructure, research and development for industrial processing, exporting and marketing, and local welfare implications in cases of minerals extraction and processing.

The Development of Productive Capacities and its Role for Implementing SDG 9 in Africa

The concept of “productive capacities” is important to understand the linkages between industrial development, infrastructure provision and innovation capacity. It was presented by UNCTAD and other research bodies and by individual experts already in the 1990s to lay the foundations for a realistic analysis of development options for low income countries (see UNCTAD 2020¹³, explaining also the sources of the concept from 2006 onwards). The productive capacity taxonomy distinguishes firm-level productive capacities and country-level productive capacities with various capabilities attached (UNCTAD 2020, p. 35). One purpose to introduce this development policy concept was to overcome the focus on policies and macroeconomic stability, to overcome the focus on governance in development economics, and to overcome the focus on one sector, such as agriculture or manufacturing as a leading sector, or the focus on binding constraints to growth. All these issues are incorporated into the concept of productive capacities which is a holistic concept. Now the concept is widened. An assessment was done in a report by looking at the readiness for the future of production (WEF 2018).¹⁴ In the study 59 indicators were included for a) the production structure and b) the drivers of production for 100 countries (WEF 2018). In this report two indicator

¹³ See UNCTAD 2020 on the concept of “productive capacities”:
https://unctad.org/en/PublicationsLibrary/aldcinf2020d1_en.pdf

¹⁴ See WEF 2018: <https://www.weforum.org/reports/readiness-for-the-future-of-production-report-2018>

groups (complexity and scale) refer to the structure of production to understand the current base of production, and six indicator groups (technology & innovation, human capital, global trade & investment, institutional framework, sustainable resources, and demand environment) refer to the drivers of production to understand the changes of the structure of production. These groups of indicators help to analyse and to understand the status and the options of the countries; they tell a lot about relevant indicators to keep the chances of future production capacities and capabilities open for the countries. The 15 African countries, out of the 100 countries which were included in the study, are mentioned in the “nascent” group of countries, one of the four archetype groups investigated. This “nascent” group has a limited current base and is at risk for the future; no African country is placed in the other three archetype categories of countries (high potential countries, leading countries, and legacy countries). However, the African countries included differ in terms of the scores for the current base of production and the positioning for the future (WEF 2018). SDG 9 reminds the policymakers that the future production capabilities will depend on a holistic view of industrialization patterns, infrastructure development, and innovation capacity.

The definition of “production” is important. It is conceived as a full cycle from Design, Source, Manufacture, Assemble, Distribute, Service to End of Use. Not the performance today, but the readiness for the future matters. There is a view in the WEF study of the average situation existing in a country, not a view exclusively on the highest-performing subsectors and sub-regions. There is an alarming trend of polarization in view of the readiness for the future as 90% of the countries in Latin America, Middle East, Africa, and Eurasia which are included in the WEF assessment are in the group of Nascent countries, characterised by a limited current production base and being at risk for the future in terms of production possibilities. Anyway, even in the group of nascent countries different development paths will be taken when policymakers decide about changes of their production structure. Successful countries will follow unique models of change, but for the countries in the nascent group successes may be short-lived, temporary, or too small to affect the average conditions.

It is important to overcome through policies on SDG 9 - by linking industrial development, infrastructure provision and innovation capacity - the polarization in regard of future production possibilities, a trend which is shown as a real danger for African countries in the report (WEF 2018). Polarization means that from the 100 countries which are included in the WEF assessments only 25 countries from Europe, North America and East Asia are positioned to benefit from the changes in production, while most of the countries in Latin America, Middle East, Africa, and Eurasia will not benefit. By including the SDG 9 issues and targets into the policy frame, this second group of continents and countries may get the impulses to act and to change their production structure so that they can benefit from the globally changing nature of production. Spill-over effects from discussions of the

seventeen SDGs of the Global Agenda 2030 to the policy reforms may benefit in future some more African countries. Despite of the small and in some African countries even shrinking manufacturing sector, because of the insufficient and inefficient infrastructure base in many African countries, and because of the lack of an adequate innovation capacity in industrial sectors of many African countries there are great opportunities for ambitious latecomers if changes in industrial policies and in funding industrial sectors are really implemented. It may even be possible to overcome the deindustrialization trend which has started to affect African countries.

Interestingly enough, the Action Plan For The Accelerated Industrial Development Of Africa (AIDA) has such a course in mind when discussing the background, the objectives, and the targets of the initiative.¹⁵ The IDDA 3 (Third Industrial Development Decade for Africa 2016-2025) shares the same objectives and targets.¹⁶ Focus is on promoting infrastructure and innovation to boost the manufacturing sector in Africa and in other developing countries.¹⁷ Care is now taken - through the Industrial Development Decade For Africa Three (IDDA 3) - to prepare Africa for the Fourth Industrial Revolution (4IR).¹⁸ It is argued in the Concept Note for an IDDA 3 High-Level-Meeting (UNIDO 2019a): “Industry 4.0 in particular, which represents the subset of the 4IR focusing on industry, manufacturing/production, offers new opportunities for Africa to create completely new business models, a solid business environment and lower costs of production, improving thus their productivity and competitiveness. Such an improvement could contribute to the development of African regional value chains and enhance integration into new global value chains, which are being established being a result of recent technological advancements. African countries can serve highly profitable niches in newly created value chains, as designers, trainers and those who modify products and services to local needs and customs. For example, the mobile money services in African banking could serve as a best practice example that could be utilized in other sectors.”

On infrastructure development, there is a new focus forthcoming, as can be seen in the Concept Note (UNIDO 2019a): “Improved quality infrastructure including in standardization, metrology, accreditation and conformity assessment

¹⁵ See on AIDA: https://www.au.int/web/sites/default/files/documents/30985-doc-plan_of_action_of_aida.pdf

¹⁶ See on IDDA 3: <https://www.unido.org/who-we-are/idda3-third-industrial-development-decade-africa-2016-2025>

¹⁷ See on important high-level meetings on IDDA 3, focussing especially on innovation and infrastructure: <https://www.unido.org/events/idda-3-promoting-innovation-and-infrastructure-development-pathway-boosting-manufacturing-fourth-industrial-revolution>

¹⁸ See the concept note (pages 1-2) on measures for Africa to prepare the continent for the Fourth Industrial Revolution (UNIDO 2019a): https://www.unido.org/sites/default/files/files/2019-09/Concept_Note_IDDA_III-25_September_2019_0.pdf

services are critical to the enhancement of market accessibility in the digital era. One of the major constraints for the limited accessibility of African products into international and regional markets is the lack of adequate quality infrastructure necessary to provide acceptable evidence that products and services meet defined requirements coupled with the lack of skills required to produce products of competitive quality. This has worsened with the advent of the fourth industrial revolution that increases the potential of e-commerce in growing industries. In Africa, digital trade, estimated at US\$5.7 billion, remains low even by the standards of most developing countries.”

Also transport and energy are critical infrastructure sectors; both subsectors are deeply discussed in Unit 2. There is increasing ECA (Economic Commission for Africa) support for road safety as roads are of key importance to connect within and between regions and within and between rural and urban areas (UNECA homepage, Regional Integration and Trade; Industrialization and Infrastructure, accessed 28 October 2020). ECA is a supporter of the UN Decade of Action for Road Safety (2011-2020); the road safety is a critical bottleneck and needs improvement because of its importance for industrial development and personal mobility.¹⁹ ECA states about the various Africa-wide programmes of African Union Commission, UNECA, and African Development Bank (UNECA homepage, Regional Integration and Trade, Industrialization and Infrastructure, accessed 28 October 2020): “In addition to UN General Assembly mandates, member States and regional organizations, particularly African Union Commission (AUC) and Regional Economic Communities (RECs), rely on ECA to develop and implement programmes such as those of transit transport corridors, the Trans-African Highways (TAH) network, the Sub-Saharan African Transport Policy Programme (SSATP), the Yamoussoukro Decision for air transport liberalization, and the Programme for Infrastructure Development in Africa (PIDA).” All these programmes matter for promoting industrial development, innovation, and other infrastructure sub-sectors. The concept of “productive capacities” includes these elements of policy change.

A new type of industrial policy, related to the development potential of key sectors and the political economy of governments and private businesses, is important to address the job crisis, meaning that by 2040 Africa will have a jobs gap of 50 million jobs between the labour force and total employment (Akileswaran et al., 2017). The new industrial policy approach is consistent with the ambitions to realize SDG 9 and its eight targets in Africa. The idea behind this approach is to

¹⁹ See the UNECA homepage entries about “Regional Integration and Trade, Industrialization and Infrastructure” on the UN Decade of Action for Road Safety and on other programmes which are intended to stimulate transport infrastructure:

<https://www.uneca.org/pages/industrialisation-and-infrastructure>; accessed on 28 October 2020.

align political and economic incentives for key industrial sectors, to develop and to use a strategic approach to make the market system work, to establish a coordination mechanism in government, and to establish a dedicated delivery team to support the coordination mechanism. All this fits the strategy to work for realizing the three elements of SDG 9 - industry, innovation, and infrastructure.

The Role of Frugal Innovations for the Base of the Pyramid (BOP) Consumers and Implementing SDG 9 in Africa

Frugal Innovations are defined as innovations which reduce the complexity but keep the basic functions of a product.²⁰ Research on frugal innovations and their role in and for Africa is stimulated in our times by international donors, NGOs, research institutes, and by entrepreneurs in developed and developing countries; also multinational corporations and start-ups are active in the business. Even research centres on frugal innovations are growing up²¹; first activity reports are available (LDE CFIA, 15 October 2020).²² But, the location of such research centres is of importance; how intensive is the cooperation with enterprises, research centres and the civil society in Africa? The main question in the context of this introductory chapter is how important the frugal innovation are now and could become in the future for inclusive growth and sustainable development in Africa, and for realizing the SDGs and especially so the SDG 9. How can the market of 4 billion poor people (Bottom of the Pyramid/BOP people) around the world, with around 500 million people in Africa, be served through reengineering and re-inventing of products so that relatively sophisticated products can be purchased by the poor people? What is the difference to the many basic products and services supplied by the many informal sector enterprises to the poor people in Africa? The craftsmen of the informal sector and of small and medium enterprises have the skills, as we know from computer hardware and software clusters of enterprises in Africa. Also, governmental institutions in African countries have abilities to design and to produce prototypes of easily reproduceable and maintainable equipment for agricultural production and for other activities.

The idea is to provide under the label of a “frugal innovation” low-cost solar lighting, effective means for the handwashing hygiene with cold water through sachets with detergents, low-cost water purification units, and low-cost transport vehicles based on bicycles. But frugal innovations make sense only if the environmental and labour standards are not undermined. Any “stripping down” process

²⁰ See in Wikipedia: https://en.wikipedia.org/wiki/Frugal_innovation

²¹ See on the LDE Centre for Frugal Innovation in Africa (CFIA), co-managed by Leiden University, Delft University of Technology, and Erasmus University Rotterdam the respective homepage with the news: <https://www.cfia.nl/home>

²² See on LDE CFIA’s first activity report of 15 October 2020: <https://www.cfia.nl/news/publication-cfias-first-gofrugal-bulletin>

of products should not create new social and environmental problems. This may be the main difference to the production conditions in the informal sector enterprises as in many cases emissions are high and working conditions are poor. And frugal innovations are only sustainable and inclusive if local entrepreneurs adapt and produce such products and services. If enterprises in Western countries and in China, India, Brazil, and in other large emerging countries have the key role in the business, without a substantial interaction with local entrepreneurs in Africa, the relevance for reaching the SDGs and especially SDG 9 will be quite limited.

In times of COVID-19 frugal innovations get a new role, to help immediately at local African levels to provide cheap, sustainable, inclusive, and locally reproducible equipment and facilities for the health sector.²³ In short supply were also in developed countries testing kits, ventilation devices, protective clothing, and face masks. Also, in developed countries like The Netherlands frugal health technologies were forthcoming (LDE CFIA, homepage, news, 15 April 2020). The case of the Netherlands shows that the technological sophistication of medical devices which are produced by global value chains is so high that even single developed countries cannot afford to produce all the parts for hygiene products and medical devices at competitive costs. When lockdowns interrupt the global value chains, many countries are affected by the lockdowns which lead to severe resource constraints; production, supply and transport constraints lead to resource constraints. In this situation frugal solutions matter. Local adaptations take place, to substitute for certain so far imported parts; innovations follow at many points of the value chains for hygiene products and medical devices. Simpler technologies may play a role, but quality and safety standards need to be maintained - at levels high enough to avoid any risk for customers, medical staff, and patients. Frugal innovations emerged quickly in The Netherlands and in other European countries (see: LDE CFIA, homepage, news, 15 April 2020). Hospitals in The Netherlands used an open source ventilator was adapted as a much cheaper alternative to a conventional respirator, and it was medically certified. In Italian hospitals a snorkel normally used for underwater sports was adapted for medical purposes - to ventilate patients. FFP2 mouth masks are coming from traditional producers of bed mattresses; and other materials and devices for medical purposes are supplied by other companies which repurpose their production capacity. Corona boxes containing monitoring and test devices are designed from boxes formerly used for people with heart diseases. Apps and digital devices are used for diagnosis and testing of corona. Reusing, repurposing, redesigning, and remaking activities

²³ See the LDE CFIA blogs on COVID-19 responses – the case of The Netherlands (LDE CFIA, homepage, news, 15 April 2020) and the case of East Africa (LDE CFIA, homepage, news, 19 May 2020): <https://www.cfia.nl/news/innovation-during-the-crisis-how-covid-19-could-boost-frugal-health-technologies>, and: <https://www.cfia.nl/news/frugal-innovation-during-the-covid-19-crisis-examples-from-east-africa>

are part of the frugal innovations taking place in developed countries. Much more can follow, as the health systems need more resilience in developed countries.

Also, in Africa frugal solutions were found in times of COVID-19 (see: LDE CFIA, homepage, news, 19 May 2020). The many lockdown measures - closing of international and regional borders, closing of schools and universities, curfews, social distancing restrictions, business closures, etc. - had adverse effects on local economies and social structures. To minimize these adverse effects, frugal solutions did help. As all these sharp restrictions have interrupted the flows of hygiene products and of medical devices, frugal solutions were found quickly. Innovations take place at all levels and in all institutions, as there are no alternatives to it. Innovations are forced by the sheer daily need in the hospitals and the homes. Innovations include the recombining of locally available materials, knowledge, and skills in creative ways, and/or the repurposing of existing technologies to cope with the COVID-19-crisis. The emerging innovations are frugal in nature. Recombining and repurposing are the basis of innovation strategies which are also relevant for informal workshops and for the settlements of poor people in the periphery. There may be links to large, medium and small formal sector companies, and such links can help to speed up the recombining and the repurposing of production inputs and production capacities.

Africa has achieved a lot during the months of COVID-19 pandemics. Kenya is an outstanding case (see: LDE CFIA, homepage, news, 19 May 2020). The country did well to meet the basic hygiene requirements for combating the pandemic, by providing for sanitisation and face coverings. The local manufacture of hand sanitisers and soaps was based on locally available and affordable materials; all this was done at the grassroots level. And mechanical and automatic water and soap dispensers were built and installed in public stations. To minimise human contact with sanitisation equipment pedals and thermal sensors were used. Small-scale manufacture of face masks was started quickly by using kitenge fabric and other locally available materials. To distribute these products, the vendors did use informal supply chains to reach the grassroots. Informal entrepreneurs got a new attention now. But also, the partnerships between small informal ventures and large local corporations have worked. The partnership between large local companies also worked, such as the cooperation between Haco Industries²⁴ (a leading producer and distributor of personal care products and homecare products) and East African Breweries Limited²⁵ (which was funding a programme to reach vulnerable groups with hand sanitisers for free).²⁶ Many new actors were involved to

²⁴ See: <https://www.haco.co.ke/>

²⁵ See: <https://www.eabl.com/>

²⁶ See on this initiative: <https://www.foodbusinessafrica.com/east-african-breweries-funds-production-of-free-alcohol-based-sanitizers/>

produce and to distribute hand sanitisers in Africa. And a coalition of leading technology firms in Kenya formed “Safe Hands Kenya”²⁷, and this together with community groups and other local organisations. They use their digital platforms and their supply chains to distribute sanitisers, surface disinfectants, soap, and face masks among targeted vulnerable communities, especially in densely populated informal settlements (see: LDE CFIA, homepage, news, 19 May 2020).

The cooperation and integration of capabilities and business models of these key actors has positive effects for fighting COVID-19; it is possible to optimise processes and to reach customers in a cost-effective way. We can see that COVID-19 is an accelerator in bridging formal and informal sectors, regions of different development level, groups of firms with different sizes and degrees of formalization, and rural and urban groups of inhabitants. But such a repurposing, reorganization, and recombination can also lead to an uneven distribution of benefits and costs at industry and economy levels. Diageo is the parent company of East African Breweries Limited and may be more interested in public awareness campaigns than in health motivations.²⁸ So the market position of the large ventures may be escalated relative to the small ones. Power relations will change after the successful public awareness campaigns. And there is a lot of warnings that external innovators could benefit largely from informal sector frugal innovators with some effects on exploitative relations; there is reference to various forms of exploitative practices (Meagher 2018).²⁹ In both cases local industries in Africa could be disadvantaged. But COVID-19 may have changed the situation when also external innovators came under pressure, so that local African enterprises become more independent. Often frugal innovations are associated with the sustainable development goals. But sustainability and frugality cannot be automatically equated, as studies have shown, based on criteria for sustainability (see on cases of frugal innovations from water and energy sectors: Levänen et al. 2015). Some frugal innovations may fit the test of sustainable development goals and criteria, but others not.

When looking at SDG 9, we see that frugality and sustainability as defined by the targets of SDG 9 have indeed some common basis. The criteria for SDG 9 according to the definition “build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation” are a call to work for resilience, inclusiveness, and sustainability. Frugal innovations will contribute this task; local industries which increase the hygiene space and the healthcare space benefit

²⁷ See on this initiative to build a first line against COVID-19, as an alliance of Kenyan organizations: <https://www.safehandskenya.com/>

²⁸ See on this company: <https://www.diageo.com/>

²⁹ See on Meagher 2018 and the danger of some “cannibalizing effects” of the external innovators on the informal economy in Africa: <http://eprints.lse.ac.uk/84947/7/Frugal%20Innovation%20Cannibalizing%20the%20Informal%20Economy%20Final.pdf>

from such innovations. Kenya is again of interest when looking at the healthcare space. Local industries have the lead in providing medical equipment. Automotive companies linked to the Kenya Association of Manufacturers (KAM)³⁰ have developed a portable, robust, compact, and economical ventilator which can be used by untrained medical personnel and can operate off grid for up to four hours (see: LDE CFIA, homepage, news, 19 May 2020). Medical and engineering students from various universities in Kenya have also collaborated to build portable ventilators for medical purposes, using mostly locally available materials. Also, a variety of mobile phone-based e-health applications have emerged in Africa to help individuals to assess their COVID-19 risk category through a digital “triage tool”; government agencies and private sector enterprises increased efforts to cooperate and to innovate during the crisis. The Kenya Medical Research Institute (KEMRI) has begun to produce rapid test kits. KEMRI has repurposed existing diagnostic machinery, which was developed during the HIV-AIDS, tuberculosis, and Avian flu epidemics, to identify gaps in mass testing for COVID-19 (see: LDE CFIA, homepage, news, 19 May 2020). Personal Protective Equipment is manufactured by Kenya’s Kitui County Textile Centre (KICOTEC) and by the Shona EPZ (Export Processing Zone); both have reengineered their processes to supply goods that would otherwise have been imported from overseas.

In the consumer goods sector and in commerce COVID-19 has brought great changes in Africa. Frugal innovation affected electronic commerce models; these models were scaled up and adapted. These models are no longer for the middle classes and upper classes but have reached the BOP households. Households and individuals who are quarantined can remotely purchase; they receive essential goods, such as groceries, toiletries, and pharmaceuticals, at their doorsteps. These e-commerce models are operated on mobile apps; cashless transactions are supported by fintech solutions such as mobile money transfer; motorcycle taxis are repurposed into couriers and delivery services. Female fruit and vegetable vendors are connected by apps to their customers. The Kenya Association of Manufacturers (KAM) has created a digital directory for use by micro-, small- and medium-sized enterprises to source for raw materials. By such digital connections and cashless payments, the production of the goods is optimized – by regions, sector, firms, scale, and logistics. Digital technologies are transforming education and training systems; frugally delivering online education is filling the gap created by school closures. Private schools and universities have adopted popular video conferencing platforms for teaching. Educators of underprivileged learners in poorer households use new technologies and media and get response from their clientele (see: LDE CFIA, homepage, news, 19 May 2020).

³⁰ See: <http://kam.co.ke/>

Digital transformation gets a great push over most important sectors and for rural and urban households. These technologies are bridging formal and informal sectors, large and small size ventures, rural and urban suppliers and purchasers, public and private sector actors. It can be expected that longer-term effects are possible, as the resilience of BOP households increases. Frugal innovations have diverse sources and impacts, and many actors are involved to fight COVID-19 on this basis. The Innovation Challenge introduced by the Kenyan government is of particular interest.³¹ The Great COVID-19 Innovation Challenge 2020 of Kenya is a broad-based cooperation of the governmental Konza Technopolis Development Authority (KoTDA)³², the Association of Countrywide Innovation Hubs, the private sector, academia, non-governmental organisations, and UNDP (United Nations Development Programme). The Innovation Challenge intends to bring the digital transformation, innovation, infrastructure, and local supplies also to the poor living in remote areas. The objectives of the initiative relate to the eight SDG 9 targets.

The Revitalization of Commodity-based Industrialization for the Continent and Implementing SDG 9 in Africa

There is a great optimism among development economists that the African Continental Free Trade Area (AfCFTA) will be a great step towards industrialization in Africa, towards infrastructure development, and towards leapfrogging of innovations and developing an own substantial innovation capacity. Arguments are the economies of scale in production, more infrastructure links between countries, and more competition between firms of African different countries with impacts on R&D and on innovation capacity in the countries of the AfCFTA. A recent book by the World Bank (World Bank 2020) gives new hope (see the Abstract): “The African Continental Free Trade Area (AfCFTA) agreement will create the largest free trade area in the world, measured by the number of countries participating. The pact will connect 1.3 billion people across 55 countries with a combined GDP valued at \$3.4 trillion. It has the potential to lift 30 million people out of extreme poverty by 2035. But achieving its full potential will depend on putting in place significant policy reforms and trade facilitation measures. The scope of the agreement is considerable. It will reduce tariffs among member countries and cover policy areas, such as trade facilitation and services, as well as regulatory measures, such as sanitary standards and technical barriers to trade. It will complement existing subregional economic communities and trade agreements by offering a con-

³¹ See on the Innovation Challenge of Kenya: <https://nairobiagarage.com/the-great-covid-19-innovation-challenge-kenya/>

³² See: <https://www.konza.go.ke/>

continent-wide regulatory framework and by regulating policy areas—such as investment and intellectual property rights protection—that have not been covered in most subregional agreements.”

The study by the World Bank (World Bank 2020) quantifies the long-term implications of the agreement for growth, trade, poverty reduction, and employment. While previous studies have largely focused on tariff and nontariff barriers in goods, this study includes the effects of services and trade facilitation measures. Focus is also on the distributional impacts on poverty, employment, and on the wages of female and male workers. Policymakers should be aware of the scope of reforms needed and of the potential benefits that the agreement offers. The analysis shows that full implementation of AfCFTA could boost national income by 7 percent, or nearly \$450 billion, calculated in 2014 prices and market exchange rates. This growth would expand African trade, especially so the intraregional trade in manufacturing. Employment opportunities and wages for unskilled workers would increase with the effect that the wage gap between men and women would decline. It is expected that African countries as producers and suppliers of raw materials would benefit from processing for African markets, such as in tea, cocoa, and cotton. But also, many other examples of raw materials could work, such as oil and gas, iron ore, metals, and many other minerals. SDG 9 with its eight targets seems to be a perfect blueprint for a strategy to use a huge market for industrial development. Africa has plans for continental industrialization, plans for continental infrastructure development, and plans for a continental expansion of the innovation capacities in private and public sectors.

There is a direct link between the 17 SDGs with its 169 targets and realizing the objectives of AfCFTA. It is stated by Tralac (Trade Law Centre) in a Blog (Tralac Blog, 23 February 2018): “To achieve these objectives the AfCFTA is not just focused on liberalisation of trade in goods, but also services liberalisation, trade facilitation, addressing non-tariff barriers to improve access to markets, competition policy, intellectual property rights and possibly e-commerce. If these objectives can be achieved the AfCFTA can make a valuable contribution to African countries’ progress on the SDGs.”³³ The AfCFTA can contribute to the SDGs by three main transmission mechanisms (Tralac Blog, 23 February 2018): first, through improved intra-Africa goods trade; second, through services liberalisation and the movement of business people; and third, through competition policy, intellectual property and e-commerce.³⁴ On point 1, development of hard and soft

³³ See the Tralac Blog, 23 February 2018, by Willemien Viljoen: <https://www.tralac.org/blog/article/12762-the-african-continental-free-trade-area-afcfta-and-the-sustainable-development-goals-sdgs.html>

³⁴ See the Tralac Blog, 23 February 2018, by Willemien Viljoen: <https://www.tralac.org/blog/article/12762-the-african-continental-free-trade-area-afcfta-and-the-sustainable-development-goals-sdgs.html>

infrastructure is key for benefitting from such a huge market; the effects of better market linkages through infrastructure provision on poverty reduction, food security, and reduction of inequality can be substantial. However, competitive access to infrastructure services needs to be provided by adequate policies and regulations. On point 2, it can be argued that many of the SDGs will be affected by liberalising services flows throughout Africa. The movement of businesspeople facilitates technology transfers, foreign direct investment, expansion of education and health services, and the growth of firms in regions with skills shortages. Industrial and infrastructural development can be accelerated when businesspeople can move without impediments. On point 3, intellectual property is of great importance for developing pharmaceutical production capacity. This is so important in times of COVID-19 but will make the continental health system much safer and resilient than so far. E-commerce and mobile phone/internet connectivity at continental level will support small producers to find customers and to source for inputs, but also to finance their activities. Entrepreneurship will benefit from the greater and growing continental market (see: Tralac Blog, 23 February 2018, written by Willemien Viljoen).

The AfCFTA has a direct link to the implementation of SDG 8 on Decent Work and Economic Growth, as the export of raw materials to overseas customers can be substituted by exports of processed goods to neighbouring countries on the African continent. This potential is great, as recently emphasized by African trade and development promotion services (see ACINTaD 2020).³⁵ Exports of unprocessed goods have a relatively low labour input, while processing for the continent will increase labour inputs of products. Employment, skills, and wages will increase, directly through processing and indirectly through the generation of related services. SDGs 1, 8, and 9 will be strongly impacted, much to the benefit of the young labour force in Africa. As women traders are traditionally active in cross-border trade, SDG 5 on Gender Equality will be positively affected by the AfCFTA. Regional value chains are facilitated by the AfCFTA, and the job opportunities created thereby at the continental level will reduce inequalities and thereby strengthen SDG 10. Ensuring food security through continental integration measures will contribute to ending hunger (SDG 2). SDG 9 and some other SDGs are directly affected by the formation of the AfCFTA.

For Post-COVID-19 times, the AfCFTA has a great perspective and will be a helpful instrument to advance the SDGs. Based on the infrastructure created in COVID-19 times through repurposing industrial capacities, through making health systems more resilient, and through exchanging at continental level medical equip-

³⁵ See on ACINTaD/Africa Centre For International Trade And Development, 2020: <http://www.acintad.org/the-significance-of-african-continental-free-trade-area-afcfta-in-the-attainment-of-sdgs/>

ment, services, and skills, the time after COVID-19 will be different and can become more favourable. The foundations for structural transformation may then be better, but innovation-led changes and the acceleration of implementing the SDGs will have a high priority. Innovation is key as the fast-growing young population (a force of youth with 850 million people by 2050) needs for a rewarding employment and decent jobs all the skills for digital and technological transformation. Innovation capacity will become an even more important development factor; Africa can participate in the Fourth Industrial Revolution already now and the more so after COVID-19.³⁶ Examples from the medical and health sector show that the reaction to COVID-19 has revealed and mobilized a strong technical competence in Africa. The “Docteur Car” is a good example from Senegal; this is a robot which is supporting massively the health personal and the patients. The robot is equipped with many important technical components and digital devices to help in the hospitals during anti-Corona actions.³⁷ The robot speaks four languages (international and local ones), is delivering drugs, food, and thermometers to the patients, and is reminding the personal to adhere to their tasks. Important is the way how university, research institutes, and private and public sectors have cooperated in Senegal to integrate technical components, logistics, and application software. Countries like Kenya and Senegal are leading in fighting COVID-19, and these countries are also leaders in the digital transformation. Africa is proud to have recorded ten key innovations to fight COVID-19.³⁸ Some countries, like Kenya, have launched the Great COVID-19 Innovation Challenge.³⁹ Other countries, like Ghana, benefit from donors’ programmes to support employment and enterprises; the Green Employment and Enterprise Opportunities (GrEEen) project in Ghana.⁴⁰ COVID-19-related inventions and innovations are sponsored, and a push for WASH solutions (foot pedal handwashing machine) and for renewable energy solutions (such as solar lanterns, clean cookstoves, etc.) is expected. Some of these initiatives have only a local attention, but others get an Africa-wide model attention.

³⁶ See on the post-COVID 19 strategy for Africa: https://www.policycenter.ma/opinion/covid-19-and-implementation-sdgs-africa#.X5P_p-1pHct

³⁷ See on the “Docteur Car” of Senegal: <https://www.emergency-live.com/news/senegal-docteur-car-fights-covid-19-polytechnic-institut-of-dakar-presents-the-robot-with-anti-covid-innovations/>

³⁸ See on the ten African innovations to fight COVID-19: <https://www.bbc.com/news/world-africa-53776027>

³⁹ See: <https://nairobi-garage.com/the-great-covid-19-innovation-challenge-kenya/>

⁴⁰ See on the Green Employment and Enterprise Opportunities (GrEEen) project in Ghana: https://ec.europa.eu/trustfundforafrica/all-news-and-stories/green-covid-19-innovation-challenge-supports-innovative-solutions-covid19_en

The Reorientation of Foreign Investment towards Inclusive Growth and Sustainable Development and Implementing SDG 9 in Africa

When looking at the facts on foreign direct investment (FDI) in Africa, we see that the structure of source countries and recipient countries has changed since the year 2000; we also see important changes in regard of intra-African investors over time (Brookings, 2019). Important is the fact that the new source countries (China, United Arab Emirates, India) have now a relevant share of FDI flows, but also have a higher share of jobs created than their share in FDI flows to Africa.⁴¹ These new source countries have not only a high share of projects (34%), but even a higher share (over 50%) in terms of jobs created and capital investments. FDI flows to Africa are mostly determined by four factors (economic growth, policy reform, economic diversification, and GDP size). This means that successful countries in terms of attracting FDI flows can benefit from economic diversification and GDP size (like South Africa), from policy reform (like Rwanda), but also from economic growth and GDP size (like Nigeria, Egypt, and Morocco). Large and small countries can benefit if they attract by policy reforms, by economic growth figures, by level and progress in economic diversification, and by the sheer size of GDP. Economic diversification plays a role, as countries like Kenya and Senegal attract FDI flows. If digital transformation supports the economic diversification, such countries will benefit from higher FDI inflows.

The sectoral structure of FDI inflows to Africa is revealing (Brookings, 2019): Although extractives still had in 2018 a share of 36% of the FDI inflows, other sectors are getting stronger. TMT (Telecommunications, Media, and Technology) sectors and CPR (Consumer Products and Retail) sectors are the dominating sectors of FDI inflows to Africa, followed by Transport & Automotive. Such inflows to Africa therefore support the economic diversification. When coupled with digital transformation, this will accelerate structural transformation. Level and progress of economic diversification, digital transformation, and steps towards the implementation of the AfCFTA are now the three key factors drawing FDI inflows. A fourth factor is the increasing role of intra-African FDI flows (from South Africa to all regions of Africa, from Egypt and Morocco to North African countries, from Kenya to East African countries, and from Nigeria to West African countries). The intra-African FDI flows mean that the FDI development cycle is advancing in Africa; FDI inflows and FDI outflows to and from African countries play an increasing role. The greater the balance between outflows and inflows, the more developed is the FDI contribution to regional development and integration.

⁴¹See the Fact Sheet on FDI in Africa (Brookings, 2019): <https://www.brookings.edu/blog/africa-in-focus/2019/10/09/figure-of-the-week-foreign-direct-investment-in-africa/>, figures based on: EY, Africa Attractiveness Report 2019; Download: https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/attractiveness/ey-africa-attractiveness-report-2019.pdf

Relevant is also the changing structure of resource cycles; various factors determine the behaviour of raw materials prices, the exploration and exploitation strategies of countries and corporations, the demand and supply factors for oil, gas, and minerals, and the competitive rivalry between multinational corporations which are active in Africa. But also, the role of global and regional value chains for agricultural raw materials changes; the value chains and the governance systems are restructured; some changes towards regional actors and new lead firms take place.

Investment policies, investment laws, and investment acts can guide the foreign investment activities in African countries; they can determine the behaviour of corporations at all phases of entry and during post-entry phases. They also can impact on the effects of FDI inflows, on the economy, the ecology, the political, and the social situation. International and regional organisations look carefully at the regulatory activities of countries towards FDI inflows and the behaviour of investing firms. The Ease of Doing Business Project of the World Bank is a guide to the policy reforms undertaken by countries, although the application of the criteria may be somewhat biased.⁴² The World Investment Reports of UNCTAD are good guides on the changes in the behaviour of corporations.⁴³ The SDGs for the Global Agenda 2030 have also led to a rethinking of investment policies, investment laws, and investment acts - towards inclusive growth and sustainable development. The SDGs have already impacted on the investment policies, laws, and acts of African countries, but also on the type of FDI flows to Africa. Industrial policies of African countries were enriched by the discussions about the relevance of SDGs for domestic and foreign investment.

All the three elements of SDG 9 (industry, infrastructure, innovation) play a role in the design, implementation, and review of investment policies, laws, and acts. This is confirmed by analyses of SDG index scores as applied to African countries. When considering the SDG index scores of the 17 SDGs for a sample of 44 African countries (Aust et al. 2020), we see that FDI increases the probability of better trends with regard of SDGs 1, 7, 9, 14 and 16. We also can observe a negative correlation of FDI inflows with index scores for SDG 13 (on climate action).⁴⁴ While FDI may have a positive effect on poverty reduction, clean water, sanitation, food security, basic infrastructure, and renewable energy provision, the

⁴² See on the Ease of Doing Business rankings by World Bank: <https://www.doingbusiness.org/en/rankings>

⁴³ See on the World Investment Reports by UNCTAD: <https://unctad.org/topic/investment/world-investment-report>; and on the Investment Trends Monitor by UNCTAD for the Top 100 and the top 5000 MNEs: https://unctad.org/system/files/official-document/diaeiainf2020d1_en.pdf

⁴⁴ Aust, Viktoria, Ana Iabel Morais, and Inês Pinto, 2020. How does foreign direct investment contribute to Sustainable Development Goals? Evidence from African countries, in: *Journal of Cleaner Production*, Volume 245, February 2020.

impact on environment may be negative. With strong measures of the government towards environmental protection, those groups, regions, and sectors which are affected negatively by the environmental consequences of FDI will get relief. It is possible to mandate requirements for international corporations to protect the environment; it may be possible to accelerate through incentives the changes in the structure of FDI away from mining and conventional agricultural export crops and towards clean services and clean production. All this will improve the balance of FDI in regard of the SDGs.

But reviews of investment policies, laws, and acts to impact on the FDI inflows to Africa were undertaken since the year 2000. Since this year, there was an ongoing discussion about attracting, regulating, and guiding foreign investment to Africa. A focus was on the experiences of small and resource-poor African countries, and the question was if they can attract FDI inflows despite of the limited resource endowment. In a World Bank study at that time (Morisset 2000), it was argued that some few small and resource-poor countries (Mali, Mozambique, Namibia, and Senegal) have attracted more FDI than countries with larger domestic markets (like Cameroon, Republic of Congo, and Kenya) and countries with greater natural resource abundance (Republic of Congo and Zimbabwe). Mali and Mozambique have improved their business conditions by policy reforms based on strategic decisions (liberalizing trade, launching privatization programmes, modernizing mining and investment codes, adopting international agreements on foreign direct investment, developing priority projects with multiplier effects on other investment projects, and starting image-building campaigns to attract foreign investment (Morisset 2000)). However, when looking carefully at the regulations and policies to guide the FDI inflows, evidence from African country cases shows that the transparency about FDI pre-entry, entry and post-entry measures is rather weak. It is difficult to assess on the basis of the reviews the real situation of foreign investors – a) with regard of rights and privileges, bureaucratic impediments, gaps in the rule of law, and corruption, b) the conformity of investor contracts with policies, laws, and acts, c) if there is a discrimination of foreign investors relative to local investors, and d) about the type, scope and extent of restrictions applied for foreign investors (OECD 2005). However, there is increasing awareness that such transparency is needed; OECD is supporting such reviews of investment policies in various programmes for Africa. Investment policy reviews are also done for African countries (especially for Botswana, Egypt, Mauritius, Morocco, Mozambique, Nigeria, Tanzania, Tunisia, and Zambia).⁴⁵

Various studies report that Africa can attract FDI if infrastructure is developed, if innovation capacity is created, and if industrial policies are modernized. So, we see that the elements of SDG 9 are quite important to attract FDI inflows

⁴⁵ See about the support programmes of OECD for Africa: <https://www.oecd.org/africa/>, and: <https://www.oecd.org/investment/countryreviews.htm>

in African countries. Political instability and policy uncertainty are often mentioned as key factors impeding FDI inflows to Africa (KPMG 2016), as FDI needs a stable policy environment, growing consumer and investment goods markets in a longer perspective, diversification of production and exports, digital transformation, and improving the ease of doing business conditions.⁴⁶ All these requirements for FDI inflows have to do with the key elements of SDG 9. Some authors (see Adegboye et al. 2020) point to the need to invest in infrastructural services to stimulate domestic investment in Africa as a base for foreign investment. Domestic investment will crowd in foreign investment, and will in the longer run make the country less dependent on foreign investment; then the country could enforce a stricter regulation of FDI inflows.⁴⁷ The role of institutional quality is important for attracting FDI, and is composed of political stability and policy certainty. Institutional quality relates to all the elements of SDG 9, but the context of domestic sector investment and of infrastructural services as a basis to crowd-in foreign investment is important. With infrastructural services (comprising hard and soft components), a major element of SDG 9 comes in as a vital part of addressing inclusive growth. Policies to stimulate domestic investment (DI), preferably comprising all types of infrastructure, can crowd in DI. A targeted approach towards DI and FDI is needed to ensure that a favourable impact on economic growth and employment can be reached. Policy reform is a complex issue; it is pointed out (see Asiedu 2004) that it is not enough to improve the conditions for attracting FDI through policy reforms; it is important to follow the trends and the speed of reforms as practised by other countries attracting FDI funds. Slight improvements are not enough; all the major criteria and a continuity of reforms for ease of doing business matter. Progress on reforms is needed in absolute and in relative terms so to succeed in a globalized environment.

2 The Contributions

Four contributions consider the continental perspective for Africa. The pertinent questions are: How can Africa achieve the sustainable development goals (SDGs) through developing productive capacities to industrialize and to diversify its economies, especially by promoting agro-industrial value chains? How can Africa use

⁴⁶ See on KPMG 2016: <https://assets.kpmg/content/dam/kpmg/pdf/2016/07/What-influences-FDI-into-Africa.pdf>

⁴⁷ Adegboye, F. B., Osabohien, R., Olokoyo, F. O., Oluwatoyin, M., and Oluwasogo, A., Institutional quality, foreign direct investment, and economic development in sub-Saharan Africa. *Humanities and Social Sciences, Communications* 7, 38 (2020). <https://doi.org/10.1057/s41599-020-0529-x>; Download: <https://www.nature.com/articles/s41599-020-0529-x>

the micro-, small- and medium enterprises (MSMEs) to produce and to innovate for the benefit of poor households, especially by frugal innovations? How can Africa benefit from the continental free trade area (CFTA) area by new forms of trade and production cooperation, and by developing continental value chains, especially for its key commodities? How can Africa develop more inclusive and sustainable forms of promoting direct investment from outside and from inside the continent, especially by renewing the investment policies and investment acts? These four questions are interrelated and find answers in four essays; these four chapters give a frame for analysing challenges and opportunities and for proposing policies and strategies to make SDG 9 to become a reality in Africa.

Although industrialization always is related with developing productive capacities, it is necessary to have a holistic view of developing productive capacities. This is done by **Patrick N. Osakwe** in the first chapter to the Unit 1 with the title **Developing Productive Capacities to Industrialize and Diversify African Economies and Achieve the SDGs**. The author is from the Trade and Poverty Branch, United Nations Conference on Trade and Development (UNCTAD), Geneva, Switzerland. UNCTAD has presented early a concept for developing productive capacities mainly for least developed countries (LDCs), but this concept is relevant also for low-income and middle-income African countries. Patrick N. Osakwe goes further to the established stock of literature on productive capacities by relating the concept and the elements of productive capacities to the imperatives of sustainable development goal nine (SDG 9) which is combining three levels of action and progress – building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation.

The author argues that African policymakers, academics, and development institutions have repeatedly acknowledged that fostering sustained economic development in Africa and achieving the SDGs will require developing productive capacities, transforming domestic production structures towards manufacturing, and diversifying exports. But there is a very limited understanding of the linkages among these crucial processes of economic development. To fill these gaps, the chapter considers these linkages in detail. Therefore, some mechanisms are identified through which the development of productive capacities could be linked to structural transformation and to exports diversification; it is also analysed how these processes can contribute to the goal of poverty alleviation in Africa. The chapter also examines the role of infrastructure and innovation in developing productive capacities. Finally, policy recommendations are developed on how productive capacities could be built to support Africa's industrialization agenda and to enhance prospects for achieving the SDGs.

While section 1 introduces to the theme, section 2 analyses the concepts of productive capacities, export diversification and structural transformation; the section 2 also explains the linkages between these processes of economic develop-

ment and how they contribute to the goal of poverty alleviation. Section 3 examines the drivers of productive capacities' development by focussing on the role of infrastructure and technology and innovation, while section 4 identifies and discusses policies to develop productive capacities in such a way that Africa's Industrialization Agenda is supported. A final section 5 contains concluding remarks. There is a specific approach used in the chapter to analyse the development of productive capacities. A threefold approach is used. It is asked how better use can be made of existing productive capacities, how existing capacities can be maintained, and how new productive capacities can be built. Quantitative assessments of the development of productive capacities do not consider these three dimensions in detail; more of such studies would be needed to show how divergent the situation with regard of developing productive capacities in Africa is.

Preliminary evidence shows that some few African countries are leading in this regard, such as South Africa, Egypt, Tunisia, Mauritius, Botswana, and Morocco. But these countries are either in Northern Africa or in Southern Africa, and their progress has to do with the income level and the level of industrialization, or the governance of raw materials value chains. Recently, Ethiopia, Ghana, and Kenya are mentioned as countries leading in some specific direction and/or source of growth. These countries have various strengths in their development path (digitalization, creating export platforms, improving the raw materials value chains, attracting foreign investors, etc.). It is obvious, and this is the main suggestion from Patrick Osakwe in his chapter, that the availability of key infrastructure, the accumulation of human competences, and the existence of innovation capabilities support the development of productive capacities.

In section 2, the author links productive capacities to structural transformation and export diversification. A two-ways relationship is analysed - how productive capacities are impacted by structural transformation and export diversification, and how productive capacities impact on structural transformation and export diversification. Theoretical insights and examples show how these interrelations work, and how policies should be designed to exploit these interrelationships. The understanding about the mutually reinforcing relationships between productive capacity development on the one side and structural transformation and export diversification on the other side is of great importance to design appropriate policies. In a next step, the link between productive capacities, export diversification, and structural transformation to poverty is analysed. SDG 1 (No Poverty) and SDG 9 (Industry, Innovation And Infrastructure) can be easily related through these links, and it is by this way that Patrick Osakwe presents a sound framework for analysis.

Section 3 on infrastructure and innovation and the relation to productive capacities opens another round of clarifying concepts. The case of Ethiopia is presented to show why the level of manufacturing in the country is still so low – also because of gaps in infrastructure development and innovation capabilities. Although the country has recently shifted from agriculture-focussed industrialization

policies to a model of industrialization based on export processing zones (for Chinese and other direct investors), it may not be the case that this shift produces better results. The recent COVID-19 crisis impacts on manufacturing and will again break the links between productive capacities, structural transformation, and export diversification. But the major problem is the weak interest of policymakers in infrastructure development and the creation of innovation capabilities. The message is that Ethiopia as well as so many other African countries should concentrate much more systematically on infrastructure development and the build-up of innovation capabilities to support the industrial sector.

Even African countries with a better score of their infrastructure index are not well off, mainly because of the low level of private investment for infrastructure. Beside of infrastructure, section 3 covers technology and innovation. So, SDG 9 is covered in full depth. The innovation index for African countries is also presented and gives a similar picture of neglect (despite of differences in the performance between African countries). Either the innovation index has a low score (from the side of inputs and/or outputs) or the innovation efficiency ratio is unsatisfactory, so that innovations are expensive. The result is that too often the scores of both indexes, for infrastructure and innovation, are weak in African countries and impede manufacturing. Anyway, Africa has some “innovation achievers”, such as Kenya, Rwanda, and few others, but even these countries have performance problems in the sense that there are other gaps to increase the share of manufacturing. A problem is also that the African countries being on the list of “innovation achievers” cannot transfer the knowledge about their successes to other African countries, so that they can follow their path. Productive capacities can be developed by policies which support innovation and infrastructure, and structural transformation and export diversification, but for this a continual policy frame is requested.

Section 4 of the chapter brings to attention seven very useful policy recommendations, and all these are very important and helpful. The list of policy recommendations is impressive, taking account of various levels of action, and arguing that a full package is needed to improve the situation of African Countries in regard of SDG 9. But regrettably, many of these policy proposals have been advanced in Africa for many years, but without effect. However, the context of SDG 9 justifies a new look at these recommendations. It is now much clearer why infrastructure and innovation are pillars for industrialization. And it is useful to bring the messages again to the attention of the policymakers and stakeholders, knowing that the political economy of interest groups in Africa affects deeply the implementation process.

The two contributors **Julia Arlinghaus and Eugenia Rosca** present a second study to the Unit 1 on **Frugal innovations driven by micro, small and middle enterprises: Characteristics and challenges in the African landscape**, to address the issues of those innovations which are relevant for poor consumers and

poor households. The relevance of these “frugal innovations” is great for many households in Africa (and globally, what explains the interest in such innovations at global level). So, the question arises how poor households can benefit from modern technologies in communication and telecommunication, in medicine and high nutrition food, in transport and mobility, and in many other areas where complexity and scale of production tend to exclude such segments of the population from purchasing such items and using such technologies. The SDG 9 therefore refers also to a type of industrial development which cares for such households, aside of infrastructure and innovation which are adapted to such production patterns. These “frugal innovations” can be developed and can work only if industries and infrastructure are adapted to their character, say by linking informal enterprises with consumers and markets through transport and market infrastructure being relevant for the poor. It is quite relevant when discussing the implications of SDG 9 to understand how industrial development in Africa can support the production and distribution of goods and services for the so-called Base of the Pyramid (BOP) consumers and households.

In this second chapter to Unit 1, the authors discuss the issues in six sections. After the Introduction in section 1, Section 2 addresses the growing importance of frugal innovations for micro-, small, and medium enterprises (MSMEs) in driving sustainable development efforts. Section 3 is on methods of analysis for MSMEs which are operating in Base of the Pyramid (BOP) markets. Section 4 is presenting the main findings from the survey, emphasizing the challenges and the solution approaches. Section 5 is presenting a discussion of the findings and gives a review of the implications for different stakeholders. Section 6 is on Conclusions.

Some pertinent questions arise in this context and are discussed in the chapter: What can African micro, small and medium-sized enterprises (MSMEs) do to work for BOP innovations, to develop such products and adapted processes, as well as reorganizing production and business models? How can policymakers in African countries support such firms to achieve economic scaling and sustainable social impact creation by frugal innovations, and is there evidence that policymakers act in this direction? How to analyse the characteristics and the specific challenges of the diverse African enterprise landscape, and what is the evidence in regard of pushing frugal innovations? Frugal innovations of MSMEs will play an increasing role in developing countries, especially so in Africa. As this aspect of MSME activity is under-researched, the chapter adds to the information needed for action from the side of policymakers and other stakeholders. But mainly the entrepreneurs of MSMEs will benefit from generating and disseminating additional data to find out new niches for production centred at the BOP markets and ways and means of organizing it.

The authors argue that inclusive growth and sustainable poverty alleviation efforts in Africa are driven by numerous micro-, small- and medium-sized enterprises (MSMEs). This aspect of poverty alleviation is too often neglected when

discussing MSME policies. These enterprises address the needs of the so-called Base of the Pyramid (BOP) consumers and households. But, as the authors emphasize, they go beyond the BOP narrative and challenge traditional innovation trajectories from idea to final use; this is done by rethinking entire processes of production and business models leading to frugal innovations. Frugal innovations are broadly defined as innovations which reduce complexity and cost of products, mainly by removing nonessential functions and features from a durable good, such as a phone, a solar heater, a stove, sanitation facilities, water purification systems, a washing machine, medical equipment, etc. Poor people need many products which are sold for different income groups with different characteristics, different functions and different designs. Related to this core innovation are other innovations, such as new distribution channels and means of adapting the product to harsh climatic conditions so that the durability is increased.

In times of the COVID-19 pandemics, such frugal type-innovations may get another push, because of repurposing industries due to deglobalization pressures, because of increasing poverty and unemployment caused by declining incomes for informal sector workers, and because of the interruption of established supply chains. Important is the need to establish a local mass production of various goods for daily use, as the people in many African countries still live under weak hygiene and safety conditions. Especially in all healthcare fields, frugal innovations cannot compromise on performance, reliability and safety; maximum performance is still requested, and there cannot be tolerated a discount on quality, but the supplies have to be organized at cheaper prices and with local distribution modes. Frugal innovations can give a push to regional supply chains and as well to modified global supply chains, although such changes need time.

Through their frugal innovation-nature, the MSMEs bring together multiple stakeholders from formal and informal sectors; their activity is reaching across geographical regions and is combining international expertise with local knowledge. So, as an example, international mobile phone operators may cooperate with local African firms and operators which reach out to BOP households with their products being based on frugal innovations. In this way, these frugal innovations have a high potential to address the multifaceted challenges of poverty and sustainable development as they merge top-down and bottom-up approaches and bring together actors from different stakeholder groups. To further contribute to the sustainable development goals (SDGs) of the United Nations and in particular, to SDG 9, these companies need to be supported by policymakers, also at the local government level, to achieve economic scaling and to create a sustainable social impact. All this may happen by means of (1) producing goods and services for the poor under ecological conditions, (2) improving access of the poor to hard and soft infrastructure, and (3) using technology and innovation for eradicating poverty. The authors of this chapter give many examples how this will occur under

African production conditions. COVID-19 may give a push to realise these positive changes on ecology, infrastructure, and technology with the aim to eradicate poverty.

The MSMEs are very diverse in terms of their ownership (e.g. local, foreign) and governance structure (e.g. social enterprises, for-profit enterprises). This diversity helps to adapt flexibly to the BOP markets. However, too often the managerial and political recommendations provided by governments and donors typically are of a rather general character and do not consider the diversity of internal and external challenges that different groups of enterprises face. The chapter therefore aims to find out more specific interventions from the side of governments and other stakeholders to develop the BOP markets. Based on a profound literature review of different actors of the inclusive business ecosystem and a survey among 59 African enterprises, the authors identify the main internal and external challenges as well as various solution approaches which different groups of enterprises apply. The enterprises in the sample engage extensively in value co-creation activities with Base of the Pyramid (BOP) consumers and use first, technology to innovate for serving the needs of the poor and second, business model innovation to address basic needs and poverty issues in Africa. The enterprises in the sample are mostly addressing basic needs issues, such as lack of clean water, sanitation, nutritious food, clean energy, and housing. A great number of these enterprises uses technological innovation as an instrument to address these issues. The sample of African MSMEs has a focus on the following countries: Kenya, Uganda, Zambia, Nigeria, Ghana, Malawi, and Tanzania. Therefore, the coverage by African regions is balanced. Most of the enterprises are still young, free-standing, and independent. The MSMEs in the sample are mostly locally developed and managed ones, but nonetheless they are open to national, regional, and international cooperation and co-value creation. Mobile phones are a good example for co-value creation, as international and local operators can add value in the sense of producing products with key functions and at low prices, but with distribution systems guaranteeing a regular local supply.

It is found out in the chapter that the main external challenges include high costs of doing business, poor infrastructure, and a highly regulatory environment, while the main internal challenges include insufficient resources, high risks, and low return on investment. Progress along the learning curve and policy support can help to address these challenges. The “solution mechanisms” proposed encompass innovative business models, partnerships with NGOs and multinationals, inclusion of low-income consumers into product design, maintenance, and distribution, and experimenting with novel revenue collection and distribution channels. Based on these insights and the needs of MSMEs and BOP households, the authors develop a list of policy implications on how the MSMEs can be supported throughout various stages of development in order to ensure their economic scaling and sustainable social impact creation.

The key issue in the paper is the question how MSMEs can support poverty alleviation in Africa through frugal innovations. The chapter is well structured. After the Introduction, the growing importance of frugal innovations for MSMEs in driving sustainable development efforts is presented. Then the methods of analysis for MSMEs which are operating in BOP markets are outlined, followed by a presentation of the main findings from the survey, emphasizing the challenges and the solution approaches. Finally, a discussion of the findings, a review of the implications for different stakeholders, and conclusions follow. The chapter shows that frugal innovations of MSMEs are relevant for daily life goods and services in local African contexts. The chapter presents new evidence to understand the functioning and the growth of such firms and enriches the knowledge about the market dynamics of the BOP markets. Poverty alleviation strategies in Africa should not miss this important group of stakeholders. Poverty alleviation economics is now advancing rapidly through experiments on instruments and solutions to aid the poor and through the focus on frugal innovations for BOP markets.

The third contribution to Unit 1 by **Giovanni Valensisi** from the United Nations Conference on Trade and Development (UNCTAD) is about the theme **Harnessing the AfCFTA for commodity-based industrialization: a synthesis of three case studies**. The chapter explores the scope for the African Continental Free Trade Area (AfCFTA) to support the achievement of SDG 9. The main question is how the AfCFTA can become an instrument to accelerate the industrial development in Africa, by enhancing economic cooperation, trade, market integration, foreign investment, technology transfers, access to continental skills, and by developing continental and regional manufacturing and processing value chains. The expectations in regard of the AfCFTA are very great, covering so many development objectives and areas for policy action. It is analysed in the chapter how the AfCFTA can support sustainable and inclusive industrialization, especially by paving the way for enhanced value addition in commodity-based sectors. To overcome the export of commodities in raw form, processing and manufacturing activities can benefit from the market integration in Africa. It is not only trade expansion that matters for the strategy to build an AfCFTA, but it is sustainable and inclusive industrialization. The focus is on SDG 9, and this goal of the Global Agenda 2030 is interrelated with all the other SDGs, especially the ones related to poverty eradication, eliminating hunger, improving health systems, promoting universal education, sustainable production and consumption, environmental protection, etc. Although many studies were written on commodity-based industrialization and on regional cooperation and integration of commodity-based exporters, the issues of sustainable and inclusive industrialization were neglected so far. In this chapter, a new approach is presented to link these issues in a policy-focussed direction for Africa as the continent now moves to a deep continental integration strategy.

The author analyses the functioning of three value chains of significant importance for the African continent, namely tea, cocoa, and cotton/textiles/apparel. Many countries are involved in producing tea, cocoa, and cotton textiles/apparel, and any progress in developing and strengthening these value chains will be helpful in terms of employment creation, building competences, and in gaining competitive advantages. Use is made of disaggregated (HS 4-digit) export import and tariff data, to discuss first, the pattern of trade specialization in primary inputs, processed intermediates, and in final products along each of the value chains considered; second, the depth of integration at regional level; and third, the positioning of regional players in the corresponding global value chains (by studying also the reliance on key imports from outside the continent). Based on this meso-level sectoral approach, the study complements recent analysis based on computable general equilibrium models (CGEMs); it also provides key insights on successful cases of industrial policy interventions and their articulation with the regional trade policy framework. So, an AfCFTA can also be helpful to identify new frameworks for industrial policy development in important commodity sectors. Because of the great number of new entrants to the African labour market every year any progress along these three commodity sectors will have an impact on the creation of jobs and on the development of competences. Recent studies on the employment perspectives in Africa up to 2040 show how important such additions to the number of sustainable and adequately remunerated jobs will be.⁴⁸ Commodity-based industrialization is a chance to implement SDG 9 with impacts on infrastructure, innovation and industry.

Beyond the specificities of each value chain, the analysis underscores three main points. First, even in sectors where African countries have comparative advantages, regional value chains remain shallow and piecemeal, with most commodity-producing countries being still dependent on exports embodying limited value addition, and with manufacturing hubs in the region mainly relying on processed imported inputs from the rest of the world. Second, the disjointed nature of these regional value chains is partly exacerbated by the uneven progress at the level of consolidation of Regional Economic Communities (RECs), with key economies on the continent still trading with one-another on a Most Favoured Nation (MFN) basis. Third, by examining both MFN and preferential tariffs within the region, the study shows that there is significant scope in the context of the AfCFTA to strategically use preference margins to enhance the breadth and depth of regional value chains, with potential benefits for domestic and regional value

⁴⁸ See the study (2017) - based on country experiences - about the job gap in Africa: <https://institute.global/advisory/jobs-gap-making-inclusive-growth-work-africa-0>, and the report (2020) about the recent conference on Africa's Employment Perspectives up to 2040: <https://www.die-gdi.de/en/events/details/africas-employment-perspectives-towards-2040/>

addition. These main findings point to the fact that the AfCFTA presents an historic opportunity to enhance the consistency between African countries' trade policy frameworks, and their industrialization and employment objectives, as well as the continentally agreed vision for Africa, the Agenda 2063. Although there is some potential in this approach to implement SDG 9 in a continental framework, the real progress with AfCFTA and with the Industrialization Agenda of the African Union will be of decisive importance for the level of implementation.⁴⁹

The chapter is structured as follows. After the Introduction in Section 1 which situates the study in the broader policy discourse, by articulating the strategic link between the AfCFTA, SDG 9 and Agenda 2063. The Section 2 outlines the history of Africa's regional integration and the context in which the AfCFTA will be implemented. This section will outline the uneven progress towards Africa's regional integration (especially at REC level), identify key challenges, and contextualize the three value chains considered in the context of intra-African trade. Section 3 discusses the three commodity-based value chains individually. This section assesses the working of the three value chains considered in terms of the pattern of specialization, the importance of the continental market, the reliance on imports from the rest of the world, as well as the intra-Africa tariffs. One sub-section is devoted to each product: tea, cocoa, and cotton/textiles. Section 4 presents an overall synthesis of the analysis. This section is distilling common traits across the three value chains and explains how an ambitious AfCFTA could address some of the obstacles hindering greater value addition, by better aligning trade and industrial policy frameworks. It will also elaborate on the importance of buttressing trade reforms with broader policy measures, at a national as well as at a regional level, aimed at addressing supply-side issues, reducing trade frictions, and fostering more inclusive socio-economic outcomes. Finally, Section 5 concludes by drawing key policy recommendations. Reference is made again to other flagship initiatives set out in the AUC (African Union Commission) frame, like the BIAT (Boosting Intra-African Trade) Action Plan, the Programme for Infrastructure Development in Africa (PIDA), the Comprehensive Africa Agriculture Development Programme (CAADP), and the commitment to the Accelerated Industrial Development for Africa (AIDA) strategy. The potential contribution of the AfCFTA to the attainment of SDG 9 and the Agenda for Africa 2063 will also depend on the commitment towards these other flagship programmes of the AUC from all key stakeholders in Africa at continental, regional, and national levels.

The fourth contribution to Unit 1 is by **John Ouma-Mugabe and Albert Edgar Manyuchi**, both based in South Africa, and the chapter has the title **Making**

⁴⁹ See the tralac blog by Talkmore Chidede and Trudi Hartzenberg on 06 Sep 2020: <https://www.tralac.org/blog/article/14898-industrial-development-the-importance-of-services-regulation-and-good-governance.html>

Foreign Direct Investment Work for Inclusive and Sustainable Industrialization in Africa. This theme complements the other three chapters by reviewing the role of foreign investment for inclusive and sustainable industrialization in Africa, what is done through considerations and analyses of investment trends, investment acts, and investment policies. As the continent is known as a destination of investments by minerals corporations from Western countries, China, India, and other source countries, it matters how such investments fit the paradigm of inclusive and sustainable industrialization. But also, the diversification of foreign investments towards manufacturing and services sectors matters in this context, as the new paradigm of sustainable and inclusive industrialization may have even more impact on these sectors. Country experiences are brought in by the authors so that investment cases by country and sector can be compared in regard of approaches and performance criteria. The basic idea behind the chapter is that a lot can be done to make foreign investment more developmental so that inclusive growth will be enhanced and with it also sustainable development. Although this focus on foreign investment is a theme of heated discussions since many years in Africa, because of the long-lasting dominance of foreign investments in minerals sectors and sectors producing agricultural export commodities, the issues of inclusiveness and sustainability are rather new. More researches are needed to discuss these issues deeply. The Global Agenda 2030 gave a new impetus to these discussions. Many of the seventeen SDGs have relevance in this context.

The chapter starts with an analysis of investment trends. The past two decades have witnessed a remarkable surge of interest in the promotion of Foreign Direct Investment (FDI) inflows into Africa. This is because FDI is recognized as an important source of capital, management knowhow, and foreign technologies that are critical to the continent's efforts to achieve economic growth and industrialization. If the investments are well configured, FDI can spur technological change and structural transformation of African economies, it can create employment and reduce poverty, and at the same time it can maintain the integrity of the natural environment. In Unit 2 there are chapters directly focussing on the social effects of direct investment by multinationals in the minerals sectors. This chapter has a continent-wide focus and is about the nature of policies, legislations, and institutions that would make FDI inflows contribute to the achievement of inclusive and sustainable industrialization of Africa. It argues that African countries need to design and to implement investment, industrial and innovation policy mixes that direct FDI inflows to sectors and activities that spread economic, social, and environmental benefits of industrialization across society. The issue of directing FDI flows to specific sectors, regions, and activities is also not a new one, but the frame of policies has changed; new objectives, such as social cohesion, employment creation and poverty reduction, environmental protection, gender issues, local empowerment, and regional equalisation of economic opportunities, matter now much more. FDI policy instruments—of both home and host countries—should

focus on inducing long-term transformative change of African economies. In this regard, innovation in FDI and industrialization should be the preoccupation of African policymakers. And FDI plays a role in any effort to stem against deindustrialisation trends in African countries.

Making FDI work for inclusive and sustainable industrialisation has direct and indirect outcomes. Various development objectives are affected. FDI can support or contribute to the attainment of various Sustainable Development Goals (SDGs), especially SDG 9—with emphasis on inclusive and sustainable industrialization. It indirectly contributes to the achievement of other related SDGs, such as SDG 8 —Decent Jobs and Growth, SDG 12 —Sustainable Production and Consumption, SDG 13 —Climate Protection, and SDG 16 —Peace, Equity and Strong Institutions. Other SDGs could also be mentioned, as FDI can contribute to poverty reduction, food security, and education/training. Cases in Unit 2 show that direct investors in minerals sectors can be mandated to look at schools and feeding of children.

The chapter is organized as follows. The section two after the section 1 for the Introduction gives an overview of Africa's economic growth trends and highlights the experiences with FDI and industrialization. It shows that economic growth and FDI inflows of the past two decades have not had any significant impact on the transformation of economic structures of most of the African economies. There is no evidence that they have contributed to industrialization, poverty reduction, environmental protection, and job creation, not to speak about sustainable and inclusive industrialization. Poverty, unemployment, and ecological degradation persist in most of Africa. More than this, structural transformation did not show any measurable effects from FDI inflows. In this section two major evidence from international and African sources is presented.

The third section proposes conceptual contours for studying or analysing FDI-led inclusive and sustainable industrialization. Through a review of literature, it identifies industrial, investment, and innovation policy instruments and institutional arrangements that some developing countries, mostly Asian countries, have used to spur industrialization and economic development in the past three or four decades. It is argued that African countries should especially engage in innovation and industrial policy learning from such countries, mainly located in Asia. But the effective transfer of such instruments, tools and policy mixes need to be understood by adapting them to the institutional settings which are prevalent in African countries. The development history, the geography, and the role of the elite matter. Any comparisons of Asian and African development trajectories may be misleading if such aspects are ignored. Also, African views on inclusive and sustainable industrialisation need to be considered; African regional and continental organisations have developed such views in recent decades. Ownership matters also in terms of investment policies and investment acts.

In section four of the chapter various policy instruments for FDI and industrialization in Africa are reviewed. Country cases are brought in. It is argued that there are mismatches or a lack of coherence between different industrial, investment, and innovation policy instruments which are used by many African countries. The effect is that various legislations give different and conflicting incentives to act as foreign investor and as local administrator. Not only these policy areas may have conflicting rules among each other, but also between federal, state, and local government levels may be different policy signals at work on similar issues. African countries have not configured or organized their industrial, investment, and innovation policy instruments in such ways as to implement policy mixes that promote inclusive and sustainable industrialization. It is argued that changes in this context are complex, but it may be possible to go step-by-step in this direction.

The last two sections five and six give Policy Recommendations and the Conclusions. Section five outlines proposals and gives suggestions for improving policy mixes and the effectiveness of FDI inflows to promote inclusive and sustainable industrialization in Africa. Detailed recommendations are presented. An adaptation to country-specific conditions will be needed. Emphasis is on a) building capacity for policy design and implementation, b) on investing in policy learning, c) on introducing measures that will direct FDI inflows to a diverse range of sectors, and d) on promoting measures at SME-based innovation activities that are socially and environmentally sustainable. These four groups of policy recommendations present an impressive number of suggestions for reforms of investment laws and acts. Section six with the Conclusions presents some major insights of the chapter. The chapter gives signals of hope; making FDI work for sustainable and inclusive industrialization is a difficult process, but such a project is not unattainable.

3 The Strategy

Strengthening the Linkages between Industrial Development, the Infrastructure Base, and the Innovation Capacity for Developing Productive Capacities

A key message for a strategy to realize SDG 9 is based on policies to develop productive capacities as the nature and the pattern of productive capacity development determine the path of transformation in an economy. Productive capacities need to be developed in the direction to increase the output of new, dynamic, and more sophisticated products. This strategy will support structural transformation of the economy, particularly into manufactured products and services. Therefore, African policymakers need to adopt a holistic approach for developing productive capacities to achieve their industrialization and transformation agenda. Seven key strategy elements are of importance:

First, industrial policy should be used strategically to redirect the development of productive capacities. Thereby, the goals of industrialization and transformation can be realized and will support the realization of SDG 9. Industrial policy is re-discovered now in Africa, because of the continental cooperation programmes, but will work only in the context of participatory approaches. Those private and public stakeholders who are knowledgeable on and responsible for industrialization, infrastructure development, and innovation capacity should cooperate when industrial policies are formulated and implemented. The SDG 9 gives with its targets and indicators an encouragement to move in this direction.

Second, promoting entrepreneurship and enhancing competitiveness of domestic enterprises is a cornerstone of industrial development and is the basis for the development of productive capacities. In the past, policies in Africa were fragmented towards entrepreneurship development and strengthening competitiveness. SDG 9 gives with its eight targets a good frame for developing a coherent strategy of entrepreneurship development and an integrated strategy to support the competitiveness of domestic enterprises. Also, state-owned companies and large domestic enterprises need deep reforms in many African countries. Innovation and industrial finance policies, industry policies, and infrastructure plans are the basis for such a strategy.

Third, supporting technology and innovation at the level of firms, industrial sectors, and the whole economy is an important part of the strategy to strengthen the linkages between industry, infrastructure, and innovation. Technology and innovation focus on new products and services and allow it to use the resources of the country in new directions. Thereby the productive capacities are developed, while reaching higher productivity levels. SDG 9 signals that technology and innovation are of great importance for developing micro-, small- and medium-sized enterprises. So far, these enterprises were not adequately supported in Africa in contrast to foreign companies, state-owned companies, and large domestic companies.

Fourth, exploiting the potential of regional cooperation for inclusive industrialization is an important element of a strategy to strengthen the productive capacities. Regional integration was not a success story in Africa because of so many impediments (from ill-defined goals and overambitious agendas to political and bureaucratic implementation problems). The speedy implementation of the African Continental Free Trade Area (AfCFTY) now signals that African policymakers want to benefit from the large continental markets, from intra-industry trade of goods and services, and from cross-border exchanges of skills, technologies, services, and direct investments.

Fifth, improving the effectiveness and the efficiency of supply chains and industrial networks matters. African policymakers discover the role of intra-African value chains and industrial networks; it is argued that the benefits are largely unexploited (or left to global actors) despite of the many opportunities. The digital

transformation has impact on Africa and reduces the transaction costs on the continent. The African Continental Free Trade Area (AfCFTA) will not only strengthen the existing regional economic communities (RECs) but will also affect positively the regional value chains (RVCs). Regional value chains in the sectors of agriculture, manufacturing, and services can contribute more to the development of the productive capacities when the continental trade and investment perspective is improved.

Sixth, it is necessary to create political and macroeconomic environments for enterprises and economic actors that are conducive to production and transformation. Although macroeconomic stability has increased in some African countries, especially since the financial crisis of 2008/2009, there are still limits to the macroeconomic convergence of countries in regional economic communities. But evidence shows that regional integration in Africa has led in some cases to more convergence of macroeconomic policies. Although there are differences between countries in a regional economic community (REC) of macroeconomic policies to perform in this direction, some indexes for assessing regional integration reveal that such a convergence of macroeconomic policies can contribute to developing productive capacities.

Seventh, it is also important to make regional and international policies consistent with the goals of productive capacity development and the structural transformation of African economies. African countries became more resilient and less vulnerable to external shocks; this is important for maintaining macroeconomic stability and for continuing steadily the development of productive capacities. They have also developed since 2000 a positive, but a critical attitude to increasing economic openness and of extending economic liberalization. Digital transformation is an important global trend, and Africa is more and more affected by this trend. Africa needs to understand the implications of the digital transformation, and there are now many attempts to follow the new developments.

Integrating Frugal Innovations into an all-inclusive innovation strategy for sustainable and inclusive industrialization

Frugal innovations have important repercussion on the poor in Africa, as products for the Bottom of the Pyramid (BOP) households benefit from products and services which have relevant functions, but are cheaper than the products and services designed for middle class and rich household segments. It is then obvious that there is a close link between SDG 9 – Industrial Development, Innovation, and Infrastructure - and SDG 1 – Poverty Eradication. Micro, Small and Medium Enterprises (MSMEs) are key players in the BOP landscape, as they connect relevant stakeholders in the production value chain, the marketing and distribution chain, and the R&D and regulation chain. These enterprises are near to the BOP local communities and contribute to local education and capacity building. Thus, creating an environment in which MSMEs can achieve economic scaling is a central

prerequisite. Such a strategy package with the focus on MSMEs is considered below; various targets of SDG 9 are integrated.

First, MSMEs are vital players in the relevant value chains; these enterprises are leading actors in the field of frugal innovations. They produce goods and services for the poor; they consider ecological conditions at the local level; they contribute to the development of infrastructure networks and to the supply of corresponding services, such as telecommunication, distribution, installation, and transportation; they also contribute to the creation of jobs in the different stages of the value chain, namely in the development, procurement, production, and distribution phases. MSMEs are also actors which work on sustainable development in their business models when they have BOP markets and BOP households in mind. A strategy to support the MSMEs in these functions and contributions will be helpful for the realization of SDG 9.

Second, MSMEs contribute with their designs, their products and services, and their business models to poverty alleviation, although most of them are profit oriented and not charity centred. But they have a great social impact when they sell basic goods and services to low-income urban and to rural consumers, based on frugal innovations. They impact on small rural and urban enterprises when they adjust to the local market constraints for basic goods, and when they are providing basic services like solar-based electricity in remote rural areas. This role is especially important in the case of industries which are relevant for water purification and sanitation, for electricity supplies through renewable energy production, for local housing construction, and for healthcare. COVID-19 gives evidence how important such local supplies and local industries are, which have a multiplier effect on various aspects of life. However, firms which are operating in low-income settings need very strong ethical values and principles to avoid an exploitation of unequal power relationships and of vulnerabilities of BOP local communities and households. A strategy to support such an ethical-based orientation of local firms towards local low-income communities is needed, either through incentives and/or communal pressure.

Third, the strategy to make households and enterprises benefit from frugal innovations has implications not only for the MSMEs, but also for other relevant groups of stakeholders, namely the “intermediaries” (NGOs which are often owned or funded by development agencies), the “policymakers” (mainly at local and municipal levels), and various “cross-sector partners” (like R&D institutes, political groups, business and trade union associations). MSMEs have a key role among the stakeholders as they need to take one step further in the coming years – especially to tackle challenges related to sustainable development and to design their long-term strategy with a clear sustainability strategy in mind. They can focus on BOP markets and households with a product-based consumption, with a service-based consumption, and on BOP partners in a circular-based economy. And additionally, the MSMEs can employ localization approaches - for adapting value

chains to use local resources and ideas, or to promote a new lifestyle with a focus on self-realization. Implications for the various stakeholders are of importance for the strategy building and for the implementation of the strategy. Such a strategy needs to become participatory and long-term.

Fourth, MSMEs face numerous challenges and need to deal with limited resources when they use frugal innovations for their products and services. Thus, it is critical for them to create an ecosystem of relevant partners to enable them to operate together in a network. By working jointly and relying on the competences of the partners the MSMEs can focus more successfully on BOP markets and grow through their frugal innovations. So, they will contribute to realize SDG 9. In this sense, it is important to select the relevant partners wisely and with a clear focus on building long-term-oriented relationships. A mix of local and foreign knowledge may be helpful to combine local knowledge and local legitimacy with foreign expertise and with relevant NGOs as influential social networks. Growth-oriented local MSMEs can actively engage in partnerships with foreign MSMEs and with NGOs to learn from other business innovators and social innovators. MSMEs which provide basic services to rural consumers can build on the expertise and the social network of local NGOs for key value chain activities, including the creation of awareness and the promotion of education campaigns. Partnerships between local and foreign MSMEs can reduce the costs of developing frugal innovations when products and services are redesigned from innovations for more developed markets. Supporting partnerships of local and foreign MSMEs is key for a strategy which favours both partners; NGOs as social networks can consolidate the partnerships.

Fifth, various partners should be invited to cooperate. The “intermediaries” play a significant role in this context. The BOP landscape entails a wide variety of intermediaries, with international platforms, hubs, and networks; these intermediaries offer different services to the MSMEs at local levels. Therefore, intermediaries could provide targeted services to MSMEs in specific sectors and at different stages of development, such as in the fields of social, technical, and ecological advice. At later stages, MSMEs try to find partners which provide knowledge, skills, capabilities, and resources to replicate and to scale their operations. Intermediaries should provide support on how to find the right partners who are relevant for the enterprise at the specific stage of development of enterprises. It is an open question to what extent large companies and government institutions can perform such roles as intermediaries; in many cases international and regional NGOs and international donors may be more useful.

Sixth, “policymakers” have a great role at all stages of development of MSMEs. There is a need for targeted policies and support programmes for MSMEs at different stages of development, and for policies to strengthen the links between MNCs, impact investors, large companies, cross-sector actors, and

MSMEs operating in BOP markets. Policymakers can elaborate policies for different types of BOP enterprises, depending on their specific goals, partners, and impacts. There is need for the policymakers to measure the impacts in the long run to ensure that the initial social orientation of the MSMEs is not lost. Policymakers can give incentives so that long term approaches are becoming effective, and for this to happen they can give incentives for a deeper collaboration between governments, MNCs, local and regional investors, large companies, and MSMEs. On this basis the combination of skills, resources, capabilities, and of orientations of the different stakeholders will advance the fulfilment of sustainable development goals (SDGs). Anyway, policymakers need to tighten the regulatory framework to prevent exploitation of enterprises issues and to protect low-income consumers. And policymakers can promote and support an increased visibility of successful enterprises which are contributing to sustainable change, thereby attempting to educate a new generation of business leaders.

Seventh, cross-sector actors, such as local NGOs, community associations, and knowledge institutions, play a role as supporters of MSMEs and should be strengthened. Cross-sector actors can play important roles when they adapt to characteristics of sectors, types of enterprises, and geographical conditions. The NGOs are often valuable partners for several types of MSMEs which are operating in BOP markets. NGOs can cooperate with MSMEs, especially in sectors where approaches for natural environment protection are still lacking, so that the competences of the NGOs are sought after. They can also encourage MSMEs to define a clear sustainability strategy and to support the implementation of such strategies at tactical and operational levels. Knowledge institutions can support MSMEs especially in technology-intensive sectors, with R&D, innovation capacity, and with adapted technologies. Such knowledge institutions are supportive for various sectors, such as healthcare, training, ICT, and banking.

Starting with new approaches and tools towards inclusive and sustainable commodity-based industrialization

A strategy for the industrialization of African countries which still are exporters of agricultural commodities like tea, coca and cotton is envisaged. The eight targets of SDG 9 give a frame for the discussion. However, the discussion of such strategies has a long history in development economics. What is new is the change in the environment for African countries which aim to industrialize. The global value chains (GVCs), the African Continental Free Trade Area (AfCFTA), and the developments in the international trade policies matter. The value chains of the commodities in which African countries are key suppliers are quite diverse, but there are opportunities to overcome commodity dependence at the national level by new steps towards regional integration in Africa. Some key points of a strategy are laid down.

First, cash-crop sectors have a great importance for African countries but exploiting forward linkages through an expanding agro-processing industry is so far not very successful. These countries work towards an industrial policy, but scale economies and entrepreneurial capabilities play a limiting large role. African economies are exporting low value-added goods, while they are importing semi-finished or final products from the rest of the world. But Southern Africa has some experiences and successes with regional value chains (RVCs); it may be useful to learn in other regional economic communities (RECs) from their experiences.

Second, African countries suffer from premature de-industrialization despite of the obvious opportunities and latent comparative advantages in some manufacturing sectors. The integration of local firms into GVCs participation has brought only limited upgrading effects, especially so in the textile and garments value chain, despite of preferential schemes such as the EBA (“Everything But Arms”) or AGOA (African Growth and Opportunity Act) initiatives. The rules and regulations for governing the value chains have limited the potential for productivity growth; more participation in the governance of such value chains is important.

Third, various factors need to be mobilized to address these problems in African countries. Key factors are the lack of investment and of technological upgrading, the inadequate infrastructural provision, the skills shortages, and policy failures. It is necessary to correct the policy failures of the past by long-term industrial policies which stimulate investment by local and foreign sources. The African manufacturing sector cannot rely only on temporary inclusion into GVCs; exploiting the market base of urban middle classes and rural enterprises for industrialization is important. The project of the AfCFTA gives new opportunities to overcome limits of the GVCs; the limits from scale economies and entrepreneurial capabilities for upgrading industrial processing activities can be overcome through the continental perspective. At the continental perspective key services (logistics and quality assurance, marketing, and R&D) can be more competitively supplied, so that the disadvantage for new entrants in the competition disappears. But hard and soft infrastructure sectors need higher investments in most African countries and at cross-border level to support local industrial producers.

Fourth, changes can only be expected if the AfCFTA becomes reality not only on paper but through concerted action and coherent implementation. Not only the levels and forms of protection, but also the non-tariff barriers and the “behind the border” measures of governments to protect their local industries need action to overcome the fragmentation of markets. Reaching a minimum efficient scale is one point for action but attracting market-seeking investment by lead manufacturers is as well important. Africa has numerous lead manufacturers, and the continent has large state-owned and private companies; these companies can take the lead in investments and in demanding policy reforms and infrastructural investments.

Fifth, the potential of intra-African trade can only be exploited by deepening and broadening the regional value chains (RVCs), what requires action at the level of regional economic communities (RECs) parallel to ambitions to link the RECs towards the AfCFTA. The AfCFTA is a possibility to take advantage of a relative sophistication of intra-African trade; this would contribute to the consistency of trade, agricultural, and industrial policies. If intra-African trade is growing for semi-finished and finished products, this will lead to higher export values and to scale economies and technological upgrading in the trading African economies. A strategy to increase the local trade of African intermediate products could stimulate the processing in relatively less sophisticated supply chains. Agro-processing is a promising area as the scope for tariff cuts is relatively large, as the sector is characterized by moderate levels of sophistication and capital-intensity, and as it mainly focuses on consumption goods, whose demand is set to expand as a result of demographic growth and because of the emergence of an African middle class. An integrated market leads to greater economies of scale and may attract market-seeking investors; they could benefit from a strategic use of tariff schedules through preference margins to stimulate downstream segments of the value chain. It is also necessary to overcome the African trade protection system within and between RECs insofar as it disadvantages local African producers relative to global trade actors.

Sixth, it is important to design and implement regionally coordinated and sector-specific industrial policies to further resource-based and commodity-based industrialization in Africa. Sector-specific industrial policies are needed as actors and countries have different positions in the value chain and different strengths in bargaining power within the global and regional value chains. Regional integration means to balance the country-specific differences that exist in specific sectors, such as tea, cocoa, or cotton. Long-term industrial policies consider these differences and work out sector- and country-specific industry, innovation, and infrastructure policies along the SDG 9 targets. Mechanisms could be developed to involve countries with different levels of development, such as in the East African Community (EAC), to support the involvement of producers from less developed countries in regional value chains. It may be that engaging regional or global lead firms, strengthening farmer-based organizations, and integrating small and medium enterprises (SMEs) into regionally embedded chains could be such mechanisms. The AfCFTA could be used in the years to come as a platform to organize policy coordination at a regional level, especially in areas such as industrial collaboration, exchanging export experiences and market information, skills-pooling and joint training, R&D alliances, and greater circulation of specialised service providers.

Seventh, the AfCFTA project could be an important step to enhance the consistency of the continent's trade policy framework in relation to its agricultural, industrial, and STI (science, technology, and innovation) policy objectives. The

uneven progress towards regional integration has constrained the scope for harnessing economies of scale and trade complementarity; this situation has undermined the efforts to create deeper inter-sectoral linkages between commodity sectors and manufacturing. The AfCFTA will be successful if it stimulates important prerequisites of commodity-based industrialization – first, investment to tackle infrastructural bottlenecks and second, the promotion of technological upgrading. But, the AfCFTA should be considered as a complement to other continentally agreed frameworks geared towards structural transformation, such as the Programme for Infrastructure Development in Africa (PIDA), the Comprehensive Africa Agriculture Development Programme (CAADP), the BIAT (Boosting Intra-African Trade) Action Plan of the AUC (African Union Commission), and the commitment to the Accelerated Industrial Development for Africa (AIDA) strategy. However, some observers consider the commitment towards these complementary programmes as weak. The AfCFTA has the potential to advance the SDG 9 targets related to sustainable and inclusive industrialization (namely the SDG 9 targets 9.2 and 9.B), and the achievement of the SDG 9 target 9.5 on technological upgrading. An integrated regional market will also enhance the viability of resilient and inclusive infrastructural investments (in line with SDG 9 targets 9.1, 9.4, and 9.A), but will also stimulate greater financial deepening (which is encompassed under the SDG 9 target 9.3) and the spread of information and communication technologies (SDG 9 target 9.C). This integration project is developing all the eight SDG 9 targets if properly assessed, coordinated, and implemented.

Improving Investment Policies and Investment Acts to make Foreign Investment work for Inclusive and Sustainable Industrialization

Improving investment policies and investment acts is for many African countries an important developmental task. Foreign investment contributes to economic growth and to structural transformation, but only if certain conditions are fulfilled. If foreign investment is directed to key sectors of the economy (manufacturing, agriculture, and the generation of key productive services), inclusive growth and sustainable development will be able to advance. If foreign investment is changing its practices, like in mining and agricultural cash crops, towards social and ecological responsibility and towards long-term development, also this sectoral direction of foreign investment will contribute to inclusive growth and sustainable development. The focus of SDG 9 is on accelerating industrialization, building innovation capacity, and developing soft and hard infrastructure. Foreign investment will benefit from the focus of SDG 9 and its eight targets but will also impact on these three elements of inclusive growth and sustainable development.

First, foreign investors in Africa will benefit from comprehensive policy reforms and therefore adequate policy capacities need to be developed. African countries need capacities for designing and implementing policy reforms for all major policy areas, but also for frameworks related to foreign investment. There

is a need for instruments and tools to advance an FDI-based inclusive and sustainable industrialization, but as a complement to inclusive growth and sustainable development as being based on domestic resources mobilization. Training courses and workshops for government officials and investment promotion agencies could be organized along the lines of SDG 9 targets and indicators. Universities, research institutes, think tanks, NGOs and international development agencies play a role in such ventures. Such a training should include the transfer of techniques through practical lessons in policy design, monitoring and evaluation, and implementation. The strengthening of policy capacities is of importance for implementing the frameworks for FDI; the source country and firm of FDI and the sector and region of destination should be part of this training. However, the training modules for policy reforms and for strengthening the policy capacities should be organised by the organization which has the greatest role in acquisition, negotiation, and control of FDI. Capacity building for policy reforms takes time, and therefore such activities are a long-term process. Governments should mobilize and utilize all the existing policy capacities that may be inside or outside of ministries and departments. Such capacities are available in the private sector, at universities, research institutes, and think tanks, and with local and international NGOs and donor agencies. All phases of policy reforms matter – formulating objectives and targets, identifying sectoral and regional implications, designing implementation plans and supporting policy monitoring and evaluation, having in mind also the continual strengthening of governmental policy capabilities.

Second, policymakers in Africa which are dealing with foreign investors can learn systematically from studying their own economic history, but they can also learn from successful industrializers and their negotiated deals with multinational corporations. Phases of economic development in the own country give lessons about successes and failures, but also successful country cases in Africa and in other world regions should be reviewed. Policy learning is about collecting information and drawing and using lessons from policy failures and successes in the own country or in comparator countries. Such a method helps to avoid repeated policy failures and to consolidate policy successes; all this enhances policy effectiveness. African countries need to invest in learning about and drawing lessons from investment, technology and innovation, trade and regional integration, and mining/agricultural/industrial policies that have proved successful at promoting FDI-led inclusive and sustainable industrialization. These countries can look back to past periods of their own country, or to the development paths of neighbouring countries, or countries in other regions of the world. They can learn from successful FDI and industrial policies of countries in Asia, such as Singapore, South Korea, and Taiwan; but lessons can be taken also from many other countries which have designed and implemented progressive investment policies and acts. Learning about cases where FDI and industrial policies have not worked in the direction of inclusive and sustainable industrialization is also a useful approach to improve

the own country's regulations and acts. The learning process on investment and industrial policies that worked satisfactorily should inform the African policymakers at reforming FDI and industrial policies to achieve SDG 9 targets; these targets are a useful benchmark to develop a framework for new investment and industrial policies.

Third, policymakers and foreign investors in Africa can benefit from steady improvements of policymaking, law-enforcing, and regulating institutions. Improvements of these institutions will impact on the quality of foreign investment in African countries. To strengthen policy coherence and to promote the design as well as the implementation of appropriate policies on foreign investment, the co-ordination between different government ministries and between the many agencies of public and private sectors dealing with issues of foreign investment is critical. All these offices related to foreign investment need to understand the message of inclusive growth and sustainable development, and what this means for foreign investment. In this regard, inter-ministerial committees on inclusive growth and sustainable industrialization could be established by governments, with a strong representation of business associations and trade unions. Government agencies should invite a representation from the private sector and the civil society, so that local and international NGOs have a greater role to play. The committees would review the investment policies and investment acts and would also work for the implementation of the SDG 9 targets, to make sure that the FDI policies and the industrial policies align with the social, economic, and environmental sustainability goals. This is not an easy task as so many issues are raised - competition, finance, trade and technology policies, sector-specific characteristics, social affairs, and employment, etc.

Fourth, policymakers can stimulate foreign investors in Africa to link at mutual advantages to small and medium enterprises (SMEs) in urban and rural areas, and in formal and informal businesses. Weak links between foreign companies (particularly multinational companies) and SMEs are the source of obstacles to inclusive growth and sustainable industrialization in many African countries. Where such links exist, the mutual advantages are manifold: SMEs benefit from orders and contracts to supply produced parts, labour input, digital services, agricultural raw materials, transport services, and trading services, etc. Also, SMEs could benefit from finance, technology, and marketing competences. Foreign investors benefit from localization advantages of SMEs, low-cost supplies, social networks, and access to labour markets. To address this challenge African governments, associations of SMEs, and foreign investors should design and implement policies and programmes that stimulate foreign companies and SMEs to cooperate at a deep level. It is possible to engage foreign companies in mentoring domestic SMEs; this is a delicate task as power relations between these two groups are uneven. Such programmes should include the transfer of skills and of environmen-

tally-sound technologies from foreign companies to SMEs. This form of cooperation would be consistent with SDG 9.3 that is about linking SMEs to global value chains, to finance, and to markets. FDI can even play an important role in supporting start-up enterprises on the continent. Industrial parks exist which bring together affiliates of foreign companies and SMEs, as it is the case in South Africa.

Fifth, foreign investors can contribute much more to inclusive growth and to sustainable development if the public and private stakeholders address the key issues raised by the SDGs and particularly SDG 9. Looking at all the eight targets of SDG 9, we see that frameworks for the presence of FDI in African countries could be designed in such a way that small firms and local labour are employed at favourable terms. Informal and formal sector enterprises can also benefit from foreign investors when resource use is reorganized in the production system of the SMEs, so that working and living conditions, health and safety modalities, waste treatment and water use practices get improved by new technologies and social innovations. FDI can contribute to inclusive and sustainable industrialization in Africa and can promote the attainment of SDG 9 through optimized mixes of investment, industrial and innovation policies. It is obvious that such mixes are country- and sector-specific. New approaches are needed; traditional and/or conventional policy approaches to FDI are not suitable for inclusive and sustainable industrialization. Therefore, the SDGs bring a new platform of interlinkages and an innovative matrix for action to the policymakers. To design, to draft, and to implement appropriate policy mixes for FDI, African countries need innovative instruments for capacity-building and policy learning as well as new forms of institutional arrangements to transfer skills and ideas and to give incentives for change to public and private actors. Improving institutional coordination and policy coherence as well as promoting FDI-SMEs linkages are crucial for the attainment of SDG 9 and its targets in Africa. Informal sector enterprises can also become part of the networks, via platforms and digital instruments. The digital transformation in Africa can support capacity-building and policy learning and can help in the implementation of new policies with a focus on SDG 9.

References

- ACINTaD/Africa Centre For International Trade And Development, 2020, The Significance of African Continental Free Trade Area (AfCFTA) in the Attainment of SDGs; download: <http://www.acintad.org/the-significance-of-african-continental-free-trade-area-afcfta-in-the-attainment-of-sdgs/>
- Adegboye, Folasade Bosede/Romanus Osabohien/Felicia O. Olokoyo/Oluwatoyin Matthew/ and Oluwasogo Adediran, 2020, Institutional quality, foreign direct investment, and economic development in sub-Saharan Africa, in: *Humanities and Social Sciences Communications* 7, Article number: 38, 2020
- Akileswaran, Kartik/Antoine Huss/Dan Hymowitz/Jonathan Said, 2017, The Jobs Gap. Making inclusive growth work in Africa, Tony Blair Institute For Global Change, Effective Governance, London: Tony Blair Institute For Global Change, June 2017; download: https://institute.global/sites/default/files/inline-files/IGC_Jobs%20Gap_13.07.17x.pdf
- Asiedu, Elizabeth, 2004, Policy Reform and Foreign Direct Investment in Africa: Absolute Progress but Relative Decline, in.: *Development Policy Review*, 2004, 22 (1), pages 41-48; download: <https://library.fes.de/libalt/journals/swetsfulltext/18871098.pdf>
- Aust, Viktoria, Ana Iabel Morais, Inês Pinto, 2020. How does foreign direct investment contribute to Sustainable Development Goals? Evidence from African countries, in: *Journal of Cleaner Production*, Volume 245, 1 February 2020, 118823.
- Brookings, 2019, Figure of the week – Foreign direct investment in Africa; download: <https://www.brookings.edu/blog/africa-in-focus/2019/10/09/figure-of-the-week-for-foreign-direct-investment-in-africa/>, data based on: EY, Africa Attractiveness Report 2019
- EY, 2019, Africa Attractiveness Report 2019. How can bold action become everyday action? EY Attractiveness Program Africa, September 2019; download: https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/attractiveness/ey-africa-attractiveness-report-2019.pdf
- KPMG, What influences foreign direct investment into Africa, Insights into African Capital Markets, KPMG Services Proprietary Limited: 2016; download: <https://assets.kpmg/content/dam/kpmg/pdf/2016/07/What-influences-FDI-into-Africa.pdf>
- LDE CFIA, homepage, news, 15 April 2020; accessed 28 October 2020: <https://www.cfia.nl/news/innovation-during-the-crisis-how-covid-19-could-boost-frugal-health-technologies>
- LDE CFIA, homepage, news, 19 May 2020; accessed 28 October 2020: <https://www.cfia.nl/news/frugal-innovation-during-the-covid-19-crisis-examples-from-east-africa>
- LDE CFIA, 15 October 2020, First #GoFrugal Bulletin; download: <https://www.cfia.nl/news/publication-cfias-first-gofrugal-bulletin>

- LDE CFIA, homepage, news, LDE Centre for Frugal Innovation in Africa (CFIA), co-managed by Leiden University, Delft University of Technology, and Erasmus University Rotterdam; access: <https://www.cfia.nl/home>
- Levänen, Jarkko/Mokter Hossain/Tatu Lyytinen/Anne Hyvärinen/Sini Numminen/Minna Halme, 2015, Implications of Frugal Innovations on Sustainable Development: Evaluating Water and Energy Innovations, December 2015, in: *Sustainability* 8(1):4; download: https://www.researchgate.net/publication/288039514_Implications_of_Frugal_Innovations_on_Sustainable_Development_Evaluating_Water_and_Energy_Innovations
- Meagher, Kate, 2018, Cannibalizing the informal economy: Frugal innovation and economic inclusion in Africa, in: *European Journal of Development Research*, 30 (1), January 2018, pp. 17-33. Available in LSE Research Online: November 2017; download: <http://eprints.lse.ac.uk/84947/7/Frugal%20Innovation%20Cannibalizing%20the%20Informal%20Economy%20Final.pdf>
- Morisset, Jacques, 2000, Foreign Direct Investment in Africa, Policies Also Matter, Policy Research Working Paper 2481, The World Bank and The International Finance Corporation Foreign Investment Advisory Service, November 2010; download: https://openknowledge.worldbank.org/bitstream/handle/10986/19748/multi_page.pdf?sequence=1&isAllowed=y
- OECD/Organization for Economic Cooperation And Development, 2005, Regulatory Environment For Foreign Direct Investment, Preliminary inventory for selected African countries, NEPAD/OECD Investment Initiative, Roundtable: Investment for African Development: Making it Happen, Session 2, Paris: OECD Secretariat 2005; download: <https://www.oecd.org/investment/investmentfordevelopment/34783838.pdf>
- SDG Center for Africa and Sustainable Development Solutions Network, 2019, Africa SDG Index and Dashboards Report 2019, Kigali and New York: SDG Center for Africa and Sustainable Development Solutions Network; download: <https://www.sdgindex.org/reports/2019-africa-sdg-index-and-dashboards-report/>
- Tralac Blog, 23 February 2018, The African Continental Free Trade Area (AfCFTA) and the Sustainable Development Goals (SDGs), by Willemien Viljoen, tralac (Trade Law Centre); download: <https://www.tralac.org/blog/article/12762-the-african-continental-free-trade-area-afcfta-and-the-sustainable-development-goals-sdgs.html>
- UN/United Nations, ECOSOC/Economic and Social Council, 2020, Progress towards the Sustainable Development Goals, Report of the Secretary-General, 28 April 2020, 2020 Session, 25 July 2019 – 22 July 2020, E/2020/57: download: <https://un-docs.org/en/E/2020/57>
- UNCTAD/United Nations Conference On Trade And Development, 2020, Building And Utilizing Productive Capacities In Africa And The Least Developed Countries, A Holistic and Practical Guide, UNCTAD/ALDC/INF/2020/1, Geneva: UNCTAD 2020; download: https://unctad.org/system/files/official-document/aldcinf2020d1_en.pdf

- UNECA/United Nations Economic Commission for Africa homepage, “Regional Integration and Trade, Industrialization and Infrastructure”; accessed on 28 October 2020: <https://www.uneca.org/pages/industrialisation-and-infrastructure>
- UNIDO/United Nations Industrial Development Organization, 2019, Concept Note: High-Level Event On IDDA III, Promoting innovation and infrastructure development: A pathway for boosting manufacturing in the Fourth Industrial Revolution, New York: United Nations Headquarters, 25 September 2019; download: https://www.unido.org/sites/default/files/files/2019-09/Concept_Note_IDDA_III-25_September_2019_0.pdf
- UNIDO/United Nations Industrial Development Organization, 2019, Statistical Indicators Of Inclusive And Sustainable Industrialization, Biennial Progress Report 2019, Vienna: UNIDO 2019, download: https://www.unido.org/sites/default/files/files/2019-05/SDG_report_final.pdf; see also the UNIDO statement about the report: Progress Report on SDG 9 targets; download: <https://www.unido.org/news/progress-report-sdg-9-targets>
- WEF/World Economic Forum, 2018, Readiness for the Future of Production Report 2018, World Economic Forum: Cologny, Geneva, Switzerland; access for download: <https://www.weforum.org/reports/readiness-for-the-future-of-production-report-2018>
- World Bank, 2020, The African Continental Free Trade Area, Economic and Distributional Effects, Washington D. C.: IBRD/The World Bank, 2020; download: <https://openknowledge.worldbank.org/handle/10986/34139>

Developing Productive Capacities to Industrialize and Diversify African Economies and Achieve the Sustainable Development Goals

Patrick N. Osakwe*

1 Introduction

In January 2015, the African Heads of State and Government took a bold step to build the foundation for sustained growth by adopting the African Agenda 2063 as the long-term framework that will guide the continent's development in the next five decades. This was followed in December 2016 by the design of a domestication strategy aimed at ensuring that elements of the Agenda are incorporated into national plans, programmes and budgets. Efforts have also been made by the African Union (AU) to reconcile the African Agenda 2063 with global development initiatives, such as the Agenda 2030 and the Sustainable Development Goals (SDGs). A common feature of these recent national, continental and global development initiatives is the recognition of the fact that Africa's development challenges are largely structural in nature and need to be addressed to achieve better development outcomes than in the past. In this context, there is an emerging consensus that African countries and the least developed countries (LDCs) must develop productive capacities, transform the structure of their economies towards industrial activities, and diversify exports to lay a solid foundation for robust growth, employment creation, poverty alleviation and the achievement of the SDGs (Signé 2018). The international community has acknowledged the crucial role of structural transformation in the development process, by specifically dedicating goal 9 of the SDGs to promoting industrialization and related issues, such as infrastructure and innovation.¹

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¹ Goal 9 of the SDGs is entitled "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." It has eight industry-related targets and its inclusion in the SDGs is an acknowledgement of the crucial role of industrialization in the economic development process (see United Nations 2015). Goal 9 also recognizes the importance of innovation and infrastructure development as essential drivers and enablers of industrialization.

The development of productive capacities is needed to enhance the ability and capacity of African countries to create employment and fully exploit opportunities created in the multilateral trading system. Export diversification is important to reduce vulnerabilities to global shocks. And structural transformation is necessary to ensure that resources are used in areas where they are most productive and lay a robust foundation for sustained economic growth and employment creation. UNIDO (2016) provides several reasons why achieving industrial development is a necessity in Africa and in the LDCs: first, it is crucial for meeting goal 9 of the SDGs; second, it has high potential for job creation and can therefore contribute to poverty alleviation;² third, no country has been able to achieve sustained economic growth without effectively transforming the structure of the economy, mostly into production of manufactured goods; and fourth, it promotes inclusive development by providing decent jobs and government revenue for social investments.³

Despite the importance of first, productive capacities; second, export diversification; and third, structural transformation to the achievement of Africa's broad development goals and the SDGs, the three concepts are often discussed in isolation, and policies are often designed without a clear understanding of the linkages among them. This lacuna stems from the fact that there is no unified and comprehensive treatment of these issues or development processes in the extant economic literature. Against this background, this paper seeks to provide an understanding of the mechanisms through which the development of productive capacities can be linked to export diversification and structural transformation and how these processes of economic development can contribute to the goal of poverty alleviation in Africa. It also examines the role of infrastructure and innovation in developing productive capacities and offers policy recommendations on how productive capacities could be developed to support Africa's diversification and industrialization objectives and to enhance prospects for achieving the SDGs.

The rest of the paper is organized as follows: Section 2 introduces the concepts of productive capacities, export diversification and structural transformation and explains the linkages between these processes of economic development and how they contribute to the goal of poverty alleviation. Section 3 examines the drivers

² Cadot et al (2016) provide evidence indicating that the elasticity of poverty with respect to industrial value-added is negative and higher than the elasticity with respect to the agricultural and services sectors. In other words, industry is a stronger driver of poverty reduction than agriculture and services. The strong links between industrialization on the one hand and poverty and employment on the other hand suggests that achieving goal 9 of the SDGs will enhance the prospect of achieving other SDGs, especially goal 1 on poverty eradication, goal 8 on economic growth and decent work, and goal 10 on reducing inequality.

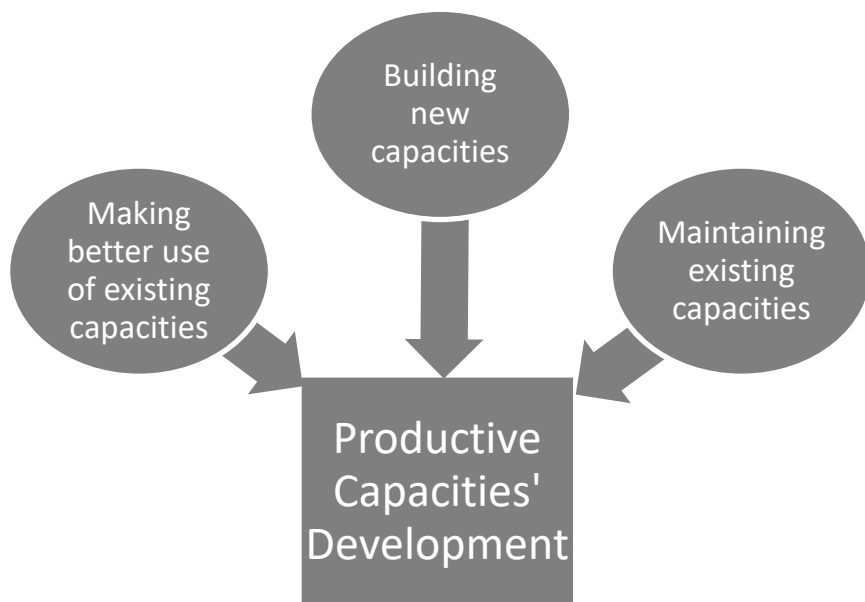
³ For a discussion of the industrialization challenge facing African countries and the role of commodities in the industrialization process see Morris and Fessehaie (2014).

of productive capacities' development with a focus on the role of infrastructure and technology and innovation. Section 4 identifies and discusses policies to develop productive capacities in such a way that Africa's Industrialization Agenda is supported. The final section (5) contains concluding remarks.

2 Productive capacities, diversification and transformation: concepts and linkages

The development of productive capacities is increasingly a hot topic in policy circles and in the literature on the economic development of Africa, of least developed countries, and of small island developing states. Yet, there is no consensus on how to define it and what it means. Over the past two decades, attempts have been made by several researchers to provide a definition of the concept. For example, UNIDO (2003) defines productive capacities as "the ability to produce goods that meet the quality requirements of present markets and to upgrade in order to tap future markets." UNCTAD (2006) refers to 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." While each of these definitions has a different focus and scope, they suggest that productive capacities refer to the potential output that can be efficiently and competitively produced in a country given its factors of production, state of technology, and the social and political environment within which production takes place. In this context, productive capacities describe the production possibility frontiers of an economy.

Part of the growing interest in productive capacities' development can be ascribed to the fact that it is regarded as a necessary condition for poor and vulnerable developing countries to better integrate into the global trading system, foster sustained growth, and meet the SDGs. Weak productive capacities have made it challenging for poor and vulnerable developing countries to fully exploit opportunities created in the global trading system and to reap the benefits of trade. In 1980 Africa accounted for about 11 percent of world population and 6 percent of world trade. In 2017 its share of world population rose to about 17 percent while its share of global trade fell to 2.3 percent. The very low and declining share of African countries in global trade is due largely to the fact that they lack productive capacities, particularly in manufacturing activities. In this regard, the development of productive capacities should be on the priority list of African policymakers to enhance their ability to fully exploit the potential of international trade for development and to enhance prospects for meeting the SDGs. There are three aspects to the development of productive capacities: building new capacities; making better use of existing capacities; and maintaining existing capacities (see figure 1).

Figure 1: Core dimensions or aspects of developing productive capacities

Source: Author

In the discourse on Africa's economic development, as well as in policy circles, the emphasis has always been on how to build new productive capacities. But building new capacities will make a significant contribution to the long-term goal of developing productive capacities only if it is combined with efforts to better utilize and maintain existing capacities. In the manufacturing sector, many plants in Africa operate well below installed capacity even though African governments are trying to build new capacities in support of their transformation agendas.⁴ Clearly, such incoherence in approach to developing productive capacities is not conducive to the realization of the long-term goal of productive transformation and it is an important factor in explaining the low productive capacities of African countries (see box 1). In this context, there is the need for a more coherent approach to developing productive capacities in Africa than in the past, with emphasis on building as well as utilizing and maintaining existing capacities.⁵

⁴ For instance, the enterprise surveys conducted by the World Bank indicate that in 2017 the average capacity utilization rate in Sierra Leone was 58 percent and in Ethiopia in 2015 it was 63.3 percent.

⁵ In principle, there are three main approaches that could be adopted to assess and monitor the development of productive capacities in African countries. The *first is an input-based*

Unlike the concept of productive capacities, there is clarity and good understanding in the literature of what structural transformation and diversification mean. In general, economists regard structural transformation as the movement of resources from low to high productivity activities both within and across sectors. The share of manufacturing value added (MVA) in gross domestic product (GDP) and MVA per capita are two widely used indicators or proxies for structural transformation in both policy discussions and in empirical work. MVA per capita represents the relative value of net manufacturing output to population size while the ratio of MVA to GDP captures the role of manufacturing in the economy (UNIDO 2017). Regarding the third concept, diversification, it generally refers to the production or export of a wide variety of goods and services. And it can be accomplished through introduction of new products to existing markets, increasing the quality of existing products, and finding new markets for existing products. Quantitatively, diversification is measured by using concentration indices such as the Herfindahl, Gini and Theil Indices, which for the most part capture inequality between product or export shares (Cadot, Carrère, and Strauss-Kahn, 2011).

Box 1: Assessing Productive Capacities in Africa

Although it is widely believed that developing productive capacities is imperative for Africa, there are no comprehensive quantitative studies measuring the state of productive capacities in the continent. To address this limitation, UNCTAD is developing a framework for measuring productive capacities in developing countries, and the findings of this study are expected to be published in 2020. That said, a recent Report by the World Economic Forum on readiness for the future of production can give us an idea of the state of production in some African economies (WEF 2018). The Report quantifies the structure of production in 100 economies in the world and discusses the drivers of production in these economies. Regarding the structure of production, its focus is on the economic complexity and scale of production. The scores for the structure of production ranges from 1 to 10 with the latter indicating a higher or stronger production structure. The findings of the Report suggest that African countries

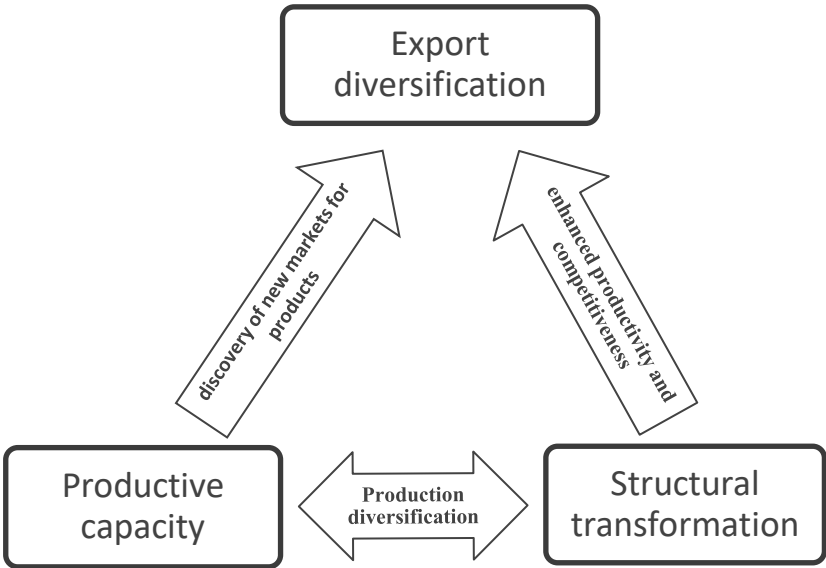
approach involving the aggregation of indicators on three core components or determinants of productive capacities' development, namely: productive resources, entrepreneurial capabilities, and production linkages in an economy (UNCTAD 2006). The *second approach* to assessing the development of productive capacities is an *outcome-based approach* involving determining a country's productive capacities by looking at the mix of products it already produces. In this framework, higher productive capacities are associated with the production of dynamic products and sophisticated goods (Freire 2013). The *third approach* is through a *benchmarking exercise*, involving computing the state of productive capacities in a relatively successful developing country and comparing actual capacity in an African country of interest with those of the representative country.

have a very limited production base when compared with countries in other continents. Among African countries in the sample, South Africa had the highest score (5.03) and global rank (45), reflecting the fact that it has a stronger production base than other African countries. Egypt, Tunisia, Mauritius and Morocco are the other African countries with a relatively strong production base while countries such as Zambia, Tanzania, Uganda and Ethiopia in contrast have a very low production base. The low scores of African countries are due to the cause that the scale of manufacturing activities in these economies tends to be small and that they produce goods that are not sophisticated. They also have relatively poor infrastructure, weak human capital, and very low innovation capabilities. But there is a considerable range in performance between African countries.

Source: Author

The economic literature recognizes the crucial importance of structural transformation and diversification in the development process. Kuznets (1973) pointed out that as an economy grows there is a movement of resources from agricultural to non-agricultural activities, resulting in a declining share of agriculture and an increasing share of manufacturing and services in output and employment. Herrendorf, Rogerson and Valentinyi (2014) also discussed the role of structural transformation in the growth process by using a multi-sector growth model. Regarding diversification, Imbs and Wacziarg (2003) have shown that export concentration and per capita income follow a U-shaped pattern in the development process. That means, as per capita income increases production and employment initially become more diversified but after a threshold level of income is reached, they become concentrated again. Until recently, the two processes of economic development (structural transformation and diversification) were treated independently of each other in economic models. Papageorgiou, Perez-Sebastian and Spatafora (2013) addressed this limitation by developing for the first time a framework that simultaneously incorporates both structural transformation and diversification in the growth process. However, their paper did not consider the issue of productive capacity development. The current paper complements existing work in the literature by identifying and discussing some mechanisms through which productive capacities' development could be linked to the concepts of export diversification and structural transformation (figure 2).

Figure 2: Mechanisms Linking Productive Capacities to Diversification and Structural Transformation



Source: Author

To understand the relationships depicted in figure 2, it is important to note that there are at least two ways that a developing country can enhance its productive capacities. The first is to increase capacity to produce existing (traditional) products and the second is to increase the capacity to produce new and more sophisticated products. When productive capacities are developed to increase output of existing products, it results in neither production diversification nor structural transformation of the economy. However, it can contribute to export diversification if it is accompanied by the creation or discovery of new markets for products. In other words, there is the possibility that the development of productive capacities could lead to export diversification even when it does not promote production diversification and structural transformation of the economy. In contrast, when productive capacities are developed to produce new and more sophisticated products, it will result in production diversification and hence structural transformation of the economy. In this context, the development of productive capacities leads to

structural transformation when it is accompanied by production diversification.⁶ Given the fact that structural transformation involves a movement of resources from low to high productivity activities, it enhances productivity and competitiveness of an economy, thereby contributing to export diversification. Therefore, when productive capacities are developed in a manner that results in production diversification, it can contribute to both structural transformation and export diversification of an economy.

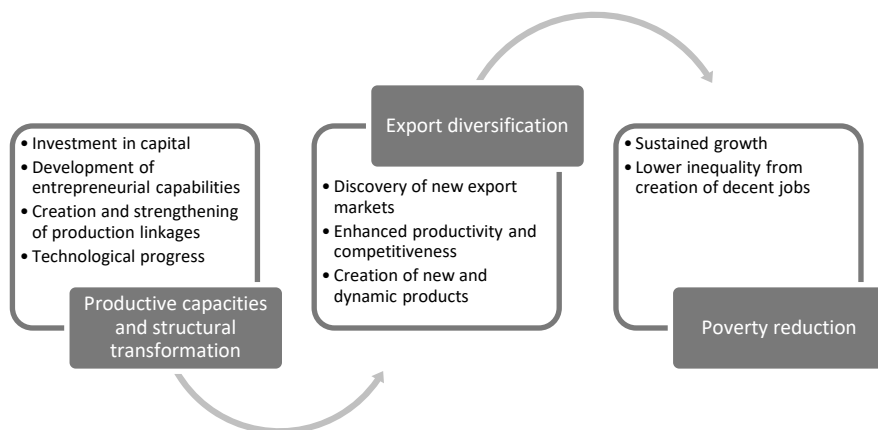
So far, I have examined how productive capacities affect structural transformation and export diversification. But the structural transformation of an economy also has an impact on the development of productive capacities. For instance, it has been argued that the transformation of the production structure of an economy towards manufacturing activities fosters technological innovation, which is a major driver of both the development of productive capacities and export diversification (Osakwe and Moussa 2018). Therefore, in the formulation and implementation phases of development policies there is the need for African policymakers to consider the mutually reinforcing relationships between productive capacity development on the one hand and structural transformation and export diversification on the other.

An interesting question to pose at this stage is how productive capacities, export diversification and structural transformation are linked to the national development goal of poverty alleviation? Figure 3 provides an illustrative mechanism linking these processes of development to poverty reduction, which is goal 1 of the SDGs.

It begins with a recognition that developing productive capacities and transforming the structure of an economy require: investments in capital (physical and human); the development of the entrepreneurial capabilities; creating and strengthening production linkages within an economy; and technological innovation. When these factors and processes are accompanied by either the discovery of new export markets for (existing and new) products or enhanced productivity and competitiveness, they foster export diversification. And, export diversification contributes to poverty reduction by affecting the two main sources of changes in poverty: growth and inequality. A key channel through which export diversification has a positive impact on growth is an increase in value-addition and productivity. Regarding the impact on inequality, it arises through the positive impact of export diversification on creation of decent jobs which reduces income gaps and hence inequality in the economy.

⁶ It should be noted that the capabilities of enterprises play a crucial role because they define the feasible set of products that could be produced in an economy and hence determine whether the development of productive capacities induces production diversification and structural transformation (Nubler 2014).

Figure 3: Linking Productive Capacities, Diversification and Structural Transformation to Poverty



Source: Author

3 Infrastructure, innovation and the development of productive capacities

This section discusses the factors that affect the development of productive capacities, with a more detailed examination of the roles of infrastructure and innovation since they are the focus of goal 9 of the SDGs and are critical to industrial development (see box 2).⁷ In general, there are several factors that determine the extent of development of productive capacities in an economy. A stable political and

⁷ Discussions on productive capacity tend to focus on how to develop capacities in the industrial sector. However, productive capacity can also be developed in agriculture through, for example, physical and human capital investments that enhance agricultural productivity. Therefore, it is important to note that, although productive capacity is often developed through industrial development, it is a much broader concept than industrial development.

macroeconomic policy environment is conducive to building and utilizing productive capacities and should be regarded as a necessary condition; however, this is not enough for developing the productive capacities in Africa. Political and macroeconomic instability increase the degree of uncertainty facing investors, thereby creating a disincentive to invest in productive transformation. While many African countries have made progress, over the past two decades, in maintaining political and macroeconomic stability, it remains a major challenge in several countries and needs to be addressed. Human capital is also an important driver of the development of productive capacities in a country; the size and quality of the workforce determine the kinds of productive activities that can be initiated and sustained in a country. They also affect a country's productivity and innovative capacity which in turn affect firms' competitiveness. The degree of entrepreneurship is another important factor in the development of productive capacities. Unfortunately, there are several deficits in Africa's enterprise structure (UNCTAD 2013) that make it challenging for domestic enterprises to thrive: these include the small and informal nature of African enterprises (which make it difficult for them to exploit economies of scale); weak inter-firm linkages (which prevent learning from others); low firm growth (so that employment growth and outreach to markets are limited); and the low innovative capacity of domestic firms (what limits the adaptation of products and processes to market and technology changes). One consequence of these deficits in Africa's enterprise structure is that most domestic firms cannot compete in export markets and this has had a deleterious effect on the development of productive capacities and industrialization.

Box 2: Industrial Development in Ethiopia: Role of Infrastructure and Innovation

Ethiopia is one of the African countries that have taken bold steps in the past two decades to build productive capacities by making industrial development one of the key pillars of its development strategies. It is a least developed country and differs from many African countries in the sense that it is an agriculturally dependent country but is not rich in mineral resources. In 2010 the government shifted from a development strategy based on improving agricultural productivity to a growth and transformation plan with an emphasis on manufacturing development. This shift in development strategy has led to some positive results. For instance, the average growth of real manufacturing value added (MVA) increased from 9.8 percent in 2005-2010 to 13.6 percent in the period 2010-2015. Despite the progress that has been made in the past decade, the level of manufacturing development is still very low relative to other African countries, and manufacturing still plays a very limited role in the economy, as evidenced by the fact that over the past decade the share of manufacturing value added in GDP has hovered around 5 percent. Weak infrastructure and

innovation have contributed to the poor performance of Ethiopia in terms of industrial development. The Africa Infrastructure Development Index (AIDI) produced by the African Development Bank (AfDB) indicates that, in the period 2003-2018, Ethiopia was one of the countries with very low levels of infrastructure in Africa. It is also one of the African countries with very low levels of innovation. UNCTAD (2015) stresses the need to boost innovation capacities and to enhance coordination between innovation and industrial policies in Ethiopia. There is also the need to strengthen infrastructure development to accelerate industrialization.

Source: Author

Another factor that affects the development of productive capacities is the level of domestic demand (Signé 2018). In many African countries the size of the domestic market is low because of low income levels. Given this constraint, domestic firms have no incentives to expand productive capacities except they are either competitive to access export markets or there is an increase in domestic income levels to the effect of an increasing purchasing power of households. The domestic demand constraint is particularly binding in the case of production of manufactured goods where African firms face serious challenges competing in export markets, and so must rely on the strength of their domestic markets to survive or stay in business. In this context, boosting domestic income and enhancing export competitiveness of domestic firms must be on the priority list of African governments if they want to develop and enhance productive capacities, particularly in the manufacturing sector.

Infrastructure and the development of productive capacities

The state of infrastructure development in a country has an impact on the capacity of a country to produce and to export goods. Nubler and Ernst (2013) argue that the availability of good infrastructure services (in areas such as transport, energy, telecommunications, water, etc.) results in improved connectivity and a reduction in production and trade costs. These reductions in transaction costs enhance firms' competitiveness, foster international trade and investment, and facilitate adoption of improved technologies. In this regard, infrastructure development increases productivity and growth and contributes to industrial development.

It is well-known that many African countries have very low levels of energy, transport, water and telecommunications infrastructure (AfDB 2018). But the infrastructure challenge facing African enterprises is not only about quantity; it is also about the poor quality of infrastructure, the high cost of infrastructure services, and the generally low access to available infrastructure. The poor state of productive infrastructure in Africa, particularly in the energy and transport sectors,

has been a major obstacle to the development of productive capacities, and to industrialization and growth in Africa. Calderon et al. (2018) provide evidence indicating that in terms of the quantity, quality and access to infrastructure, Sub-Saharan Africa (SSA) ranks behind other developing country regions. For instance, SSA has less than a third of the electricity-generating capacity of South Asia and less than one-tenth of that of Latin America and the Caribbean. Also, the share of paved roads in total roads in SSA is 16 percent compared to 53 percent in South Asia and 24 percent in Latin America and the Caribbean. Interestingly, empirical evidence suggests that the potential growth benefit from closing Africa's infrastructure gap is large. For instance, if SSA increases both the quantity and quality of infrastructure to match the median of the world, its growth per capita will increase by about 1.7 percentage points per year (Calderon et al, 2018). Within Africa, there is a wide variation in the levels of infrastructure development across countries.

The African Development Bank (AfDB) has developed the Africa Infrastructure Development Index (AIDI) to monitor the state of infrastructure development in the continent. The index lies between 0 and 100 with higher values reflecting higher levels of infrastructure development. The average annual values for the index over the period 2003-2018 show that Seychelles, Libya, Egypt, South Africa, Mauritius, Tunisia, Algeria and Morocco have relatively better levels of infrastructure development than other countries on the continent. The index also suggests that, while the level of infrastructure development in Africa is relatively low, many African countries made significant progress in infrastructure development between 2003 and 2018. For instance, in Cabo Verde the index rose from 24.9 to 48 between 2003 and 2018. In Kenya, it rose from 7.9 to 25.6, and in Swaziland it rose from 13.2 to 25.8 over the same period.

A key reason for the poor state of infrastructure development in Africa is the low level of investment in the sector, particularly by the private sector. As shown in table 1, the private sector accounts for an insignificant percentage of financing for Africa's infrastructure. For instance, in 2017 it accounted for only 2.8 percent of total African infrastructure financing compared to 42.1 percent by African national governments, 24.1 percent by members of the Infrastructure Consortium for Africa (ICA), and 23.8 percent by China, leaving only 7.2 percent for others (Arab financiers and other bilateral/multilateral financiers). Some of the reasons why there has been very limited investment, particularly from the private sector, in African infrastructure include: the lack of strong legal, regulatory and institutional frameworks, poor governance, and weaknesses in infrastructure planning, project preparation and implementation. While the lack of funds from the private sector is widely regarded as a constraint on developing African infrastructure, some have

argued that a more binding constraint is the lack of bankable projects (ICA 2018).⁸ Collier (2014) argues that one of the reasons why it is challenging to attract international private finance to African infrastructure is that projects tend to be small, costly to prepare, and hard to value. They also involve high risks because of the possibility of expropriation of assets by African governments. In this regard, there is the need to de-risk African infrastructure projects through, for example, subsidized risk insurance, re-bundling of risks, and use of commitment technologies such as that implicit in the political risk insurance provided by the World Bank under the MIGA/Multilateral Investment Guarantee Agency (Collier 2014).

Table 1: Sources of African infrastructure financing 2012-17

	Average 2012-16, Value (\$ billion)	2017	
		Value (\$ billion)	Share (%)
African national governments	30.1	34.3	42.1
Infrastructure Consortium for Africa (ICA) members	20.2	19.7	24.1
China	11.5	19.4	23.8
Arab Coordination Group (ACG)	4.4	3	3.7
Other bilateral/multilateral financiers	2.5	2.9	3.5
Private sector	6.2	2.3	2.8
Total	75	81.6	100

Sources: compiled based on data from ICA 2018 and AfDB 2018.

Over the past decade, attempts have been made to estimate Africa's infrastructure financing needs with a view to determining the continent's financing gap. For instance, Foster and Briceno-Garmendia (2010) estimated the continent's financing need to be \$93 billion per year and the financing gap as \$48 billion per year. More recent estimates by the African Development Bank (AfDB) suggest that the continent's financing needs are between \$130 - \$170 billion per year. Given that the average annual financial commitment to Africa's infrastructure over the period 2012-17 was about \$77 billion, it has been estimated that the infrastructure financing gap is between \$53 - \$93 billion per year.⁹ Table 2 presents a breakdown of Africa's infrastructure financial need and gap by sector. It shows that the Water and Sanitation sector has the highest financing gap, which is not surprising in the

⁸ AfDB (2018) defines a "bankable project" as one that provides clear incentives for lenders to consider financing it.

⁹ Note that the financing gap in table 2 is lower than the estimate presented in the African Economic Outlook 2018 (AfDB 2018) because that publication used the average financing commitments for 2012-16 while the number in table 2 is based on average commitments for 2012-17 which is much higher than those for 2012-16.

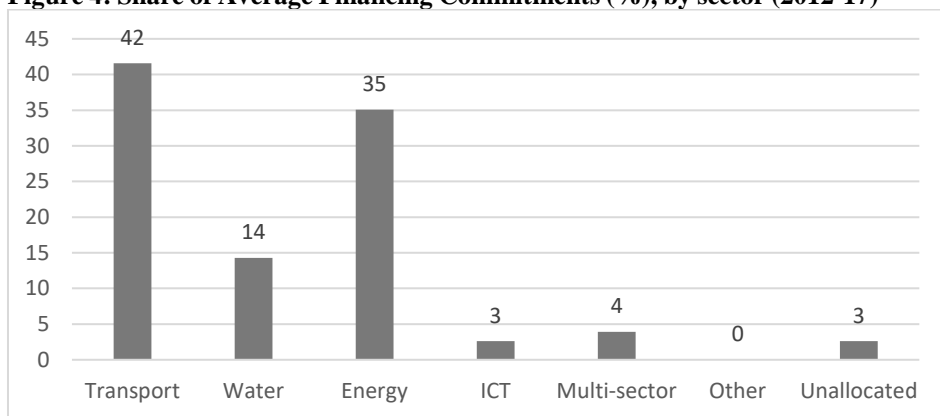
light of the fact that it accounted for only 14 percent of the financing commitments to Africa's infrastructure in the period 2012-17, while the transport and energy sectors accounted for 42 and 35 percent respectively (figure 4).

Table 2: African infrastructure financing needs and gaps, by sector (\$ billion)

	Financing need (low)	Financial need (high)	Average financing commitments (2012-17)	Minimum financing gap	Maximum financial gap
Transport	35	47	32	3	15
Water	56	66	11	45	55
Energy	35	50	27	8	23
ICT	4	7	2	2	5
Multi-sector	-	-	3	-3	-3
Other	-	-	0	0	0
Unallocated	-	-	2	-2	-2
Total	130	170	77	53	93

Source: ICA 2018

Figure 4: Share of Average Financing Commitments (%), by sector (2012-17)



Source: compiled based on data in ICA 2018.

It is interesting to note the low level of ICT financing need and commitment, especially when considering the pace of digital transformation in Africa.

Technology, innovation and the development of productive capacities

Technology and innovation will play a crucial role in developing productive capacities and transforming African economies towards industrial activities. The generation, dissemination and application of science and technical knowledge provides countries access to new techniques of production and will contribute to an increase in the competitiveness and productivity of domestic enterprises, thereby facilitating the shift of resources from low to high productivity activities (Osakwe and Moussa 2018). African leaders and policymakers have recognized this crucial role of technology and innovation in the development process by launching several initiatives at the national, regional and continental levels.

At the national level, many African countries have integrated Science, Technology and Innovation (STI) policies into their national development plans and strategies. For instance, STI has been explicitly incorporated as an important pillar in Kenya's Vision 2030. In Rwanda the role of STI in supporting the development process was acknowledged in the Vision 2020. And in Tanzania STI is regarded as one of the means to achieve its Vision 2025 of transforming the country from low to middle-income status. At the regional level, several regional economic communities, such as the Southern African Development Community (SADC), the Economic Community of West African States (ECOWAS) and the East African Community (EAC), have also developed protocols or policy frameworks on STI (ACBF 2017). There are also initiatives by African leaders at the continental level, such as Africa's Science and Technology Consolidated Plan of Action for the period 2005-2014, adopted by the African Union in 2005, and the Science, Technology and Innovation Strategy for Africa (STISA), which covers the period 2014-2024 and was adopted at the 23rd African Union Summit in June 2014 (Osakwe and Moussa 2018).

Notwithstanding the high number of STI initiatives adopted by African governments over the past few decades, many African countries still have very low levels of STI relative to countries in other continents and relative to what would be needed to boost productive capacities and to foster industrial development. To get an idea of the state of innovation in African countries relative to countries in other continents, we use the global innovation index (GII) prepared by Cornell University, INSEAD, and WIPO (2018). It measures the state of innovation in 126 countries in 2018. The index is a simple average of indices of innovation input and innovation output and ranges from 0 to 100, with higher values indicating higher levels of innovation.¹⁰ The innovation efficiency ratio uses the two indices and is

¹⁰ Innovation input is captured by factors that drive innovative activities in an economy, such as: institutions, human capital and research, infrastructure, market sophistication, the level of business sophistication as reflected in innovation linkages, and the capacity to ab-

defined as innovation output divided by innovation input. In the 2018 index, no African country was on the list of the top 40 ranked countries in the world, which reflects the generally low level of innovation in Africa relative to other continents. Among African countries, South Africa had the highest innovation score with a global rank of 58, followed by Tunisia (66) and Mauritius (75). With a global rank of 125, Togo had the lowest score among the 28 African countries included in the sample (table 3). But the innovation efficiency ratio for South Africa is not favourable, and ranks lower than that of Tunisia, Kenya and Tanzania, but is higher than that of Mauritius.

One of the interesting findings of the GII 2018 is that although Africa has a low level of innovation, the region has a relatively high innovation momentum in the sense that it has more countries on the list of “innovation achievers” (measuring the positive change of scores over the years) than any other region in the world. More importantly, out of the 20 countries on the list in 2018, seven were African countries (Kenya, Malawi, Mozambique, Rwanda, Madagascar, South Africa and Tunisia). Kenya has been on the list for the past eight years and Malawi, Mozambique and Rwanda have been on it since 2012. Another interesting finding of the GII 2018 is that a country that has higher innovation scores does not necessarily have a higher innovation efficiency, which measures the extent to which innovation inputs are effectively translated to innovation outputs. For instance, South Africa has higher innovation scores than Kenya, yet the latter has a higher innovation efficiency ratio than the former (table 3). Similarly, Egypt has lower innovation scores than Mauritius, yet it has a higher innovation efficiency ratio than Mauritius.

The low level of innovation in Africa relative to other continents and the fact that African countries have not been able to effectively use STI policies in support of building productive capacities and structural transformation of their economies are due in part to low investment in STI capacity development at the national level, which has resulted in weak institutional capacities and inadequate capacity to formulate and to implement coherent policies (ACBF 2017). But it is also a consequence of the weak systems of innovation in African countries which has not facilitated meaningful and purposeful interaction amongst key economic actors. Firm survival and growth are affected by interdependences and interactions with economic agents, such as universities and research institutes, labour exchanges, standard setting bodies, state-owned enterprises, export support agencies, and finance institutions. They are also affected by inter-firm flows of knowledge gained through, for example, joint ventures, sub-contracting and supplier-customer relations (Banji 2006).

sorb and diffuse knowledge. Innovation output reflects the outcome of innovative activities and is captured by two indicators: knowledge and technology outputs, and creative outputs.

Table 3: African Countries in the Global Innovation Index 2018.

Economy	Score	Rank	Innovation efficiency ratio
South Africa	35.1	58	0.55
Tunisia	32.9	66	0.63
Mauritius	31.3	75	0.47
Morocco	31.1	76	0.61
Kenya	31.1	78	0.69
Botswana	28.2	91	0.39
Tanzania, United Republic of	28.1	92	0.72
Namibia	28	93	0.41
Egypt	27.2	95	0.66
Rwanda	26.5	99	0.31
Senegal	26.5	100	0.6
Uganda	25.3	103	0.45
Madagascar	24.8	106	0.69
Ghana	24.5	107	0.51
Algeria	23.9	110	0.42
Cameroon	23.8	111	0.58
Mali	23.3	112	0.59
Zimbabwe	23.1	113	0.6
Malawi	23.1	114	0.52
Mozambique	23.1	115	0.52
Nigeria	22.4	118	0.5
Guinea	20.7	119	0.47
Zambia	20.7	120	0.45
Benin	20.6	121	0.35
Niger	20.6	122	0.36
Côte d'Ivoire	20	123	0.4
Burkina Faso	18.9	124	0.28
Togo	18.9	125	0.36
Note: The innovation efficiency ratio is defined as innovation output divided by innovation input.			
Source: compiled based on data from Cornell University, INSEAD, and WIPO (2018).			

In most African countries there is very weak interaction between small and large firms and between firms and governments which has created an environment in which the private sector does not play an active role in industrial policymaking. In addition, the poor coordination of knowledge generation and production activities in African countries has led to universities producing graduates without skills required by industry (Banji 2006). In this regard, there is the need for African gov-

ernments to strengthen efforts to better link research and development (R&D) institutions with the productive sectors of the economy to ensure that their activities respond to the needs of industry.

Institutions are key to the innovative activities of firms and the translation of innovation inputs into innovation output. And they are much more than formal organizations, such as universities, firms, finance houses, and state agencies. They provide rules governing interactions among agents and enforce contractual obligations, thereby creating a stable and conducive environment for collaboration between firms and for innovation. Banji (2006) argues that the reason why traditional STI policies in Africa did not have the expected impact on innovation and industrial development is that they assumed away the role of institutions. Firms innovate through continuous learning and interaction with other economic agents. They also innovate when there are appropriate local institutions to support the process of learning and knowledge acquisition. Yet, traditional technology policies in Africa were developed as if they are divorced from the institutional structures that they are embedded in. Furthermore, technology policies in Africa focused on R&D, import of machinery and equipment, and training and apprenticeships (learning by doing) as the main sources of knowledge and skills acquisition by firms. However, firms' learning could also arise from learning by using and learning by interacting (Banji 2006). In this context, there is the need for African governments to rethink their approach to the design and implementation of technology policies to ensure that they incorporate the diverse sources of learning and the pivotal role of institutions in the generation, use and diffusion of innovation.

Another factor that has contributed to the low development impact of STI in Africa is "brain drain" which has led to the loss of experts in science, technology, engineering and mathematics (STEM) with critical skills needed for productive capacity development and transformation (ACBF 2017). A recent study indicates that migrants from sub-Saharan Africa to the Organization for Economic Cooperation and Development (OECD) countries generally have better education than those from other developing regions. Furthermore, it is projected that between 2013 and 2050 the number of migrants from SSA to OECD countries will increase from 7 million to 34 million (IMF 2016). While migration also brings potential benefits to Africa, in the form of remittances, the welfare costs in the form of the loss of highly skilled manpower has dire consequences for innovation, the development of productive capacities and the transformation of African economies.

4 Policy Recommendations on how to develop Productive Capacities to support Africa's Industrialization Agenda

A key message from the previous sections of this paper is that the nature and pattern of productive capacity development matter in an economy. When productive capacities are developed to increase the output of existing (traditional) products rather than the production of new, dynamic or sophisticated products, it will not foster structural transformation of the economy, particularly into manufactured products. In this context, there is the need for African policymakers to adopt the right approach to developing productive capacities to ensure that they achieve their industrialization and transformation agenda. The rest of the paper discusses policies that African policymakers should consider adopting to make the development of productive capacities consistent with the objective of industrialization and transformation.

Use industrial policy strategically to gear productive capacities' development towards achieving the goal of industrialization and transformation in Africa

In most economies, the bulk of production of and trade in goods is done by the private sector. But the state plays an important role in redirecting production into activities and sectors that are dynamic, sophisticated and ready to generate products with higher value addition. Throughout history, especially in the advanced and emerging economies, the state has successfully played this transformative role through the judicious exercise of industrial policy (UNCTAD and UNIDO 2011). However, in Africa the state has been unable to effectively use industrial policy in support of industrialization and transformation of the production and export structures of economies. Some of the reasons for the ineffectiveness of past industrial policies in Africa include: government provision of support to domestic firms without challenging them to perform; low interaction between the state and the private sector; incoherence between industrial policies and other macroeconomic policies; a focus on import substitution and neglect of export promotion; and high production and trade costs due to weak infrastructure and burdensome regulation. African policymakers have recognized the mistakes of past industrial policies and have in the past few decades started to adopt a more strategic and pragmatic approach to industrial policy which has led to positive outcomes in some economies. For instance, industrial policy has contributed to the development of the leather, textile and garment, cement and floriculture sectors in Ethiopia. It also played an important role in the development of ICT-based services and tourism in Rwanda (UNECA 2016). A key industrial policy instrument that African policymakers could deploy to build productive capacities and to industrialize their economies is the establishment of special economic zones for targeted industrial activities. Another approach is to make monetary and macroeconomic policies consistent with the goal of industrialization and transformation by ensuring that domestic interest

rates are not prohibitive and that local firms have access to long term capital for productive investment.

Promote entrepreneurship and enhance competitiveness of domestic enterprises

The promotion of entrepreneurship is important in developing a vibrant and dynamic domestic private sector that can support the building of productive capacities and accelerating the structural transformation process. In Africa, the level of entrepreneurship is quite low, which limits the continent's industrial potential and capacity to produce goods generally. So far, efforts to address this problem have been mostly focussed on the constraints that are external to firms: weak infrastructure, skills shortage, small size of African economies and markets, and regulatory barriers. However, firms also face internal constraints that affect their survival and growth, such as: the size of firms, the capacity to learn and to innovate, the managerial capabilities, the funding level, the degree of customer orientation, the networking ability, and the efficiency of supply chains (Page 2012; UNCTAD 2018). In this regard, an effective policy package to promote entrepreneurship must address both the external and the internal constraints facing domestic firms.

One of the issues that African policymakers must address to promote entrepreneurship is to improve the quality of human capital. The stock and quality of human capital affect the productivity of firms and their ability to absorb technologies as well as to innovate. Against this backdrop, African policymakers should increase investments in education, especially in the areas of science, technology, engineering and mathematics (STEM). In doing so, however, they should redesign the educational curriculum and gear it towards skills acquisition to ensure that students graduate with skills that can respond to the demands of domestic industries (Signé 2018). There is also the need to promote vocational and on-the-job training and to incorporate it into the formal education system. A key reason why existing Technical and Vocational Education and Training (TVET) schemes in African countries have not had the desired impact on skills acquisition is that they are regarded as schemes designed for students who do not have the intellectual capacity to go through the formal education system (that is, non-achievers). As a result of this stigma, the youths are not motivated to participate in TVET programmes, and governments also do not accord them the attention they deserve. It would be desirable for African policymakers to integrate the TVET programme into the formal education system to remove the stigma attached to it and to increase its appeal to the youths.

Another measure that African governments could take to promote entrepreneurship is to strengthen infrastructure development at the national level, particularly in the area of energy and transport. This will permit domestic enterprises to reduce production costs significantly and to enhance their international competitiveness. Strengthening infrastructure development in Africa requires increasing

the quantity and quality of infrastructure and improving access to existing infrastructure services. It also requires creating political, regulatory and legislative environments being conducive to private sector participation in infrastructure development. It is estimated that insurance companies, pension funds, sovereign wealth funds and other institutional investors have about \$100 trillion dollars in assets that could potentially be deployed to finance investments in African infrastructure (AfDB 2018). Yet the private sector currently plays a very limited role in the financing of African infrastructure, accounting only for about 2.8 percent in 2017. Blended finance is increasingly discussed as an innovative mechanism to leverage private finance for infrastructure investment in Africa. It involves the use of development resources to alter the risk-return profile of an investment to attract commercial finance (OECD 2018). Given the high risks associated with private investment in Africa it is a potentially useful instrument for attracting commercial finance. But it must be deployed in a holistic manner for it to play a transformative role on the continent. That is, the focus should not only be on boosting the amount of private investment but also on enhancing the efficiency of existing investments and ensuring that new investments go to priority sectors of the economy, especially to manufacturing activities. Furthermore, the effectiveness of blended finance in attracting significant commercial capital will depend on whether appropriate measures are taken to lift the binding constraints to private investment in developing countries. These include low expected returns due to high risks, challenging investment climates, weakness of domestic financial markets, and weak investor-understanding of available investment opportunities due to knowledge and capacity gaps (OECD and WEF 2015).

In addition to exploiting opportunities created by blended finance, African governments can also generate substantial resources to finance infrastructure projects by stemming illicit financial flows (IFF). It is estimated that the continent loses about \$50 billion per year as a result of IFF, and a large part of the loss is due to trade-related commercial activities of multinational corporations and organized crime. To curtail IFF and to release development resources for infrastructure projects, African governments should strengthen their legal and regulatory frameworks, improve tax and customs administration, enhance supervision of banks and non-bank financial institutions, and promote good governance. At the international level, there is the need for more international cooperation on tax matters, adoption of country-by-country accounting and reporting standards for multinational corporations and making international transfers more transparent (UNCTAD 2016).

Most explanations for the low investment in African infrastructure tend to focus on the availability of finance. ICA (2018) argues that the lack of bankable projects rather than the availability of resources is the most binding constraint and so this factor needs to be addressed. Because of the long-time horizons as well as the high risks and costs associated with infrastructure projects, private investors

are generally reluctant to invest in the preparation of infrastructure projects. African governments also face serious challenges in preparing such projects because of weak administrative capacities and financing constraints. Against this backdrop, there is the need for donors and international organizations to strengthen capacity-building support for the preparation of infrastructure projects to enhance their attractiveness to private investors. There is also the need for African governments to strengthen the legal, regulatory and institutional frameworks to incentivize the private sector to invest in African infrastructure.

In addition to the policies discussed above, there are other actions that African governments could take to promote entrepreneurship, such as: reducing bureaucratic red tape and corruption to reduce trade and transaction costs; providing support to entrepreneurs to connect them to potential investors; assisting entrepreneurs to better understand potential markets and how to adapt to changes in these markets; and strengthening export promotion activities because of the positive impact it can have on the firms' performance.¹¹

Enhance support for technology and innovation

Technology and innovation are key drivers of productive capacity development and industrialization in an economy and so efforts to foster these goals in Africa must include a strategy to promote technological innovation. UNCTAD (2015) suggests that African countries have not been able to effectively harness innovation policies for industrial development, due largely to: policy incoherence both in design and implementation; weak monitoring and evaluation systems; gaps in policymaking structures; and lack of integration of private sector perspectives in policy frameworks and strategies. Osakwe and Moussa (2018) identified some policy measures that African policymakers should consider adopting to foster technology and innovation in support of Africa's transformation agenda. First is the development of coherent STI policies which require the coordination of STI policies with other development policies, particularly industrial development and trade policies. Second is the need to increase domestic expenditure on R&D in African countries to the 1 percent (of GDP) target set by the African Union. Third is the importance of strengthening linkages between research institutes and universities on the one side and the domestic private sector on the other side to ensure that graduates of these institutions have the skills required by domestic enterprises. Fourth is the need to promote innovation at the enterprise level through provision of good infrastructure, reduction of regulatory barriers facing enterprises, support for training programmes at the firm level, and promotion of clusters and technology parks. Finally, there is the need to increase awareness of intellectual property rights in

¹¹ There is evidence that the process of exporting increases productivity of African firms (Page 2012).

Africa to foster technology and innovation, especially by the youths and the young entrepreneurs.

Fully exploit the potential of regional cooperation for development

Given the small size of African economies and the enormity of their investment needs, regional cooperation has a crucial role to play in fostering productive capacity development and industrialization in the continent. The integration of labour, goods, and capital will permit African countries to facilitate migration of skilled workers within the continent, to relax domestic demand constraints through increasing market size, to better reap the benefits of economies of scale, and to generate agglomeration economies. Furthermore, the harmonization of policies and the reduction of trade barriers resulting from closer regional integration will reduce trade costs for African enterprises and make them much more competitive at the global level. Another important channel through which regional cooperation could promote productive capacity development and industrialization in Africa is the development of cross-border infrastructure, especially in the energy, transport, and telecommunication sectors. African policymakers are aware of the need to exploit the potential of regional integration for infrastructure development as evidenced by the fact that over the past decade they have strengthened efforts to collaborate on infrastructure projects. In July 2010, the Programme for Infrastructure Development in Africa (PIDA) was launched by African Heads of State and Government with the goal of connecting, integrating and transforming the continent. PIDA was subsequently approved by African leaders in January 2012 with a focus on projects covering the energy, transport, telecommunications and trans-boundary water sectors. It provides a strategic framework and a priority action plan for addressing the continent's infrastructure needs. While some progress has been made in the implementation of PIDA, as at November 2018, only about 32 percent of the 400 projects in the priority action plan were either under construction or operational (Mayaki 2018). In this context, there is the need for African policymakers to redouble efforts to enhance implementation of PIDA to increase prospects for achieving their transformation agenda.

Improve effectiveness and efficiency of supply chains or networks

A major challenge that African countries face in developing productive capacities and integrating into the global trading system is the existence of weak, inefficient and poorly integrated supply chains, which introduces uncertainty and instability in the supply of raw materials and other key inputs used in the production process (Signé 2018). As a result of these defects in the supply chains, African countries generally have low capacity utilization rates in manufacturing, both relative to optimal capacity and to the rates that are observed in other developing countries. Some measures that African governments and firms could take to address supply chain challenges include: investing in supply chain infrastructure development,

providing training and skills development to the workforce, reducing regulatory barriers to trade, and strengthening the vertical integration of operations by firms to reduce the unpredictability of supplies.

Create political and macroeconomic environments conducive to production and transformation

Macroeconomic stability is crucial for attracting the level and the kinds of investment needed for developing productive capacities and for industrializing African economies. Therefore, African governments are encouraged to promote macroeconomic stability through good economic management, avoiding policy reversals, and reducing uncertainty in macroeconomic policies. It is important to note that although economic factors play a key role in promoting productive capacity development and industrialization, they do not operate in a vacuum. They are effective when they are implemented in a stable political environment. Unfortunately, political instability is a re-occurring feature in many African countries, and this has had a negative impact on peace and security on the continent. While there has been significant progress made in maintaining political stability on the continent, significant challenges remain. In this context, there is the need for African governments to strengthen efforts to maintain political stability, and a necessary condition for that is it to make the growth and development process more inclusive than in the past and to promote ownership of the process and outcomes.

Make regional and international policies consistent with the goal of productive capacity development and transformation of African economies

African countries operate in a rapidly globalizing world which means that the actions they take to foster productive capacity development and industrialization are affected by policies and developments at the regional and global levels. In this context, there is the need for integration of national, regional, and international policies to ensure that there is policy coherence and that they are used in support of the goal of productive capacities' development. At the national level, there is the need to ensure that the three pillars of productive capacity development - building, utilizing and maintaining capacities - are integrated into policy design, implementation, and monitoring and evaluation. Regional policies should also be made consistent with the goals of developing productive capacities and transforming African economies. The existence of overlapping memberships of regional economic communities in Africa has had a negative impact on productive capacity development and industrialization by making it challenging to harmonize trade policies at the regional level and gear them towards the goal of productive transformation. It has also impeded efforts to eliminate regional trade barriers, enhance the competitiveness of African firms, and facilitate their integration into regional and global value-chains. At the global level, there is also the need for trade, aid, investment and environmental policies to be designed and implemented in such a

way that they are supportive of the goals of productive capacity development and transformation of African economies.¹²

5 Conclusions

The conventional wisdom in the development literature is that African countries will enhance prospects for meeting their national development objectives and achieve regional and global development goals (such as the SDGs) by developing productive capacities, transforming production structures toward manufactured goods, and diversifying exports. Despite the importance of these processes of economic development, there is very limited understanding of the linkages between the concepts and how they relate to the goal of poverty alleviation. This paper identified and examined some mechanisms through which the development of productive capacities can be linked to the processes of structural transformation and exports diversification and how they can contribute to the goal of poverty reduction in Africa. It also examined the role of infrastructure and technology and innovation in developing productive capacities and offered policy recommendations on how productive capacities could be promoted to support Africa's industrialization agenda and enhance prospects for achieving the SDGs. SDG 9 with its three pillars infrastructure, innovation and industrialization is therefore of great relevance for Africa's structural transformation agenda. It is necessary to look in Africa beyond the Agenda 2030 towards the Vision 2063¹³.

References

- ACBF (2017). *Africa Capacity Report 2017: Building Capacity in Science, Technology and Innovation for Africa's Transformation*. Harare: African Capacity Building Foundation (ACBF).
- AfDB (2018). *African Economic Outlook 2018*. Abidjan: African Development Bank (AfDB).
- Banji, O. (2006). *Learning to Compete in African Industry: Institutions and Technology in Development*. Aldershot: Ashgate.

¹² For instance, in the formulation and implementation of the Millennium Development Goals (MDGs), there was an emphasis by the international development partners on the social sectors, which led to a reduction in the share of aid to the productive sectors of the economy with serious negative consequences for the development of productive capacities and economic transformation of African economies.

¹³ See on details of the Agenda 2063: <https://au.int/en/agenda2063/overview>

- Cadot, O., de Melo, J., Plane, P., Wagner, L., and Woldemichael, M. (2016). Industrialization and Structural Change: Can Sub-Saharan Africa Develop without Factories. FERDI (Fondation Pour Les Etudes Et Recherches Sur Le Développement International), Working Paper 143, June.
- Cadot, O., Carrère, C. and Strauss-Kahn, V. (2011). Trade diversification, income, and growth: what do we know? FERDI (Fondation Pour Les Etudes Et Recherches Sur Le Développement International), Working Paper 33, November 2011.
- Calderon, C, Cantu, C. and Chuhan-Pole, P. (2018). Infrastructure development in sub-Saharan Africa: a scorecard. World Bank Policy Research Working Paper 8425.
- Collier, P. (2014). Attracting international private finance for African Infrastructure. *Journal of African Trade* 1, pp. 37-44.
- Cornell University, INSEAD, and WIPO (2018): The Global Innovation Index 2018: Energizing the World with Innovation. Ithaca, Fontainebleau, and Geneva.
- Foster, V. and Briceno-Garmendia, C. (2010). Africa's Infrastructure: A Time for Transformation. Washington, D.C.: World Bank.
- Freire, C. (2013). Strategies for structural transformation in South Asian countries. *Seoul Journal of Economics* 26(3), pp. 311-336.
- Herrendorf, B., Rogerson, R. and Valentinyi, A. (2014). "Growth and structural transformation", In: Aghion, Philippe, Durlauf, Steven (Eds.), *Handbook of Economic Growth*, vol. 2B. North Holland, Amsterdam and New York, pp. 855-941 (Chapter 6).
- ICA (2018). Infrastructure Financing Trends in Africa 2017. Infrastructure Consortium for Africa (ICA): Abidjan.
- Imbs, Jean, and Romain Wacziarg. (2003). "Stages of diversification", *American Economic Review*, 93(1): pp. 63-86.
- IMF (2016). World Economic Outlook: Subdued Demand, Symptoms and Remedies. October. Washington, D.C.: International Monetary Fund (IMF).
- Kuznets, Simon, (1973). "Modern economic growth: findings and reflections", *American Economic Review* 63, pp. 247-258.
- Mayaki, I. (2018). Statement by the Chief Executive Officer, NEPAD Agency, at the PIDA Week 2018, held 26 November, at Victoria Falls, Zimbabwe.
- Morris, M. and J. Fessehaie (2014). The industrialization challenge for Africa: towards a commodities-based industrialisation path. *Journal of African Trade* 1, pp. 25-36.
- Nubler, I. (2014). A theory of capabilities for productive transformation: learning to catch-up. In J. Salazar-Xirinachs, I. Nubler and R. Kozul-Wright (eds), *Transforming Economies: Making Industrial Policy Work for Growth, Jobs and Development*. Geneva: ILO.
- Nubler, I. and Ernst, C. (2013). Creating productive capacities, employment and capabilities for development: the case for infrastructure investment. In: I. Islam and D. Kucera (eds) *Beyond Macroeconomic Stability: Structural Transformation and Inclusive Development*. Geneva and Basingstoke: ILO and Palgrave MacMillan.

- OECD (2018). *Making Blended Finance Work for the Sustainable Development Goals*. Paris: OECD Publishing.
- OECD and WEF (2015). *A How-To Guide for Blended Finance*. Geneva: World Economic Forum (WEF).
- Osakwe, P. N. and Moussa, N. (2018). "Innovation, diversification and inclusive development in Africa". In: R. A. Alabi et al. (eds), *African Development Perspectives Yearbook 2018*, vol. 20. Berlin: LIT Verlag.
- Page, J. (2012). *Industry for Africa: why? how?* In: E. Aryeetey, S. Devarajan, R. Kanbur and L. Kasekende (eds.), *The Oxford Companion to the Economics of Africa*. Oxford: Oxford University Press.
- Papageorgiou, C, Perez-Sebastian, F. and Spatafora, N. (2013). *Structural change through diversification: a conceptual framework*. Manuscript, IMF.
- Signé L. (2018). *The potential of manufacturing and industrialization in Africa: trends, opportunities, and strategies*. Paper Prepared by the Africa Growth Initiative at Brookings, Washington D.C.
- UNCTAD (2006). *The Least Developed Countries Report 2006: Developing Productive Capacities*, New York and Geneva: United Nations.
- UNCTAD (2013). *Economic Development in Africa Report 2013. Intra-African Trade: Unlocking Private Sector Dynamism*. New York and Geneva: United Nations
- UNCTAD (2015). *Technology and Innovation Report 2015. Fostering Innovation Policies for Industrial Development*. New York and Geneva: United Nations
- UNCTAD (2016). *Economic Development in Africa Report 2016. Debt Dynamics and Development Finance in Africa*. New York and Geneva: United Nations.
- UNCTAD (2018). *The Least Developed Countries Report 2018. Entrepreneurship for Structural Transformation: Beyond Business as Usual*. New York and Geneva: United Nations.
- UNCTAD and UNIDO (2011). *Economic Development in Africa Report 2011: Fostering Industrial Development in Africa in the New Global Environment*. New York and Geneva: United Nations
- UNECA (2016). *Transformative Industrial Policy for Africa*. Addis Ababa: United Nations Economic Commission for Africa (UNECA).
- United Nations (2015). *Transforming our World: The 2030 Agenda for Sustainable Development*. New York: United Nations (UN).
- UNIDO (2003). *Africa Productive Capacity Initiative: from Vision to Action*. Background paper prepared for the 16th Conference of the African Ministers of Industry held in Vienna, 28 November.
- UNIDO (2016). *Industrialization in Africa and the Least Developed Countries: Boosting Growth, Creating Jobs, Promoting Inclusiveness and Sustainability. A Report to the G20 Development Working Group by the United Nations Industrial Development Organization (UNIDO)*.
- UNIDO (2017). *International Yearbook of Industrial Statistics 2017*. Cheltenham, UK: Edward Elgar Publishing Limited.

WEF (2018) Readiness for the Future of Production Report 2018. Geneva: World Economic Forum (WEF).

Frugal innovations driven by micro, small and middle enterprises: Characteristics and challenges in the African landscape

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1 Introduction

Inclusive growth and sustainable poverty alleviation efforts in Africa are driven by numerous micro-, small- and medium-sized enterprises (MSMEs). These enterprises address the needs of the so-called Base of the Pyramid (BOP)-consumers. Yet, they go beyond the BOP narrative to also challenge traditional innovation trajectories by rethinking entire processes of production and business models, from idea to final use, ultimately leading to a new kind of innovation often described as “frugal innovation”. One aspect of frugal innovation involves that the MSMEs are bringing together multiple stakeholders from both the formal and informal sectors, across geographical regions, in order to combine international expertise with local knowledge. By merging top-down and bottom-up approaches and bringing together actors from different stakeholder groups, frugal innovations have a high potential to address the multifaceted and complex challenges of poverty and sustainable development. Yet, these enterprises face significant challenges related to scaling and institutional voids in developing economies.

Policy makers are required to support MSMEs in their contribution to the sustainable development goals (SDG) of the United Nations. This support will contribute to the *SDG 1 – Poverty Eradication* and to *SDG 9 – Industrial Development, Innovation and Infrastructure*. By creating a favourable environment, the MSMEs can achieve economic scaling and sustainable social impact by means of

- (1) producing goods and services for low-income customers under ecological conditions,
- (2) creating jobs along the value chain,
- (3) improving access of the poor to hard and soft infrastructure, including transportation services and mobile-cellular networks, and

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(4) using technology and innovation for eradicating poverty.

MSMEs are very diverse in terms of their ownership (e.g. local, foreign) and their governance structure (e.g. social enterprises, social businesses, for-profit enterprises). However, managerial and political recommendations are often of generic character and do not consider the diversity of internal and external challenges that the different types of enterprises face.

Based on a profound literature review of the different actors in the inclusive business ecosystem and a survey among 66 African enterprises, we identify the main internal and external challenges that the different enterprise types face, as well as the various solution approaches applied in order to cope with these challenges. The enterprises in our sample engage extensively in value co-creation activities with BOP consumers and use both technology and business model innovations in order to address basic needs and poverty issues in Africa. The enterprises mostly address basic needs issues, such as lack of clean water, sanitation, nutritious food, clean energy, and housing.

We find that the main external challenges include high costs of doing business, a poor infrastructure and a burdensome regulatory environment, while internal challenges include insufficient resources, high risks, and low returns on investment. The solution mechanisms are rooted in the ideas of frugal innovations and encompass innovative business models, partnerships with non-governmental organizations (NGO) and multinationals, inclusion of low-income consumers, and novel revenue and distribution channels. Based on these insights and the needs of these enterprises, we develop policy implications on how they can be supported throughout various stages of development in order to ensure their economic scaling and a sustainable social impact creation. Section 2 addresses the growing importance of frugal innovations for MSMEs in driving sustainable development efforts. Section 3 is on methods of analysis for MSMEs operating in BOP markets. Section 4 is presenting the main findings from the survey, emphasizing the challenges and the solution approaches. Section 5 is presenting a discussion of the findings and is reviewing the implications for different stakeholders. Section 6 is on Conclusions.

2 Frugal Innovations driven by MSMEs in Africa: The growing importance of frugal innovations for MSMEs in driving sustainable development efforts

2.1 Bottom of the Pyramid (BOP) Research

The core hypothesis of the BOP research is that poverty in developing countries can be alleviated through financially profitable business activities (London et al.,

2010; Prahalad, 2005). In this way, companies of all sizes can contribute to eradicate poverty by offering products and services to BOP markets (Prahalad & Hammond, 2002). In this understanding, the poor are understood as active economic actors, and this has significant implications for the way micro-, small- and medium-sized companies as well as large companies and multi-national corporations design their value chains in terms of procurement, production and distribution operations. However, in the so-called BOP markets the companies typically need to deal over wide geographical distances and are faced with conditions of poor infrastructure (Shivaraj & Srinivasan, 2013).

At the same time, society and research emphasize the growing importance of triple bottom line approaches which argue that companies should equally measure their financial performance with their social and ecological impact (Calton et al. 2013; Elkington 1997). However, recent activities focus on economic and social value, while ecological outcomes are mainly neglected (Kolk et al., 2013; Gold et al., 2013). And, it is Hart (2005) who argues that the inclusion of ecological aspects into the BOP discourse is crucial, because eradicating poverty in developing countries can create significant ecological damage, especially so by promoting industrial and agro-industrial processes.

Several authors argue that inclusive business models which are adapted to local framework conditions (e.g., infrastructure, education, resources), when they are equipped with participative elements aimed at involving the poor into value chain activities, are needed for sustainable growth (Bendul et al. 2015; George et al. 2015; Gold et al. 2013; Rosca & Bendul. 2015). For instance, Gold et al. (2013) argue that companies should involve the poor through the participative design of value chain processes, while simultaneously ensuring economic value creation and prevention of ecological damage.

2.2 Value Co-Creation and Participation

The core proposition of the theory of value co-creation is that by engaging with consumers and other local actors in the value creation processes, companies are able to better balance the bottom line (costs and investments) and top line (revenues and growth) objectives in the short run and to create sustainable competitive advantages in the long run (Prahalad & Ramaswamy, 2002, 2004). Also, BOP scholars recommend exploring BOP issues through the lenses of value co-creation (London, 2007; London & Hart, 2004; Simanis & Hart, 2009). Experiences with BOP, frugal and resource-constrained innovation processes pinpoint the importance of involving local actors into the product and business model development from the early stages in order to create local capabilities.

2.3 Frugal Innovation in Africa and its meaning for sustainable development

Frugal innovation is an emerging innovation paradigm which '*aims to bring products, services and systems within the reach of billions of poor*' (Knorringa et al., 2016, pg. 143). It is an approach to account for affordability constraints in poverty settings (Hart et al., 2016). By combining top-down and bottom-up approaches and bringing together actors from different stakeholder groups, frugal innovation has the potential to address the multifaceted challenges of poverty and sustainable development (Knorringa et al., 2016). Bhatti (2012) defines the theoretical roots of frugal innovation at the intersection between social innovation, business innovation and institutional innovation. Business innovation explores resource constraints in BOP settings, institutional innovations support the institutional voids debate, and social innovations refer to approaches for dealing with affordability constraints. Frugal innovation lies at the intersection of the three forms of innovation because it creates value through a mix of social, business and institutional innovation.

Frugal innovation is an innovation approach with an inherent focus on resource constraints and affordability. Cunha et al. (2014) propose that frugal innovation refers to innovation under conditions of scarcity of affluent customers. The severe affordability challenges of its target customers enable frugal innovation to develop an internal 'resource scarcity' as a source for innovation of products and services, which are nevertheless of high value but entail low ownership costs.

This new approach of innovating under resource constraints is not limited to one specific organization type but has been adopted by multinational corporations (MNCs) and by MSMEs alike in order to successfully serve their BOP consumers. Additionally, frugal innovations can be implemented for solving issues across sectors, and they are prevalent in healthcare, finance, information and communication technology (ICT), energy, and in regard of consumer goods (Hossain 2017). Though often discussed in the context of the Indian Subcontinent (Hossain, 2017), many successful frugal innovations can be found in Africa.

Perhaps one of the most prominent examples to originate from Africa is the Kenyan mobile phone-based money service, *M-Pesa*, which was launched in 2007 by the MNC Vodafone for *Safaricom*, the largest telecom operator in Kenya, and by Vodacom, the largest mobile network operator in Tanzania. Since its inception it has been hailed in media as an innovation that revolutionized global banking (Monks, 2017; The Economist, 2015), but this frugal innovation originally emerged as a means for the telecom providers to target the vast market of untapped BOP consumers in Kenya. Traditional banking solutions were often not appropriate for the needs of these consumers, such as quick transfers of very small amounts, nor compatible with their abilities, as procedures for opening an official account were often complex and required multiple official verification documents

from the user, which were often not possible for BOP consumers to easily obtain. As a result, in 2006 around 80% percent of adults in Kenya did not have a bank account or did not use traditional banking services (Jack & Suri, 2011). Through its unorthodox use of mobile technology and digital accounts, *M-Pesa* was able to provide BOP consumers with high-quality finance-transaction services which they required, but at a very low price and with very simple registration procedures tailored to the abilities of BOP consumers, all this factors which reduced the barriers of entry. As a result, though the average sum of money per transfer is just shy of 20 USD, only two years after its launch *M-Pesa* was already transferring over 2 million USD a day (Morawczynski & Pickens, 2009).

Another example of a frugal innovation successfully targeting BOP consumers is the motorbike-based ambulance designed by the MSME *eRanger* (eRanger, 2019). This motorbike-based ambulance is equipped with a specialized sidecar and designed specifically to provide emergency medical response for patients in rural areas, by allowing for on-time effective transportation to the nearest rural clinic. Unlike traditional car ambulance services, which are less than ideal in terms of both cost and performance in rugged rural conditions, this frugal innovation enables the provision of basic, but timely and high quality emergency medical services under tough conditions, at a significantly lower cost for the ambulance to manufacture of under 6,000 USD (EngineeringForChange, 2019; Hofman et al., 2008). Now, *eRanger* sells their product in multiple countries across Africa, amongst others the Democratic Republic of Congo, Chad, Senegal, and Mali. The concept of a frugally designed ambulance was popularized, and it encouraged additional spinoffs such as the Bicycle Ambulance Network in Namibia (Bennamibia, 2019), the *Zambulance* in Zambia (Zambikeszambia.com, 2019), or the *Bike4Care* in Kenya (CooP-Africa, 2019).

A Frugal Innovation is highly diverse in terms of its applicability to solve challenges in different sectors, as well as in terms of a diverse spectrum of initiating organizations. Indeed, these innovations frequently take place at an inter-organizational level, where different actors work together rather than in isolation. The nature of collaboration and collaborators depends on the type of governance mode of the frugal innovation's owner. Prahalad (2005) argues that in order to meet cost and functionality requirements needed for frugal innovation, one needs to work collaboratively with customers, suppliers, governments and the civil society in the broadest sense. Companies need to create awareness to ensure that customers understand what the product is offering and how to use it; they also need to enable access to the products to ensure that customers from remote locations are able to buy them, as availability is crucial for building trust and creating a loyal base of customers. Lastly, companies need to ensure that the end price remains affordable for the target customers (Prahalad, 2012). Therefore, the nature of collaboration in frugal innovations refers to the creation of small ecosystems which enable a new system for value creation and delivery to function in poverty settings.

In poverty settings, the creation of small ecosystems, with partners such as local NGOs and government branches, can enable the acceptance and diffusion of frugal innovations at larger scale (Khavul & Bruton, 2013). For example, subsistence-based enterprises are often employed for last-mile distribution challenges; local NGOs and community associations can perform functions such as social marketing, education campaigns, training provision, quality control, and functions for business model development and public development funding. When the owners of frugal innovations embed themselves in the local business ecosystem, the sustainability-enhancing innovations are more likely to remain in the long-run. The combination of localized activities and external expertise can connect actors from the formal and informal sectors and combine global knowledge and local experiences in order to develop fully contextualized solutions (Hart & London, 2005). Bringing together local and external expertise and competences can enable the combination of local knowledge with international expertise, and therefore allow for the creation of more inclusive forms of value chains (Knorringa et al., 2016).

2.4 MSMEs as main drivers of frugal innovation

Around the world, and particularly in Africa, frugal innovation initiatives are driven by MSMEs (Rosca et al., 2018; Kolk et al., 2013). Current empirical findings suggest that MSMEs and local entrepreneurs engage actively in low-income markets and address social development issues through BOP integration in operations, local capacity building, and thereby they address inequality in labour markets and fill in institutional voids (Rosca et al., 2018). Frugal innovations driven by MSMEs and local entrepreneurs use new technologies, business models and generate employment, income and productivity. Especially grassroots innovators that promote and engage in frugal innovations have a critical role in fulfilling the SDG agenda, because their initiatives usually exhibit the necessary strong social orientation for the SDG's success. Grassroots innovators genuinely aim to improve the living conditions of their local communities and aspire to empower social minorities (Pansera & Sarkar, 2016).

However, MSMEs typically face major constraints related to acquiring funding activities, scaling operations, overcoming the lack of qualified personnel in local settings, shouldering the high costs of doing business, as well as severe affordability constraints and institutional voids. All these constraints exacerbate the difficulties of achieving economic viability, so that the social impact is affected (Hart et al., 2016).

3 Methods of Analysis for MSMEs operating in BOP markets

To better understand the challenges and needs of MSMEs in Africa, we have adopted a survey procedure employing an online questionnaire with MSMEs operating in BOP markets as a unit of analysis. We targeted MSMEs with up to 250 employees in order to comply with the original definition for MSMEs. While most enterprises in our sample have less than 50 employees and so there are mostly micro enterprises included, it is interesting to explore the differences in business models and innovation approaches between enterprises of different size and age. The selected enterprises allow it to approach BOP as suppliers, producers or intermediaries (such as retailers or wholesalers). MSMEs could be both local and foreign (with a headquarter in an industrialized country), insofar as there are small-scale production facilities or local branches in a BOP setting. Furthermore, we required – for inclusion of enterprises into analysis - that the MSMEs were profit-oriented or intended to self-finance growth through retained earnings in order to reach profitability in the medium term. The items and issues employed in the analysis were adapted from the methodologies of existing empirical studies. Several rounds of evaluation and feedback as well as a pre-study phase were conducted.

Following the recommendations of Black (1999), we used a purposive sampling approach to create a list of enterprises for sending them the questionnaire. We identified several databases of relevant enterprises, based on the following aspects/criteria: (1) a clear focus on BOP markets; (2) an intention of self-financed growth and an orientation to operate profitably; and (3), a focus on the size of the enterprises (less than 250 employees). The survey was conducted between August and November 2016: first, the online questionnaire was sent out to a list of 722 enterprises, including an explanatory email on the background of the study followed by two reminder emails after two and four weeks. Moreover, personalized emails were sent to the directors and founders of an extended list of 367 MSMEs. After excluding replies of insufficient quality and incomplete data we had a final sample of 142 enterprises, from which 66 are operating in African countries. For the purpose of this study, only the 66 enterprises which operate in Africa have been considered. The sample of African MSMEs has a strong focus on the following countries: Kenya, Uganda, Zambia, Nigeria, Ghana, Malawi, and Tanzania. Most enterprises are still young, free-standing, and independent. The respondents were mostly people with in-depth knowledge of the enterprise, namely: 70% as owners, managing directors, founders, executive directors, chairpersons, and 14% as internal managers, being responsible for IT, marketing and technical issues, and as regional project managers. 53% of the respondents had been working for the enterprise for more than a year, and 38% for more than 5 years.

Following the empirically-derived classification of Subrahmanyam and Tomas Gomez-Arias (2008), 74% of the surveyed enterprises provide basic services for survival, such as food, energy, housing, water and sanitation; 14% are classified

as ventures providing essential services for safety and security, such as healthcare, transportation, finance and education; 8% provide services for social interaction needs, such as ICT and market place for labour; and the remaining 5% provide for products and services beyond basic needs. In brief, the sample entails a high degree of diversity across MSMEs, and therefore it can lead to interesting insights.

4 Main findings from the survey – Challenges and solution approaches employed by MSMEs in key African countries

4.1 Business models, products and services

MSMEs frequently go beyond traditional business models and solutions, to develop context-specific solutions based on a deep understanding of local problems and environments, as well as to develop solutions based on natural resources development processes or on the use of waste materials as inputs. The descriptive analysis from the empirical survey points out that MSMEs in BOP settings have as a starting point given social problems in the local communities, and on this basis these enterprises develop innovative solutions. These problems include lack of clean and/or running water; high rates of infant mortality; lack of electricity, heating or cooking energy; and problems with sanitation, housing, and nutritious food availability. Figure 1 (below) gives an overview of the products and services offered by the MSMEs in our sample.

Most African enterprises manufacture products or services for energy supply (27.27%), e.g. products for general power generation, solar energy, solar lamps, or biogas. The second most common product (15.15%) is nutritional food, such as peanut butter or spices; the third most common supplies are agricultural input products (13.64%), such as fertilizers. Others (9.09%) include products such as clothing, greeting cards, or gift boxes. Products in the "Water" category (9.09%) are mainly used for water purification. "Healthcare", e.g. eyeglasses, and "Housing", e.g. Sandbag Houses, products or services are fabricated by 6.06% of MSMEs. And, 3.03% of the entrepreneurs produce products or services for education and training, such as seminars/training units for waste separation, but also products and services for sanitation, including toilets, and finance solutions, e.g. loans.

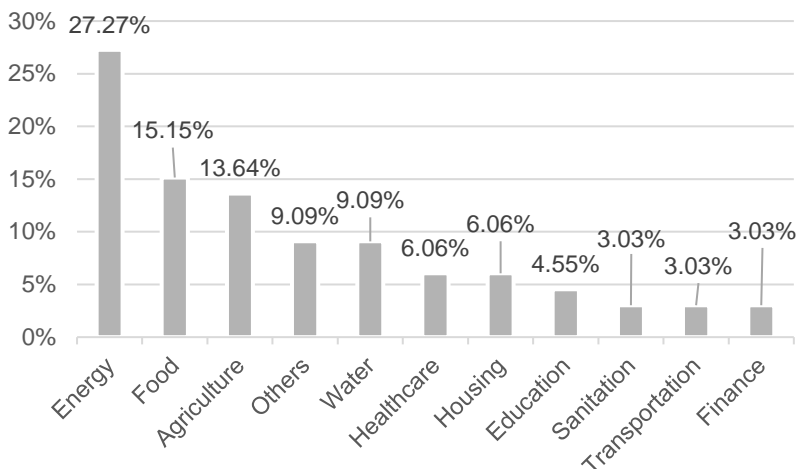
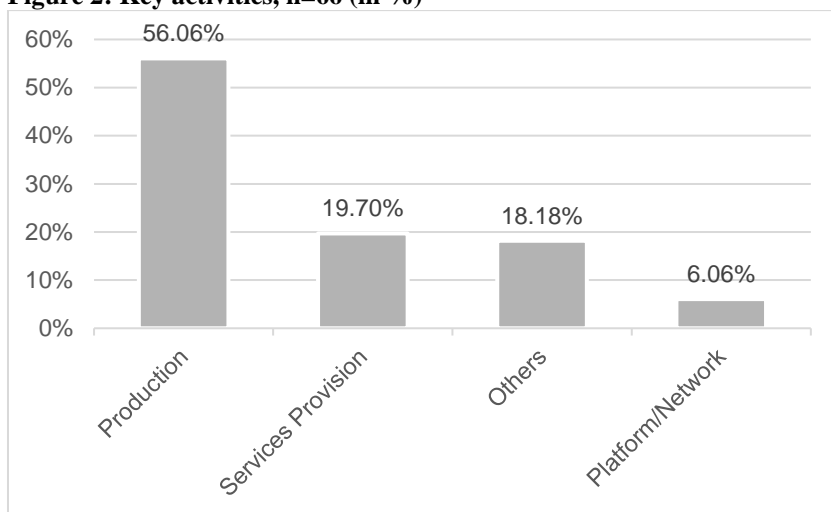
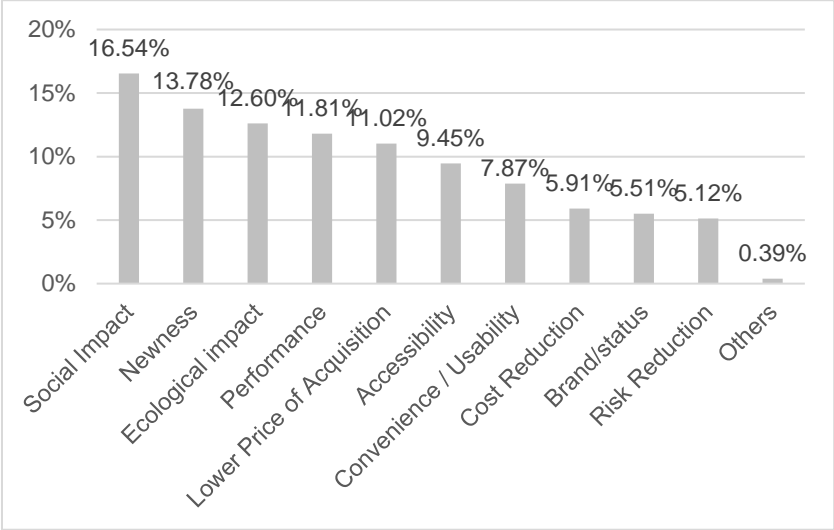
Figure 1: Products and services offered to the BOP market, n=66 (in %).

Figure 2 shows the distribution of the African MSMEs according to their key activities. 56.06% of African MSMEs have "Production" as their key activity. "Services Provision" (19.70%) and "Others" (18.18%), such as distribution, are key activities according to the survey participants. Only 6.06% see the provision of a platform or a network as a key activity.

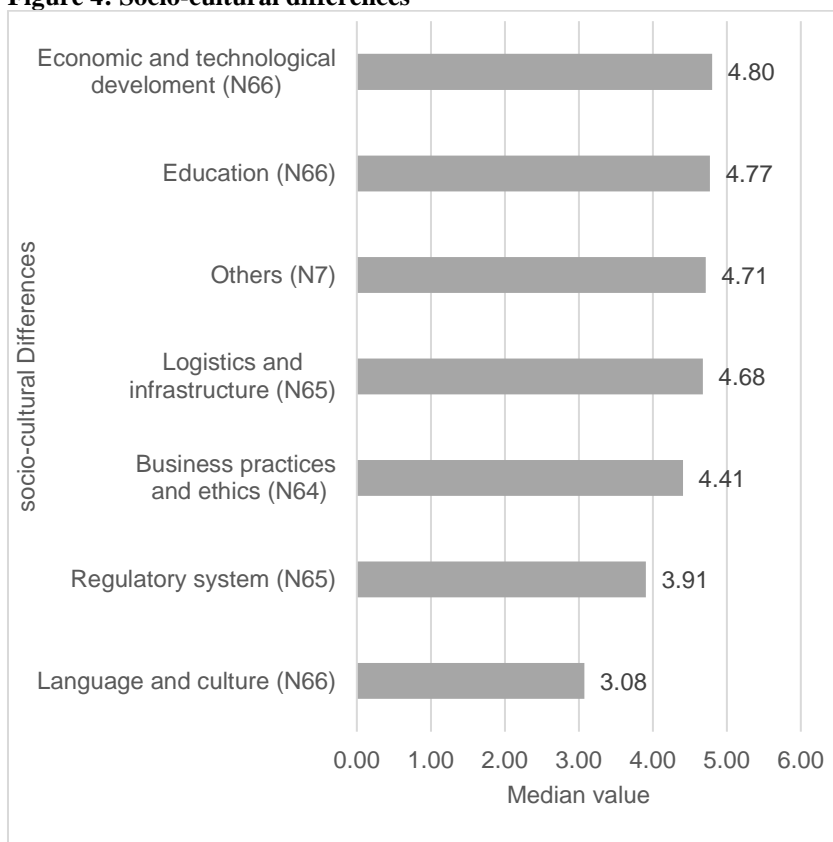
Figure 2: Key activities, n=66 (in %)

Beyond the provision of affordable products and services, the combination of local with foreign knowledge, and realizing an active engagement of local communities, the MSMEs can have other important contributions. By reaching out to remote communities and locations, MSMEs address what Prabhu and Jain (2015) call the ‘last-mile’ problem, which means filling in institutional gaps and including communities which cannot be reached by government actions (Knorringa et al, 2016). Moreover, scholars suggest that MSMEs showcase examples and best practices for a new generation of leaders determined to drive social change (Prabhu & Jain, 2015). As figure 3 shows, most enterprises (16.54%) understand the social impact of their products and services as the main value proposition, followed by newness (13.78%) of products that do not exist on the market, and the ecological impact (12.60%).

Figure 3: Central value propositions to the BOP market, n=66 (in %), (11 answers possible)



The reason for this distribution of services and products supplied by MSMEs can be found in the respondents` perception of socio-cultural differences (figure 4). The participants were asked to assess the socio-cultural differences within their market and the enterprise's local branch on a scale from 1 (different to a very low extent) to 7 (different to a very large extent). Since not all participants rated every asked socio-cultural difference, the sum of the respective ratings given can be found in the brackets for each socio-cultural difference. On the y-axis the socio-cultural differences are represented, and on the x-axis, the mean value of the respective socio-cultural differences is shown.

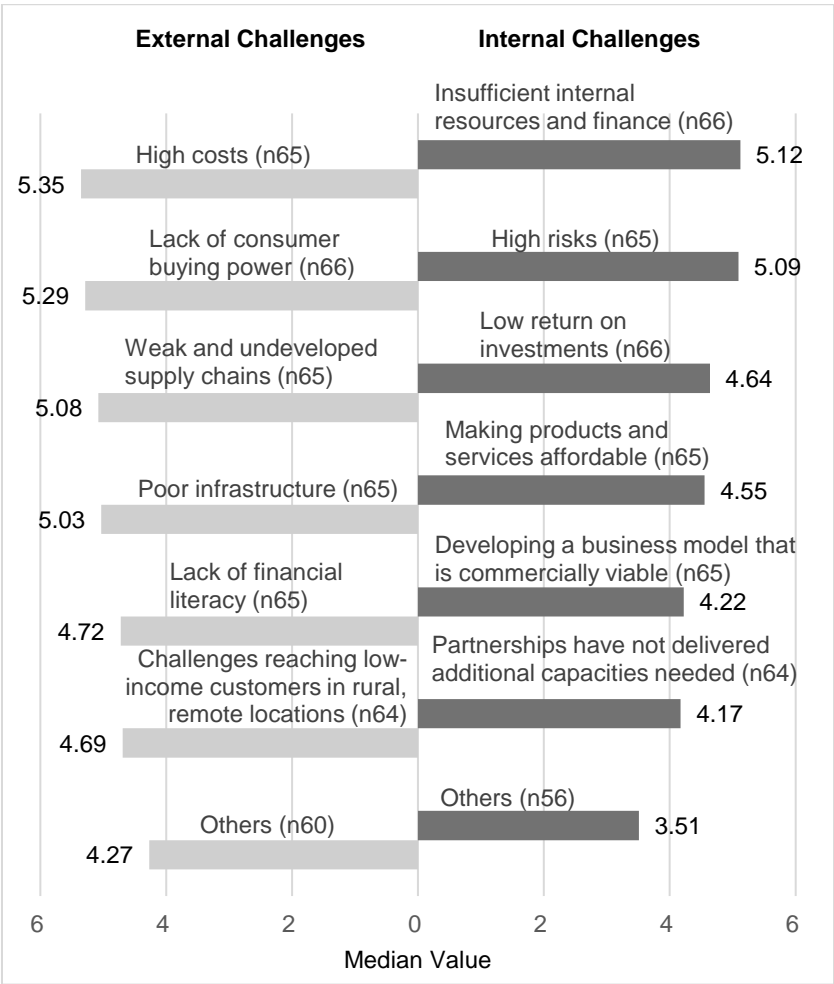
Figure 4: Socio-cultural differences

African enterprises see "Economic and technological development" and "Education" as the biggest difference between their target market and their subsidiary. This could be the case as most companies are survival services providers. "Others" as socio-cultural differences are, for example, "myths and beliefs" and the "innovation culture". These insights further illustrate that there are significant differences between the BOP markets and the MSMEs who are targeting these markets: as a result, local enterprises need to develop contextualized solutions rooted in a deep understanding of the local contexts.

4.2 External and internal challenges

Figure 5 gives an overview of the main external and internal challenges based on participants' assessments.

Figure 5: External and Internal Challenges of African MSMEs in BOP markets



The figure shows external challenges on the left-hand side and internal challenges on the right-hand side. Participants were asked to rate the extent of the external and internal challenges on a scale from 1 (very low extent) to 7 (very large extent). Since not all participants rated every asked external and internal challenge, the sum of the respective ratings given can found in brackets for each external and internal challenge. According to the survey, the participants weighted the external

challenges approximately equally. "High costs for doing business" and "Lack of consumer buying power" tend to be more challenging for the participants than other factors.

For the participants the internal challenges "Insufficient internal resources and finance" and "High risks" tend to be weighted more challenging than the other internal challenges.

The size of the enterprises has an impact. Figure 6 shows the different evaluations of the main external challenges depending on the size of the MSMEs. The x-axis shows the mean value of the given evaluations and the y-axis the respective external challenges.

Especially the micro-sized enterprises face the external challenge of "High costs". This is no surprise as micro-sized enterprises are the most vulnerable enterprises. The sum of the respective ratings given can be found in brackets for each MSME category.

The different evaluation of the main internal challenges as depending on the size of the MSMEs is shown in figure 7. The x-axis shows the mean value of the given evaluations and the y-axis the respective external challenge. For each MSME category the evaluated ratings can be found in brackets. Micro-sized enterprises face "Insufficient internal resources and finance", while medium-sized enterprises see "High risks" as an important internal challenge.

Figure 8 shows in percent how often participants have chosen an external or internal challenge with a value of 1-7. External and internal challenges are sorted according to their importance (see figure 5 above). The x-axis shows the percentage distribution of the scale values. Each possible scale value is displayed in a different colour, the corresponding legend is located below the x-axis.

How do the enterprises allocate their resources according to various important categories? The figure 9 shows the allocation of key resources of African MSMEs with a key activity in production.

64.86% of the participants with a key activity in "Production" state that they use physical resources to generate value. The key resources "Human Resources", "Financial Resources" and "Others" are only used by 5.41% each of the producing enterprises to generate value. To create added value, 16.22% of the enterprises that have their key activity in "Production" used "Intellectual Resources", while only 2.7% use "Relational Resources". Physical and intellectual resources matter most in the responses from the enterprises.

Figure 6: Ratings of main External Challenges of African MSMEs depending on Enterprise Size

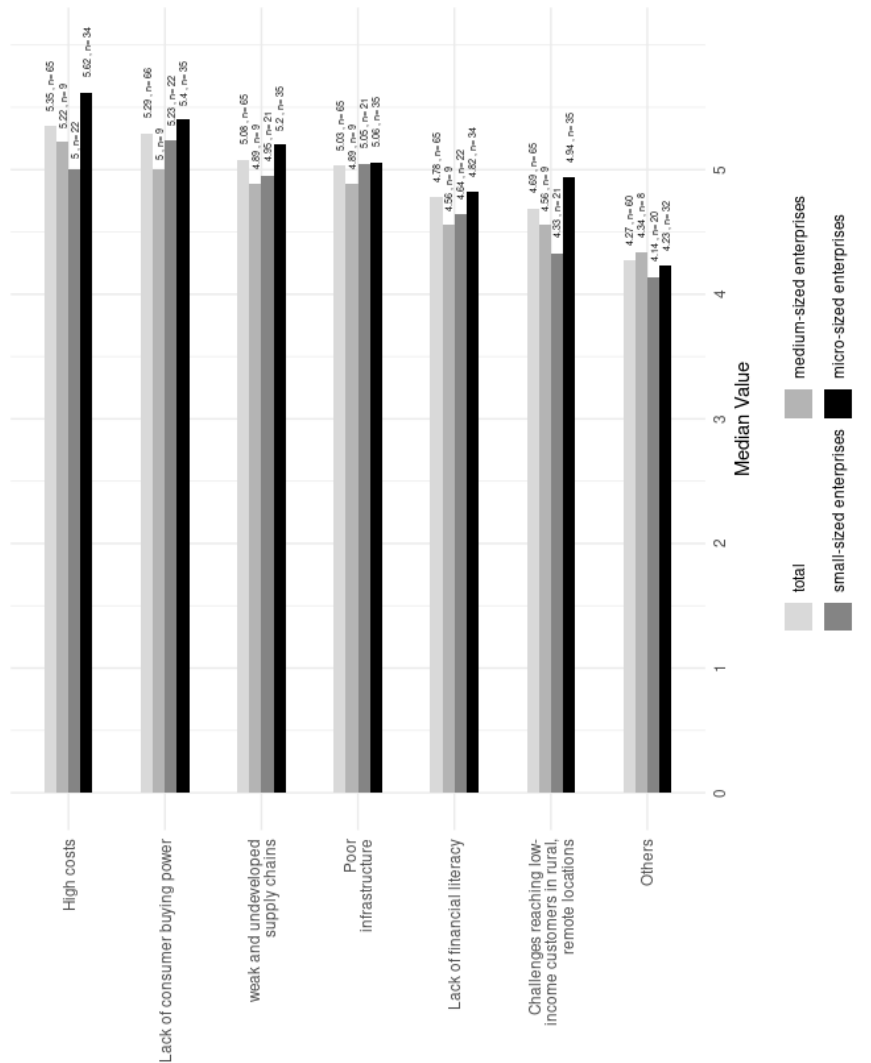


Figure 7: Ratings of main External Challenges of African MSMEs as depending on enterprise size

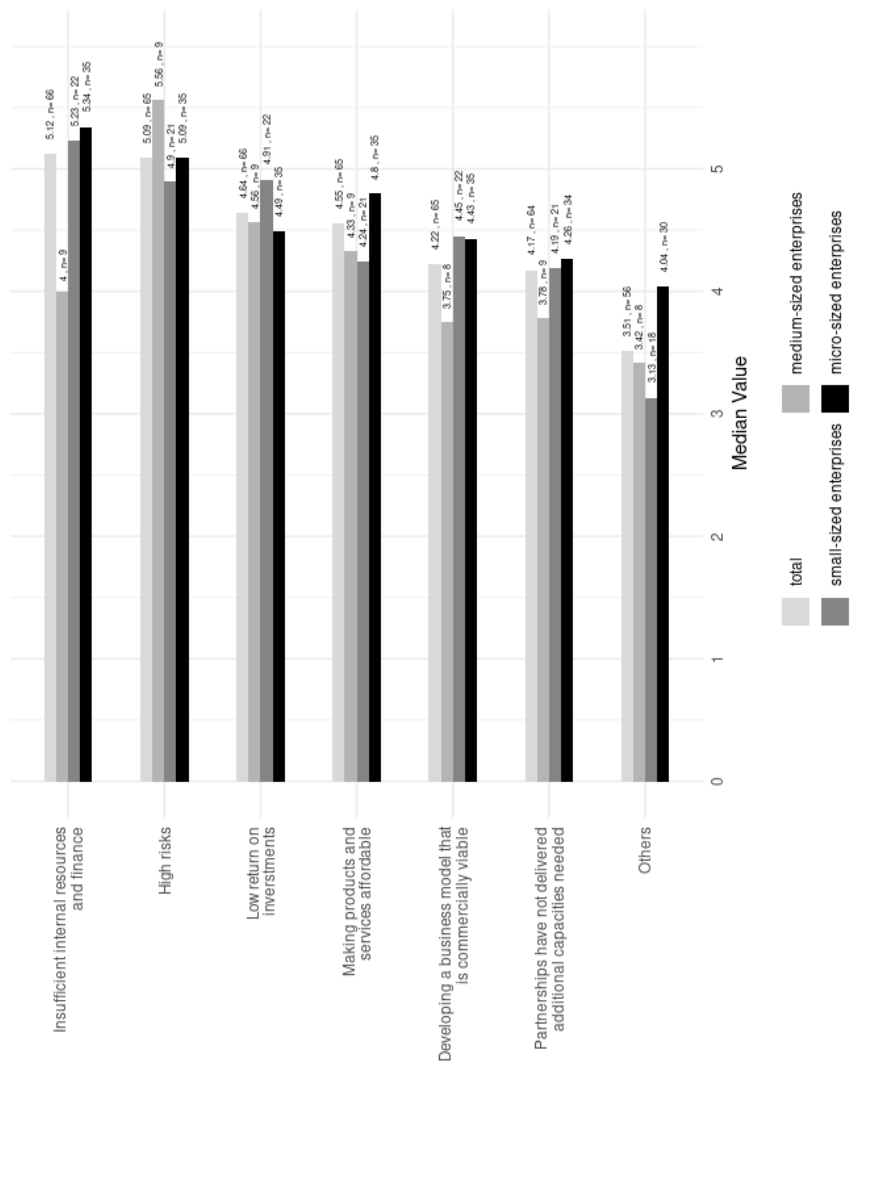


Figure 8: Frequency distribution of the selected characteristic expression of external and internal challenges of African MSMEs in BOP markets, (in %).

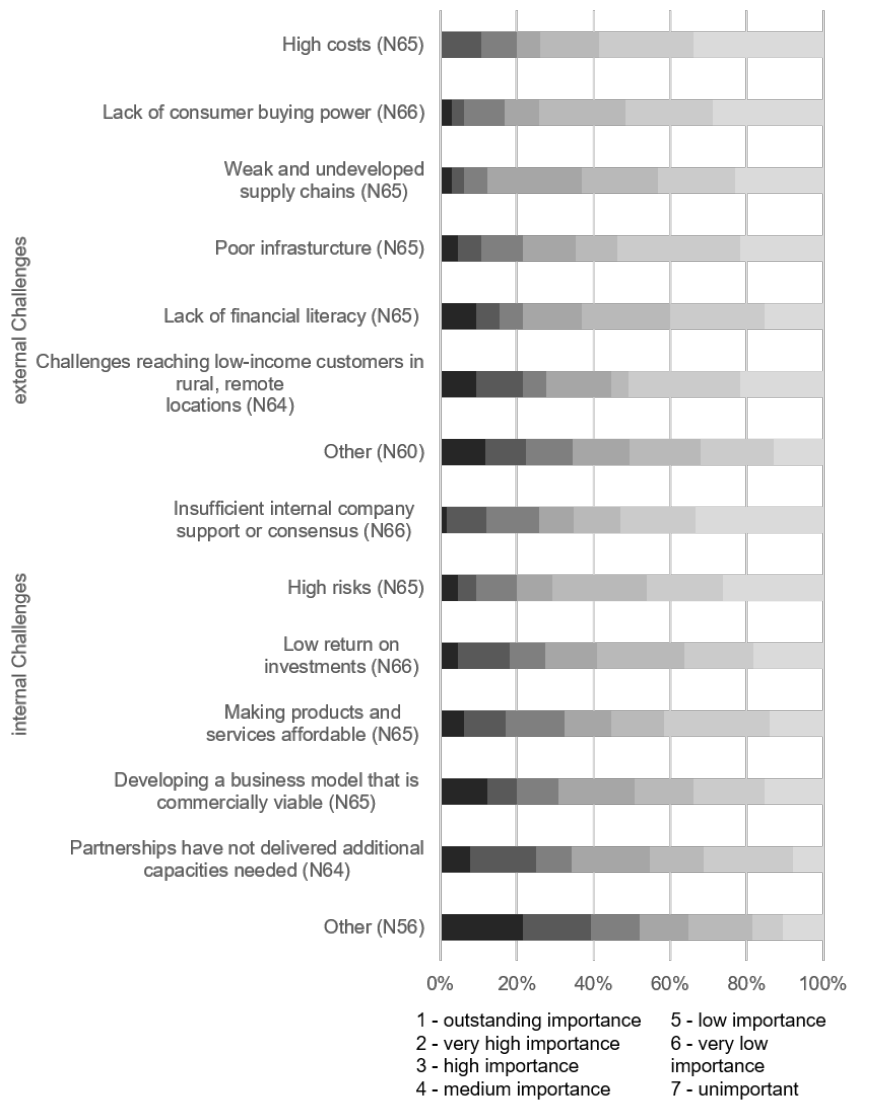
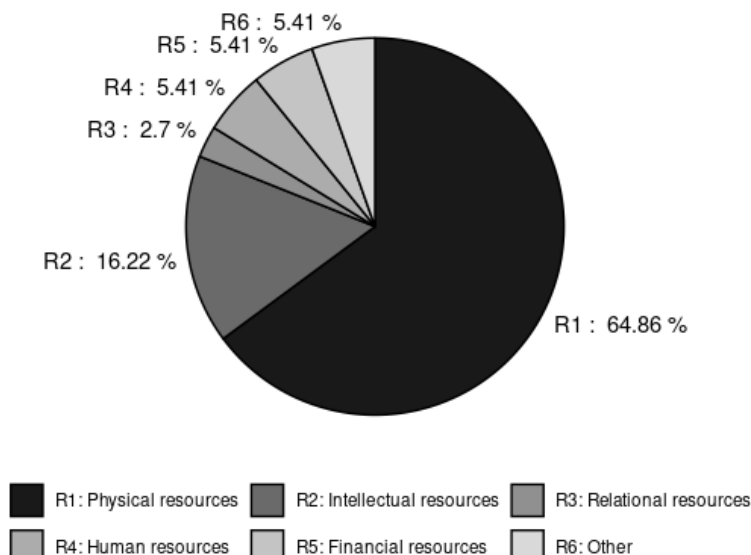


Figure 9: Key resources of African MSMEs with Key Activity in Production, n=37 (in %)



Note: Physical resources (buildings, land), Intellectual resources (technology, patents), Relational resources (partnerships, suppliers), Human resources (educated, qualified employees), Financial resources (capital).

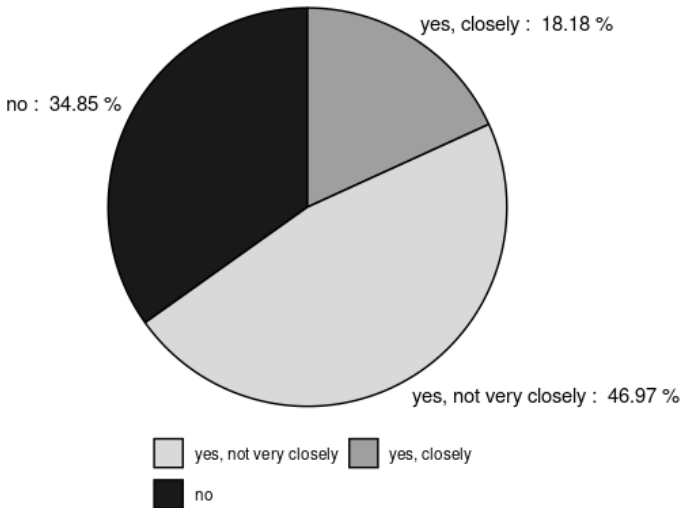
4.3 Collaboration

Figure 10 shows whether and how intensively an African MSME has entered into a cooperation with a MNC. Almost half of the enterprises (46.97%) have such a cooperation, but it is not very strong. In contrast, only 18.18% of the enterprises have a close collaboration with a multinational corporation. Of those surveyed, 34.85% stated that they had no collaboration with a multinational corporation.

Figure 11 (below) illustrates the collaboration of African MSMEs with Cross-Sector Partners (CSPs).

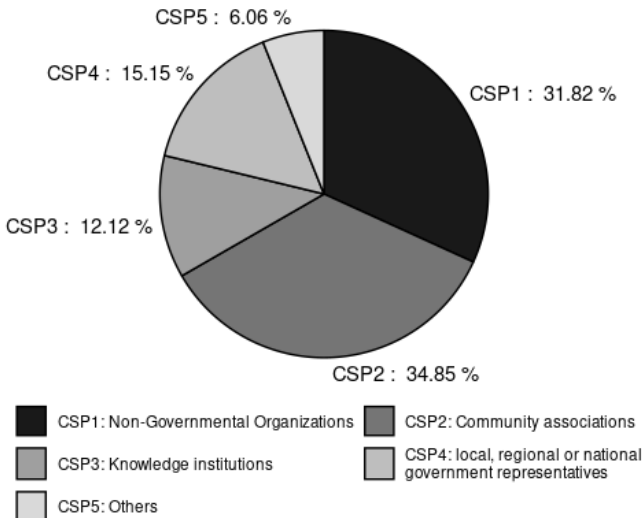
Most survey participants collaborate either with “communities associations” (34.85%), such as professional unions, local community interest groups, or with non-governmental organizations (31.82%), including local or national branches of international NGOs. And, 15.15% of the participants collaborate with government representatives of different government levels, 12.12% with knowledge institutions, and the remaining participants with others (6.06%), such as social entrepreneurs.

Figure 10: Collaboration with MNCs, n=66 (in %)



Note: Very close MNC collaboration (close partnerships and exchange of resources with MNC), Not very close cooperation (MNC as a customer or supplier only).

Figure 11: Collaboration of MSMEs with CSPs, n=66 (in %)



Note: Knowledge institutions (universities, colleges), Cross-sector partners (NGOs, development agencies).

5 Discussion of findings and implications for different stakeholders

Findings in this study provide important impulses for recommendations for MSME but reveal also implications for other relevant groups of stakeholders, namely intermediaries (often owned or funded by development agencies), policy-makers, and cross-sector partners. MSMEs need to take one step further to tackle challenges related to sustainable development and to design their long-term strategy with a clear sustainability strategy in mind. They can focus on a reduced, product-based consumption, on an increased emphasis on service-based consumption, and on a circular-based economy. Additionally, they can employ localization approaches for value chains or promote a new lifestyle with a focus on self-realization rather than on materialism. Implications for the various stakeholders are given below:

MSMEs: The analysis shows that MSMEs need to face numerous challenges and need to deal with limited resources. Thus, it is critical to create an individual ecosystem of relevant partners in order to operate together in a network. Working jointly and building up on each other's competences and impact is the only way how MSMEs can make a difference and therefore a contribution to SDG 9. In this sense, it is important to select the relevant partners wisely and with a clear focus on building long-term-oriented relationships. In order to ensure a mix of local and foreign knowledge, local growth oriented MSMEs can actively engage in partnerships with foreign MSMEs in order to combine local knowledge and local legitimacy with foreign expertise and with social networks. For example, MSMEs which provide basic needs services to rural consumers who are living in remote areas can build on the expertise and the network of local NGOs for various value chain activities, including the raising of awareness and the promoting of education campaigns. MSMEs which provide education and training services to BOP markets in rural areas can build on the local legitimacy and the local knowledge of community associations. Due to the relatively small sample size, it is hard to develop inferences based on differences between micro, small and medium enterprises. Further studies should expand the sample size and explore differences in outcomes, business models and innovation strategies between enterprises of different size.

Intermediaries: The BOP landscape entails a wide variety of intermediaries, with international platforms, hubs and networks such as Inclusive Business Action Network (IBAN), SEED (originally named: Supporting Entrepreneurs for Environment and Development) Awards, and Business Call to Action United Nations (BCtA UN). These intermediaries offer different services in terms of type, maturity and size of supported initiatives, scope, thematic and geographical focus. Yet, our study shows that MSMEs across all sectors face different challenges depending on their stage of development, that they need different partners depending

on sector and models adopted and that they have different sustainability orientations. Therefore, intermediaries should provide targeted services to MSMEs in specific sectors and at different stages of development. In the early stages, MSMEs need guidance and support on how to match the social issues they want to address with an existing market opportunity, and on how to design a value proposition which is meaningful for customers and consumers and incorporates social and ecological aspects which are locally relevant. At later stages, MSMEs need to find partners which can provide them with necessary knowledge, skills, capabilities and resources to replicate and to scale their operations. For this purpose, intermediaries can provide support on how to find the right partners relevant for the enterprise and to integrate education, training and capacity building services as part of the core operations of the MSMEs. Intermediaries can also diversify their service portfolios with offerings related to balancing economic, social and ecological goals in the long run and can lead to synergies of development between economic, social and ecological performance outcomes.

Polymakers: From the perspective of polymakers, there is need for targeted policies and support programmes for MSMEs at different stages of development and for policies in order to strengthen the links between MNCs, impact investors, large companies, cross-sector actors, and MSMEs operating in BOP markets. Polymakers can do so by firstly, developing targeted decision-making and elaborating policies for different types of BOP enterprises, depending on their specific goals, partners and impacts. There is need to measure the impacts in the long run in order to ensure that the initial social orientation is not lost for economic value and also to ensure that polymakers can incentivize such efforts so that long term approaches are becoming effective. Secondly, policy makers can design policies and regulations to incentivize collaborative efforts between governments, MNCs, investors, large companies, and MSMEs. The combination of skills, resources, capabilities and orientations of different stakeholders can advance the fulfilment of sustainable development goals (SDGs). In this area, policy makers need to tighten the regulatory framework around exploitation issues in order to protect low-income consumers. Thirdly, polymakers can promote and support increased visibility of individuals who are driving sustainable change attempting to educate a new generation of responsible leaders and role-models.

NGOs, community associations and knowledge institutions: Cross-sector actors include local NGOs, community associations and knowledge institutions who have important roles to play depending on sectors and geographical settings. The NGOs seem to be a valuable partner for several types of MSMEs which are operating in BOP markets. NGOs can work together with MSMEs, especially in sectors with no clear ecological impact in order to develop approaches for natural environment protection. They can also encourage MSMEs to define a clear sustainability strategy and to support the implementation of such strategies on tactical and operational levels. Knowledge institutions can support MSMEs especially in

technology-intensive sectors, such as healthcare, ICT and banking, and can contribute with know-how and research and development (R&D) capabilities in order to decrease the capital investments to be made early on by MSMEs.

6 Conclusions

Our findings highlight that *SDG 9 – Industrial Development, Innovation and Infrastructure* - is key to *SDG 1 – Poverty Eradication*. MSMEs are central players in the BOP landscape, as they connect relevant stakeholders and entail a strong normative orientation. MSMEs are key actors because they entail this strong normative orientation towards the BOP local communities which allows not only to design business models and value propositions for sustainability, but to move beyond and actively drive local education and capacity building through engagement with BOP local communities. Thus, creating an environment in which MSMEs can achieve economic scaling is a central prerequisite. In this environment, MSMEs can properly produce goods and services also for the poor, they can do so under ecological conditions and can therefor contribute to the limitation of negative climate change effects. In this view, they also contribute to the development of infrastructure networks as well as to the supply of corresponding services, such as telecommunication and transportation; they also contribute to the creation of jobs in the different stages of the value chain, namely the development, procurement, production, and distribution phases. MSMEs borrow different elements of sustainable development in their business models when they have BOP markets in mind, but often they do not employ clear sustainability approaches and operational mechanisms aiming to combine economic, social and ecological benefits.

While provision of affordable products and services does not directly translate to poverty alleviation, one should distinguish between the social impact of e.g. selling shampoo sachets to low-income urban consumers and providing electricity in rural remote areas. This is especially the case for industries such as renewables, clean technologies or healthcare, which have a multiplier effect on various aspects of life. In these industries, when a clear market opportunity is identified, a firm does not necessarily need a normative orientation to drive social and ecological impacts. However, in such cases firms which are operating in low-income settings need very strong ethical values and principles to avoid an exploitation of unequal power relationships and vulnerabilities of BOP local communities.

References

- Bendul, J., Rosca, E., & Hoffmann, T. (2015): Sustainable Technology Transfer for Poverty Alleviation: Unified Framework for Challenges and Transdisciplinary Solution Approaches. Sustainable Development and Planning 2015 Conference Proceedings. Volume 193, WIT Transactions on Ecology and the Environment, WIT Press, pp. 823-835.
- Bhatti, Y. (2012) What is Frugal, What is Innovation? Towards a Theory of Frugal Innovation. Said Business School, Working Paper, Oxford, UK.
- BENNamibia/Bicycling Empowerment Network Namibia. (2019). Bicycle Ambulances - Bicycling Empowerment Network Namibia. [online]; Available at: <http://bennamibia.org/projects/bicycle-ambulances/> [Accessed 6 Aug. 2019].
- Black, T. R. (1999). Doing quantitative research in the social sciences: An integrated approach to research design, measurement and statistics. Sage.
- Calton, J. M., Werhane, P. H., Hartman, L. P., & Bevan, D. (2013): Building partnerships to create social and economic value at the base of the global development pyramid. *Journal of business ethics*, 117(4), pp. 721-733.
- CooP-Africa. (2019). Bike4Care: improve access to health care. [online]; Available at: <https://www.coop-africa.org/en/causes/bike4care/> [Accessed 6 Aug. 2019].
- Cunha, E., Rego, A., Oliveira, P., Rosado, P., & Habib, N. (2014). Product Innovation in Resource-Poor Environments: Three Research Streams. *Journal of Product Innovation Management* 31(2): pp. 202-210.
- Elkington, J. (1997): *Cannibals with forks. The triple bottom line of 21st century business*. Capstone Publishers, Oxford.
- Engineering For Change. (2019). eRanger Ambulance | Engineering For Change. [online] Available at: <https://www.engineeringforchange.org/eranger/>
- eRanger. (2019). Home. [online] Available at: <http://www.eranger.com/Home.aspx> [Accessed 6 Aug. 2019].
- George, G.; Rao-Nicholson, R.; Corbishley, C.; & Bansal, R. (2015): Institutional entrepreneurship, governance, and poverty: Insights from emergency medical response services in India. *Asia Pacific Journal of Management*, 32(1), pp. 39-65.
- Gold, S.; Hahn, R.; & Seuring, S. (2013): Sustainable supply chain management in “Base of the Pyramid” food projects—A path to triple bottom line approaches for multinationals? *International Business Review* 22(5), pp. 784-799.
- Hart, S. L. (2005): *Capitalism at the crossroads: The unlimited business opportunities in solving the world's most difficult problems*. Pearson Education.
- Hart, S. L., & London, T. (2005). Developing native capability. *Stanford Social Innovation Review*, 3(2): pp. 28-33.
- Hart, S., Sharma, S., & Halme, M. (2016). Poverty, Business Strategy, and Sustainable Development. *Organization & Environment*, 29(4): pp. 401-415.

- Hofman, J., Dzimadzi, C., Lungu, K., Ratsma, E. and Hussein, J. (2008). Motorcycle ambulances for referral of obstetric emergencies in rural Malawi: Do they reduce delay and what do they cost?. *International Journal of Gynaecology & Obstetrics*, 102(2), pp.191-197.
- Hossain, M. (2017). Mapping the frugal innovation phenomenon. *Technology in Society*, 51, pp.199-208.
- Jack, W. & Suri, T. (2011). *Mobile Money: The Economics Of M-Pesa*. [ebook] National Bureau Of Economic Research. Available at: <https://www.nber.org/papers/w16721.pdf> [Accessed 6 Aug. 2019].
- Khavul, S., & Bruton, G. D. (2013). Harnessing innovation for change: Sustainability and poverty in developing countries. *Journal of Management Studies*, 50(2): pp. 285-306.
- Knorringa, P., Peša, I., Leliveld, A., & Van Beers, C. (2016). Frugal Innovation and Development: Aides or Adversaries? *The European Journal of Development Research*, 28(2): pp. 143-153.
- Kolk, A., Rivera-Santos, M., & Rufin, C. (2013). Reviewing a decade of research on the "base/bottom of the pyramid" (BOP) concept. *Business & Society*, <https://doi.org/10.1177/0007650312474928>.
- London, T. (2007): A Base-Of-The-Pyramid Perspective on Poverty Alleviation. Working Paper of the William Davidson Institute at the University of Michigan and the United Nations Development Programme (UNDP).
- London, T.; Anupindi, R.; & Sheth, S. (2010): Creating mutual value: Lessons learned from ventures serving base of the pyramid producers. *Journal of Business Research*, 63(6), pp. 582-594.
- London, T.; & Hart, S. L. (2004): Reinventing strategies for emerging markets: beyond the transnational model. *Journal of international business studies*, 35(5), pp. 350-370.
- Monks, K. (2017). M-Pesa: Kenya's mobile success story turns 10. [online] CNN. Available at: <https://edition.cnn.com/2017/02/21/africa/mpesa-10th-anniversary/index.html> [Accessed 6 Aug. 2019].
- Morawczynski, O. and Pickens, M. (2009). Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA. [ebook] CGAP World Bank. Available at: http://te.vikaspedia.in/e-governance/mobile-governance/Mobile_Financial_Services.pdf [Accessed 6 Aug. 2019].
- Pansera, M. & Sarkar, S. (2016) Crafting sustainable development solutions: Frugal innovations of grassroots entrepreneurs. *Sustainability*, 8(1):51.
- Prabhu, J., & Jain, S. (2015). Innovation and entrepreneurship in India: Understanding juggad. *Asia Pacific Journal of Management*, 32(4): pp. 843-868.
- Prahalad, C. K.; (2005) The fortune at the bottom of the pyramid. Wharton School, Upper Saddle River, US.
- Prahalad, C. K.;(2012) Bottom of the Pyramid as a Source of Breakthrough Innovations. *Journal of Product Innovation Management*. 29(1): pp. 6-12.

- Prahalad, C. K.; & Hammond, A. (2002) What works: Serving the poor, profitably. World Resources Institute. Retrieved October 15, 2007
- Prahalad, C. K.; & Ramaswamy, V. (2002) Co-creation Connection. *Strategy and Business* 27. Pp. 50-61.
- Prahalad, C. K.; & Ramaswamy, V. (2004) Co-creation experiences: The next practice in value creation. *Journal of interactive marketing*, 18(3), pp. 5-14.
- Rosca, E.; & Bendul, J. (2015): Base of the Pyramid 2.0: Co-Creating Value through Business Models. In: Proceedings of 10th European Conference on Innovation and Entrepreneurship, September 17-18, 2015, Genoa, Italy.
- Rosca, E., & Bendul, J. and Arnold, M. (2017). Business models for sustainable innovation – an empirical analysis of frugal products and services. *Journal of Cleaner Production*. 162(2017): pp. 133-145.
- Rosca, E., Reedy, J. & Bendul, J. (2018). Does frugal innovation enable sustainable development? A systematic Literature Review. *European Journal of Development Research*. 30(1): pp. 136-157.
- Simanis, E.; & Hart, S. L. (2009): Innovation from the inside out. MIT Sloan Manage. Rev. 50(4), pp. 77-86.
- Shivaraj, S.; & Srinivasan, A. (2013): The poor as suppliers of intellectual property: A social network approach to sustainable poverty alleviation. *Business Ethics Quarterly*, 23(03), pp. 381-406.
- Subrahmanyam, S., & Tomas Gomez-Arias, J. (2008). Integrated approach to understanding consumer behaviour at bottom of pyramid. *Journal of Consumer Marketing*, 25(7): pp. 402–412.
- The Economist. (2015). Why does Kenya lead the world in mobile money?. [online] Available at: <https://www.economist.com/the-economist-explains/2015/03/02/why-does-kenya-lead-the-world-in-mobile-money> [Accessed 6 Aug. 2019].
- Zambikeszambia.com. (2019). Zambikes Zambia - Zambulance. [online] Available at: <http://www.zambikeszambia.com/products/products-for-zambia/zambulance/> [Accessed 6 Aug. 2019].

Harnessing the African Continental Free Trade Agreement (AfCFTA) for commodity-based industrialization: a synthesis of three case studies

Giovanni Valensisi*

1 Introduction

The Agreement establishing the African Continental Free Trade Agreement (AfCFTA) entered into force on 30 May 2019, a month after the threshold number of 22 countries had deposited their instruments of ratification to the African Union (AU). This historic step is a remarkable testimony to the strong political will behind this initiative, even though key elements for its concrete operationalization are still being negotiated, as is the case for tariff schedules, rules of origin and services schedules.

At this critical juncture, keeping the momentum towards the rapid implementation of the AfCFTA is surely imperative. Equally important, however, is reflecting on how regional integration can be best harnessed to lift African economies away from commodity-dependence and onto a sustainable industrialization path. Articulating a more coherent and synergetic relationship between trade and agricultural/industrial policy frameworks is thus fundamental. This is the more so since many issues to be addressed in the second phase of the AfCFTA negotiations – from intellectual property, to investment, or to competition policies – will inevitably have a bearing on future industrial policy frameworks.

Buoyant expectations on the merits of the AfCFTA for Africa's industrialization are confirmed by various macroeconomic simulations, which find that tariff reduction could boost manufacturing exports and stimulate diversification across the continent (Depetris Chauvin et al., 2016; IMF, 2019; Mevel and Karingi, 2013; Saygili et al., 2017; Signé, 2018; Vanzetti et al., 2017). While these results are promising, it should be stressed that trade liberalisation as such can only go as far

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in enhancing competitiveness and stimulating a supply response as complementary factors are working effectively. Beyond static gains from trade, Africa's industrialization prospects hinge above all on mobilizing investments capable of redressing supply-side constraints, whether in terms of infrastructures, technological upgrading, skills formation or manufacturing capabilities.

These considerations underpinned the rationale for conceiving the AfCFTA as a key element of a broader spectrum of policies encompassed in the AU action plan for Boosting Intra African Trade – BIAT (Valensisi and Karingi, 2016). The latter encompasses seven clusters, including Trade Policy, but also Trade Facilitation, Productive Capacities, Trade-related Infrastructure, Trade Finance, Trade Information, and Factor Market Integration. In the same vein, the potential synergies between regional integration and sustainable industrialization cannot be fully understood without considering the complementarities across the different targets of SDG 9. Of particular relevance here are the links between the targets related to industrialization (targets 9.2 and 9.B), and those which pertain to sustainable resilient and inclusive infrastructures (targets 9.1, 9.4, and 9.A), access to financial services (target 9.3), and technological upgrading (targets 9.5 and 9.C). Analogous considerations apply finally in relation to the intrinsic linkages across different SDGs, and especially the interplay between the economic, social and environmental dimensions in the process of sustainable development, or of sustainable production and consumption evoked in SDG 12.

With these premises, this paper complements the existing literature on the AfCFTA by taking a meso-level approach to unpack key facets of the relationship between Africa's regional integration and its quest for industrialization. It does so by analysing the functioning of three commodity-based value chains of relevance for the continent, namely tea, cocoa, and cotton/textiles/apparel. Through this sectoral analysis the study sheds light on how the AfCFTA presents a strategic opportunity to enhance the consistency between African countries' trade policy frameworks and their industrialization objectives. It also provides some insights on how the AfCFTA could best pave the way for enhancing the breadth and depth of commodity-based value chains, thereby fostering greater local value addition.

The paper is structured as follows. Section 2 outlines the history of Africa's regional integration and the context in which the AfCFTA will be implemented. Sections 3 and 4 respectively discuss the three commodity-based value chains individually and through an overall synthesis of the analysis. Finally, section 5 concludes by drawing key policy recommendations.

2 From the Abuja Treaty to the AfCFTA: how did we arrive here?

Cooperation, unity and solidarity among African countries have a long history, that can be seen by looking at the 1963 Charter of the Organization of African Unity or by referring to the notion of "national and collective self-reliance in social

and economic development” from the Monrovia Declaration (OAU, 1963, 1979). Over time, these aspirations have led to a proliferation of bilateral, sub-regional and regional trade agreements across the continent, with the gradual establishment of numerous Regional Economic Communities (RECs). In 1991, these efforts culminated at continental level with the Abuja Treaty (entered into force in 1994), which foresaw a long-term roadmap to establish an African Economic Community (OAU, 1991). Underpinning a linear model of regional integration, the Abuja Treaty envisaged the following time-bound steps:

- Strengthening existing RECs and establishing new ones in regions where they did not exist (by 1999).
- Removing tariff and non-tariff barriers within each REC (by 2007).
- Establishing Free Trade Areas (FTAs) and Custom Unions (CU) in each REC (by 2017).
- Coordinating and harmonizing tariff and non-tariff measures among RECs, with a view to creating a continental CU (by 2019).
- Creating an African Common Market (by 2023).
- Establishing an African Economic Community, including a monetary union and a Pan-African parliament (by 2028).

Notwithstanding the stated ambitions, implementation on the ground has been partial and uneven. As of 2017, only five of the eight RECs recognized by the AU had established a Free Trade Area: COMESA, EAC, ECCAS, ECOWAS, and SADC, with only two of them – EAC and ECOWAS – constituting a Customs Union (UNECA et al., 2017).¹

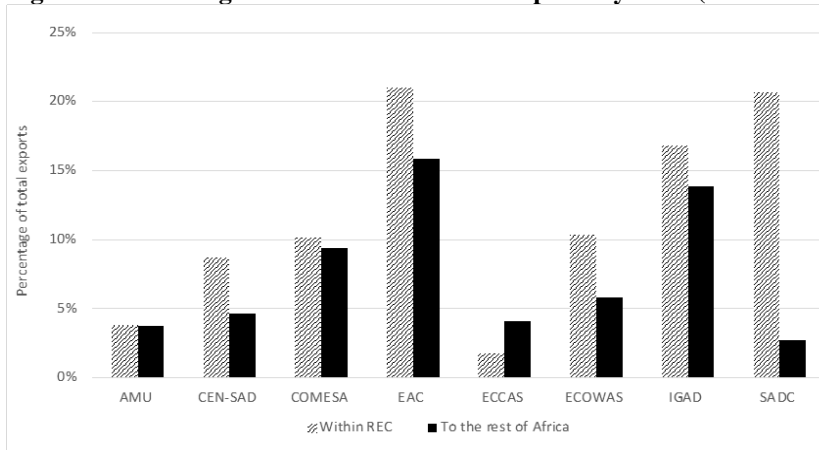
Unsurprisingly, even though intra-African merchandise exports increased five-fold from 1995 to 2017 – rising from USD 13 billion to USD 68 billion, as a share of total exports they only climbed from 12 to 17-18 per cent. This is a rather low figure by international standards, with a large variability across RECs (see figure 1 below).² Moreover, roughly three quarters of intra-African trade take place within existing RECs, suggesting that the scope for regional integration remains largely untapped (de Melo et al., 2017; Mevel and Karingi, 2013; UNECA et al., 2013; Valensisi et al., 2016).

¹ The RECs recognized by the AU are: the Arab Maghreb Union (UMA), the Common Market for Eastern and Southern Africa (COMESA), the Community of Sahel-Saharan States (CEN-SAD), the East African Community (EAC), the Economic Community of Central African States (ECCAS), the Economic Community of West African States (ECOWAS), the Intergovernmental Authority on Development (IGAD), and the Southern African Development Community (SADC).

² The figures presented in this paragraph are based on data from UNCTADSTAT database. Between 2000 and 2018, the value of intra-African trade has expanded at a faster pace (10 per cent per year) than both global trade and Africa’s exports to the rest of the world (both of which grew at 7 per cent per year).

The reasons for this weak performance are manifold and encompass structural issues, trade policies, institutional and political economy considerations. Firstly, at a structural level, African countries tend to have comparatively low GDP and limited economic diversification. The former factor tends to limit trade flows across the board, as suggested by standard gravity models (Anderson and van Wincoop, 2003; Bouët et al., 2017). Heightened dependence on primary commodities, conversely, depresses trade complementarity within the region, in so far as the scope for trade is more circumscribed when partners tend to have similar comparative advantages and analogous structures of production (UNECA, 2015). In the same vein, modest levels of industrialization constrain the possibilities for intra-industry trade, which typically involves differentiated manufactures rather than undifferentiated primary products (Brühlhart, 2009).

Figure 1: Percentage share of intra-African exports by REC (2015-2017)



Source: Computed from UNCTADSTAT (2019)

Secondly, African economies tend to impose generally high levels of protection, and this applies not only vis-à-vis the rest of the world, but also among themselves (Bouët et al., 2017; Valensisi et al., 2016). This is compounded by the fact that most African economies (notably the Least Developed Countries - LDCs) enjoy preferential market access when trading with partners outside the continent. The paradoxical result of this situation is that African exporters face on average lower levels of protection when exporting outside the continent than within Africa (Mevel and Karingi, 2013; UNECA, 2015). Poor infrastructural provision, significant non-tariff barriers and cumbersome border procedures further hinder intra-regional trade not only within RECs, but also – and perhaps more importantly –

across RECs, giving rise to a “proximity gap” (Naudé, 2009; Valensisi et al., 2016).³

Thirdly, the limited depth of regional integration in Africa is partly also influenced by political economy challenges. African RECs encompass a comparatively large number of countries, with wide heterogeneity in terms of legal framework, cultural and geographical characteristics (de Melo et al., 2017; UNECA et al., 2017). These features complicate the task of finding a balance among competing interests, stretching institutional capabilities. In addition, the overlapping membership of several African countries to multiple RECs creates a “spaghetti bowl”, hindering further efforts to deepen regional integration (UNCTAD, 2019a; UNECA et al., 2013).⁴

Against this background, since 2012 the establishment of the AfCFTA has emerged as a key strategic objective to redress the fragmentation of the continental market, while skirting the challenges posed by uneven REC consolidation and overlapping memberships (the latter representing a critical obstacle in negotiating common external tariffs). This has boosted the political momentum behind the AfCFTA, which is heralded as one of the priority projects under Agenda 2063.

³ The notion of “proximity gap” refers to a situation whereby African countries do not trade with one another as much as economic theory – and typically gravity models – would imply.

⁴ 12 African countries are members of only one of the 8 RECs which are recognized by the AU, 33 belong simultaneously to two RECs, 8 are simultaneously members of three RECs, and one country (Kenya) is member of four RECs (UNECA et al., 2017).

3 A story of three value chains

In spite of the above challenges, intra-African trade has displayed a strong dynamism over the last 15-20 years, and a higher degree of sophistication compared to the continent's exports to the rest of the world (Mevel and Karingi, 2013; UNECA, 2015; Vanzetti et al., 2017).⁵ Interestingly, these stylized facts are not driven exclusively by large sub-regional hubs (such as Egypt, Kenya, Nigeria, or South Africa), but apply to the overwhelming majority of African countries, corroborating the belief that regional integration has the potential to support industrialization (UNCTAD, 2019b).

In light of Africa's resource endowments and primary commodity dependence, gauging the extent to which regional integration can act as a springboard for commodity-based industrialization is particularly pertinent (Morris and Fessehaie, 2014; UNECA and AUC, 2013). The potential of agro-processing, in this respect, stands out for at least four main reasons:

1. the levels of protection on soft commodities (agricultural and food products) tend to be higher than on hard commodities (metals and energy) or other manufactures (Mevel and Karingi, 2013);
2. buoyant demand conditions are anticipated in the region, unlike in mature and more standard-intensive developed markets;
3. as agriculture is characterized by strong multipliers and large impacts on poverty reduction, the development of agro-processing industries creates a broader scope for inclusive growth (Christiaensen et al., 2011; UNECA, 2009); and
4. focusing mainly on consumer-goods with moderate levels of sophistication and capital-intensity, agro-processing is arguably consistent with African countries' comparative advantages and so this trade is in Africa "adjacent possible" (Hausmann and Chauvin, 2015; Lin, 2012).⁶

The rest of this section illustrates these points more specifically, by analysing the functioning of three agro-processing value chains and highlighting the scope for the AfCFTA to enhance value addition through linkage development. Such a

⁵ From here onward, unless otherwise stated, data related to trade flows and composition are taken from the ITC Trademap database, while tariff data are from UNCTAD's TRAINS database (both consulted in January-February 2019).

⁶ Similar considerations apply, *mutatis mutandis*, to the scope for establishing backward and forward linkages along hard commodities' global value chains (GVCs), notwithstanding the capital-intensive nature of extractive industries (Morris and Fessehaie, 2014). The relevance of the AfCFTA, in this context, is however mediated by the fact that hard commodities tend to face generally low levels of protection even on an MFN basis. This would shift much of the emphasis from a trade policy discussion to the level of industrial cooperation and development of regional-wide mining clusters.

meso-level sectoral approach allows discussing in greater detail the depth and breadth of regional value chains, highlighting key policy areas to enhance the synergies between trade and industrial policy frameworks.

3.1 Tea

Tea is obtained from the leaves of an evergreen shrub, called *Camellia sinensis*. Once plucked, leaves must be quickly brought to a processing factory, where they are first withered and then undergo different processing steps depending on tea varieties.⁷ Processed leaves are then sold to international buyers, which typically perform the blending, packaging and at times even the retailing.⁸ The tea value chain can be schematically subdivided into five stages: production, processing, trading, blending/packaging, and retail. Whereas upstream activities lend themselves to easy entry – with production mainly involving smallholder farmers and processing typically performed within 12 hours from harvesting, so as to preserve tea leaves' characteristics – economies of scale and market concentration are more significant in downstream stages (Morris and Fessehaie, 2014). Blending, packaging, and retail play however a key role for value addition, accounting for up to 80 per cent of the final price, and these stages are regarded by lead firms as their core business (Monroy et al., 2013). After years of “commoditization” centred on price competition, the industry is gradually shifting towards greater differentiation and higher value-added products, which can accrue substantial price premia. As a result, even though from a technological point of view the distance between the different stages is not particularly pronounced, downstream activities increasingly require entrepreneurial capabilities, ranging from quality assurance to logistics, marketing and branding (FAO, 2018a; Loconto, 2012). This has encouraged high levels of vertical integration and market concentration, with a small number of companies – such as Lipton (Unilever), Tetley (Tata Global Beverages), and Twinings (Associated British Foods) – controlling the bulk of the world market (FAO, 2018a; Monroy et al., 2013).

Product characteristics, as well as technical and institutional parameters of the value chain, are key determinants of the extent to which participation to the tea industry translates into broader developmental gains and greater opportunities for upgrading. In this respect, brokers and intermediaries play a critical role by linking producers with international buyers. As such, they can greatly enhance the transparency and inclusivity of the chain by sharing valuable information on prices and

⁷ In the case of black tea, leaves are either crushed or rolled, then fermented and finally dried; for green tea, instead, before being rolled and dried they are pan-fired or steamed to interrupt fermentation.

⁸ According to FAO estimates, 70 percent of global tea production is sold through auctions, while the rest is traded within vertically integrated companies (FAO, 2018a).

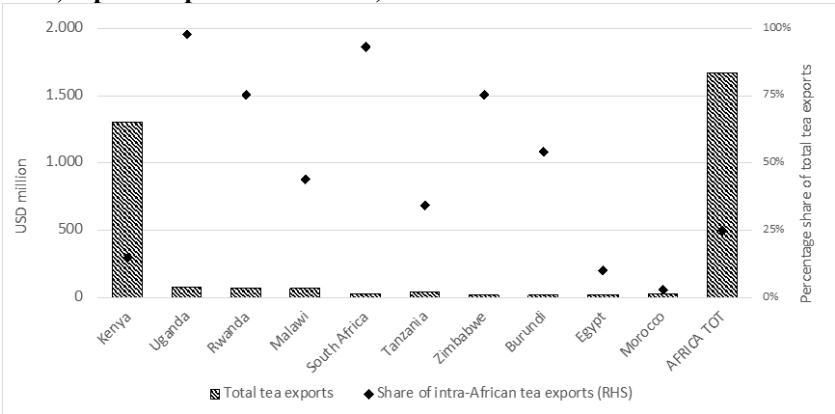
quality requirements, favouring the diffusion of key inputs, and supporting risk management, differentiation and certification (FAO, 2018a, 2018b, 2014).

The worldwide tea industry was estimated to be worth over \$14 billion in 2016, and is expected to continue its robust expansion, thanks mainly to the strong demand in developing countries (FAO, 2018a). While Asian countries (China, India, and Sri Lanka) retain a dominant position in the worldwide tea market, African economies are playing an increasingly visible and dynamic role. In 2015-2017, they accounted for 13 per cent of global tea production, over 20 per cent of related exports and 12 per cent of imports. Meanwhile, the regional market absorbed roughly 25 per cent of Africa's total tea exports and provided some 40 per cent of its imports, with the rest traded mainly with Asian countries, or exported to the United Kingdom, Russia, and the US, among others. If Kenya is by far the major player (and the world's third largest exporter with a market share of approximately 17 per cent), tea represents a significant cash-crop and foreign exchange earner also for various other Eastern and Southern African countries (see figure 2 below). Northern African countries, conversely, represent the main tea importers, with Egypt and Morocco alone accounting for over half of Africa's total tea imports, followed by, Libya, South Africa, and Ghana (figure 3 below).⁹

Over 90 per cent of the region's tea exports is in the form of black tea, overwhelmingly in bulk, while imports are more diversified, with green tea –widely consumed in the Maghreb region – accounting for over 40 per cent of the total. This pattern testifies the challenges African countries continue to face in pursuing product diversification or significantly engaging in blending and packaging (Monroy et al., 2013). As lead firms tend to carry out these activities in proximity of large consuming markets, the lack of forward linkages to downstream activities can be largely ascribed to the relatively small size of the domestic/regional market, as well as to the additional costs ensuing from poor transport and energy infrastructures (*ibidem*).

⁹ Albeit not producing significant amounts of tea, Egypt and Morocco engage in re-exporting activities, mainly to markets outside Africa.

Figure 2: African Countries’ Exports of Tea – HS 0902 – by origin (2015-2017; top-ten exporters and total)

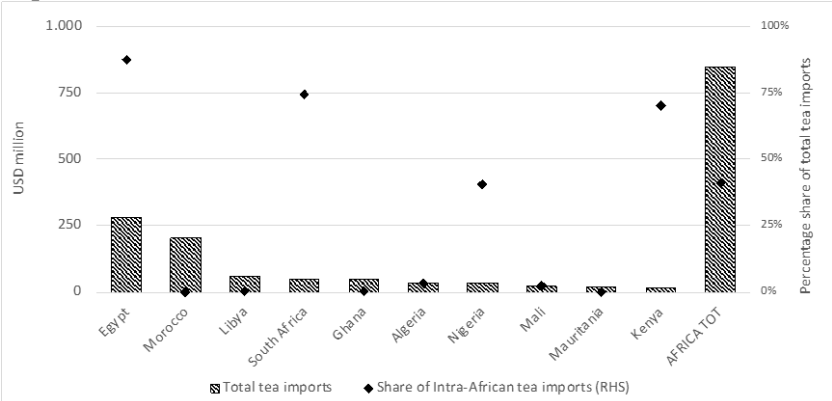


Source: Computed from ITC Trademap database (2019)

Even though Kenya only exports 15 per cent of its tea to Africa, it represents the key player for intra-regional trade, mainly through its prominent exports to Egypt (worth \$ 173 million in the 2015-2017 period). Kenya’s pivotal role, however, goes beyond mere direct exports: the country owes its prominence also to the role of Mombasa as a venue of dollar-based auctions, where tea from the whole sub-region is traded under the auspices of the East African Tea Trade Association (Wambui, 2015; Sandrey, 2017). Over 90 per cent of tea exported by Rwanda and Uganda and 40 per cent of that from Burundi and Tanzania are directed to Kenya, where it is auctioned along with domestic tea. Kenya’s centrality in intra-African tea trade is thus facilitated by its membership to both EAC and COMESA, with the latter REC also encompassing Egypt, Africa’s largest tea importer. South Africa also imports significant amounts of tea from the region – above all from Malawi, Tanzania, and Zimbabwe, in part for internal consumption and partly for re-export within SADC, often after blending and packaging. The dominant market position of the main South African packers, however, has meant that they captured the lion’s share of the benefits from regional integration within SADC (DAFF, 2013).

While their weight compared to Africa’s overall tea business might be circumscribed, initiatives to promote upgrading have indeed started gaining momentum in the region (box 1). These developments point to the importance of sectoral policies to foster vertical and horizontal upgrading. Moreover, they underscore the synergies and complementarities between the strategic aim of harnessing regional integration for greater scale economies and the objective of capturing value in more sophisticated developed markets, where price premia for high-end products can be more lucrative.

Figure 3: African Imports of Tea – HS 0902 – by origin (2015-2017; top-ten importers and total)



Source: Computed from ITC Trademap database (2019)

BOX 1: Upgrading stories in Africa’s tea value chain

If the overall picture outlined in the main text might appear sobering, it is worth noting that a rising number of African tea producers are starting to make inroad in the high value-added segments of the value chain (CBI, 2014; Kamau, 2015; Kihara, 2011). With a view to harness its role of a regional hub, Kenya has attracted investments in tea blending and packaging, including through the establishment of a dedicated Common User Facility (CUF) within Mombasa’s Export Processing Zone (which, according to the registry of the Export Processing Zone Authority/EPZA, hosts 3 distinct tea processing companies). Thanks to these measures, packing at origin is thus beginning to gain momentum even beyond organic/fair-trade certification schemes, despite the additional investments needed to meet buyers’ requirements and set up independent testing facilities (CBI, 2016, 2014). In the last decade, for instance, the Kenya Tea Packers (KETEPA) Limited has moved beyond the domestic market – which has long been its exclusive focus – to export tea bags and small packages to regional and global destinations, including Japan or the United States (KETEPA, 2019).

In line with the shift towards greater “premiumization” in the global tea market, African firms are also increasingly engaging in product differentiation. Kenyan producers are shifting from the crush, tear and curl (CTC) segment, for which they are a key global player, to so-called orthodox tea production (OTP), and so being able to capture higher prices (AFP, 2019). Through its Tea Research Institute (TRI), Kenya has also developed a new unique variety called “purple

tea”, which claims enhanced health benefits and received considerable international attention in early 2015. Commanding a substantial price premium over other varieties, purple tea is currently exported even to sophisticated developed markets such as the European Union (EU) or the United States (US).

In the same vein, South Africa has recently taken important steps to promote its endemic rooibos tea, including by legally protecting its trademark under its Geographical Indicators (GI) framework (DAFF, 2016).

Source: Author

To shed more light on AfCFTA’s potential for unlocking intra-African tea trade, figure 4 below shows the distribution of the average tariffs levied by African countries on tea, distinguishing the Most Favoured Nation (MFN) rates and preferential ones (basically intra-REC). The boxplot diagrams reveal a pattern of protection, characterized by relatively high MFN rates – typically applying across RECs – and mostly zero preferential rates.¹⁰

From the perspective of the AfCFTA, this has three main implications:

1. The high level of MFN tariffs involved point to a significant scope for boosting intra-REC tea trade, especially if non-tariff barriers are also addressed.
2. The sizeable differences between MFN and preferential tariffs suggest that the “spaghetti bowl” stemming from overlapping REC membership has a large bearing in the actual functioning of regional value chains, potentially creating incentives for trade deflection.¹¹
3. The establishment of the AfCFTA could potentially deliver large preference margins over key competitors in the rest of the world.¹²

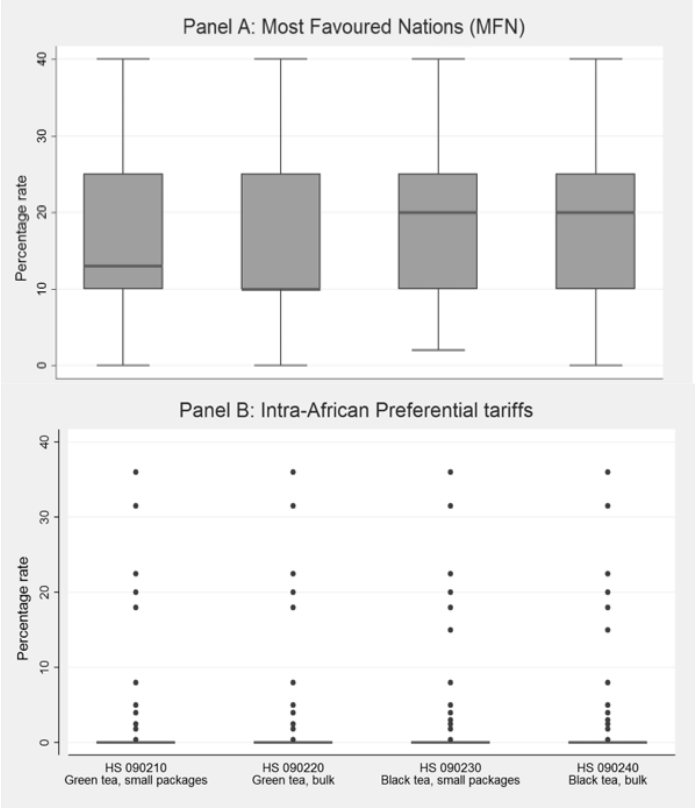
¹⁰ Boxplot diagrams are a standardized way to visually display the distribution of underlying data, highlighting the median (horizontal thick line), first/third quartile (box), upper/lower extreme (whiskers), and outliers (dots).

¹¹ For instance, tea exports from EAC countries to Egypt face different tariffs depending on whether they originate in Kenya (which shares with Egypt COMESA membership), Uganda (which has a special arrangement as member of COMESA even though it has not yet joined the free trade agreement), or Tanzania (which instead faces the MFN tariff). Likewise, tea originating from Malawi, Tanzania and Uganda would face zero tariffs when sold on the Moroccan market thanks to GSP treatment, unlike Kenyan tea which faces a 2.5 per cent tariff.

¹² When we assume that countries will not reduce tariffs in the AfCFTA context more than within their own REC, the potential preference margin for African exporters is bounded upward by the difference between MFN rate and intra-African preferential rates (or zero if the importer country has no preferential tariffs).

The company developments mentioned in box 1 signify that the tea producers can gain from the AfCFTA considerably more than in the past; global and regional markets can be linked and reached.

Figure 4: Average tariff levied by African countries on tea, by HS sub-heading (2014-2016 average)



Source: Computed from UNCTAD’s TRAINS database (2018)

Note: Tariff rates are aggregated at HS 6-digit level through simple average.

3.2 Cocoa and chocolate

The cocoa-chocolate value chain provides another telling example of the challenges Africa faces in fostering greater value addition to its primary commodities, as well as of the scope for AfCFTA to support this process. The relevance of cocoa as one of the continent's main cash crops stems not only from its impact on rural livelihoods (with cocoa smallholders accounting for 95% of the global output), but also from the region's central role in global production (Anga, 2016; UNCTAD, 2016). According to the International Cocoa Organisation (ICCO), in 2016-2017 Africa accounted for 75 per cent of worldwide production of cocoa beans (ICCO, 2018), but paradoxically the continent has struggled to translate its dominance into a significant source of value creation and retention.

The global value of annual chocolate sales is roughly ten times that of cocoa beans, pointing to a skewed value distribution along the chain. In a highly concentrated industry, large multinationals have outsourced agricultural production, but also the intermediate processing stages to international trading houses (Anga, 2016; Morris and Fessehaie, 2014). Thanks to large economies of scale and sophisticated logistical capacities, these latter have moved from grading and sorting into manufacturing of semi-finished products. Meanwhile, confectionery multinationals have developed a growing interest in retaining control of sourcing and processing, in order to pursue strategies of product differentiation, and to satisfy quality and traceability requirements.¹³

The above developments have contributed to improve cost-effectiveness and to ensure the degree of quality and traceability demanded by increasingly sophisticated consumers. Yet, they also entailed tendencies towards an oligopsony market, whereby upstream producers derive relatively small benefits from their participation in the value chain, especially if geographically dispersed and lacking the support of strong farmer-based organizations (ACET, 2014; UNCTAD, 2016).¹⁴ Moreover, the consolidation of the chain has raised entry barriers for African countries aiming to foster forward linkages with confectionery industry, other than in small niche markets. This is exacerbated by the fact that worldwide chocolate consumption is still dominated by mature developed country markets (albeit their weight is declining). Since intermediate products like "couverture chocolate" have a relatively short shelf life, and the overall quality can be severely affected by

¹³ This trend is reinforced by the fact that compliance with taste and colour specifications of high quality chocolate often requires the blending of different varieties of beans, including "fine" varieties chiefly sourced from Latin America (ACET, 2014).

¹⁴ The new floor prices for cocoa beans recently agreed in Cote d'Ivoire and Ghana (Christensen, 2019) may somewhat improve farmers' position and signal the importance of concerted government policies for key commodities; however, they are unlikely to radically tilt the balance in terms of bargaining power along the chain.

inadequate transport and storage (especially with hot temperatures), companies preferably locate processing plants near large destination markets, or at least in areas with good infrastructure and logistics (ACET, 2014).

The interplay of geographic factors, relatively small market size, poor infrastructure, and weak trade logistics has thus resulted in a global division of labour whereby African countries are mainly locked in at the lower rungs of the supply chain. Indeed, while being a sizeable net exporter of raw materials and primary intermediates – with cocoa beans alone accounting for over 70 per cent of exports – the region has remained a net importer of cocoa powder and chocolate. This leaves the continent largely unable to reap many of the benefits from its value chain participation, as epitomized by the estimates of the African Development Bank, which suggest that the continent accrues barely 5 per cent of the \$100 billion annual chocolate market value.¹⁵

Figure 5 corroborates this reading, suggesting that most African countries are yet to embark on the kind of product upgrading which characterized other cocoa producers like Brazil, Malaysia or Indonesia (UNECA, 2015; UNECA and AUC, 2013). Moreover, the figure 5 reveals three broad sets of African countries involved in the cocoa value chain:

1. Major cocoa-producers – Côte d'Ivoire, Ghana, Cameroon, and Nigeria – which are mainly involved at early stages of the chain and predominantly export outside the continent. Thanks to their scale, as well as sectoral incentives, these countries have witnessed some success in attracting investment in grinding plants, allowing them to export also cocoa paste or cocoa butter.¹⁶
2. Large manufacturing hubs, namely South Africa and Egypt, which do not produce cocoa, but engage in the final stages of the confectionery business (and in re-export). Benefitting from their role as sub-regional point of entry, they have attracted the presence of multinationals like Mars, Mondelez and Nestlé, mainly catering for the SADC market in the former case and for Middle East and North Africa in the latter.

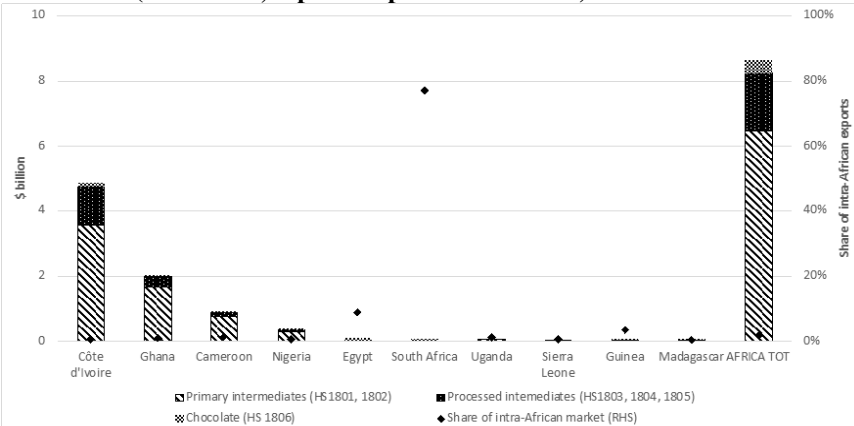
¹⁵ See on the share of Africa in the chocolate market: <https://www.afdb.org/en/news-and-events/reversing-africas-cocoa-paradox-why-easter-celebration-signals-a-call-to-action-17983>

¹⁶ Cote d'Ivoire and Ghana have successfully put in place several incentives to attract investors in cocoa processing, thereby becoming major grinders of cocoa beans. Their diverse experiences highlight how support for domestic value addition can take place under distinct policy frameworks, ranging from a fully liberalized market in Cote d'Ivoire to a situation like Ghana, where the domestic market is liberalized but the national cocoa board, Ghana Cocoa Board (Cocobod), retains the responsibility for marketing cocoa internationally (UNCTAD, 2016).

3. The third group includes smaller cocoa producers, such as Uganda, Sierra Leone, Guinea and Madagascar, where processing is not cost-competitive, and which thus remain confined to the export of cocoa beans (and to a far lesser extent are producing niche products, such as premium chocolate), with negligible involvement in intra-African trade.

Examining the pattern of imports is equally insightful to understand African countries’ participation in the industry and the untapped potential at the regional level. If the main importers of cocoa and related products tend to be the more diversified economies in the region, the composition of their imports is concentrated on processed intermediates and final goods (figure 6). Reliance on imports from outside of Africa is generalised and particularly pronounced for final products, in line with the global reach and branding of confectionary multinationals.¹⁷

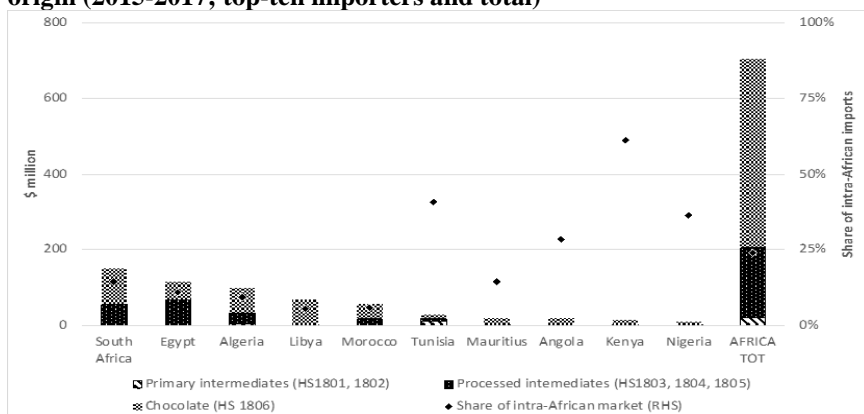
Figure 5: Exports of cocoa and cocoa preparations, by stage of processing and destination (2015-2017; top-ten exporters and total)



Source: Computed from ITC Trademap database (2019)

¹⁷ Tunisia represents a clear outlier, with significant imports of cocoa beans (mainly from Ghana), which are processed domestically mainly to supply the local confectionery industry. Besides, Kenya’s substantial reliance on intra-African imports of chocolate is largely explained by its trade with Egypt within COMESA.

Figure 6: Imports of cocoa and cocoa preparations, by stage of processing and origin (2015-2017; top-ten importers and total)



Source: Computed from ITC Trademap database (2019)

Only with respect to cocoa paste do Africa-originating intermediate imports play a significant role – at least in relative terms – along key corridors such as Cote d’Ivoire-South Africa, Ghana-South Africa, and Ghana-Egypt. While these examples testify some promising developments whereby regional integration is supporting the incipient emergence of Cote d’Ivoire and Ghana as grinding hubs, the prevailing picture remains one of shallow integration and limited value addition.

If anything, there appears to be a sort of dichotomy in African countries’ participation to the cocoa value chain:

- Most cocoa-producing countries are engaged in the value chain through forward participation, supplying raw material and semi-processed intermediates outside the region; and
- A few manufacturing hubs – such as South Africa, Egypt, and to a lesser extent Tunisia – are engaged in backward participation, by predominantly sourcing semi-finished products from outside the continent and are producing chocolate for their domestic and sub-regional markets.

Accordingly, not only production of cocoa beans largely outstrips Africa’s processing capacities, but also the few countries which successfully attracted investment in chocolate and confectionery production have limited (and mainly indirect) backward linkages with the rest of the continent. This ultimately limits the scope for value addition, both in relation to the products exported to the rest of the world and for what pertains to the final goods consumed in the African market (see box 2 below). It also leaves the continent largely reliant on imports from the rest of the world, precisely for the most lucrative and labour-intensive business segments: chocolate and confectionery.

BOX 2: Upgrading stories in Africa's chocolate value chain

Market size and scale economy considerations crucially shape the prospects for upgrading and value addition along the cocoa value chain. In Africa's large cocoa-producing countries, processing at origin has begun to take place in the middle stages of the chain, typically in the context of vertical integration processes involving large multinationals such as Cargill, OLAM, ADM, and Barry Callebaut (CBI, 2018). High production cost (especially due to poor electricity provision), bottlenecks in logistics and distribution, market power asymmetries, combined with the relatively small size of domestic/regional markets, have however constrained the scope for upgrading opportunities in this context (CBI, 2019; Pilling, 2019).

On the other hand, the growing popularity of single origin chocolate in more sophisticated developed markets has started to provide upgrading opportunities also for smaller cocoa-producing countries. Traceability requirements play a fundamental role in this respect, since the origin of the cocoa beans should be known and safeguarded along the chain, in order to justify related price premiums. Both, specialty brands (including within fair-trade circuits) and mainstream retailers contribute to this trend, as exemplified by the collaboration between the producer Tobago Cocoa in Madagascar and the French chocolatier François Pralus, or by the imports of semi-finished products by companies such as Vehgro, or Chocolate Trading UK (CBI, 2019).

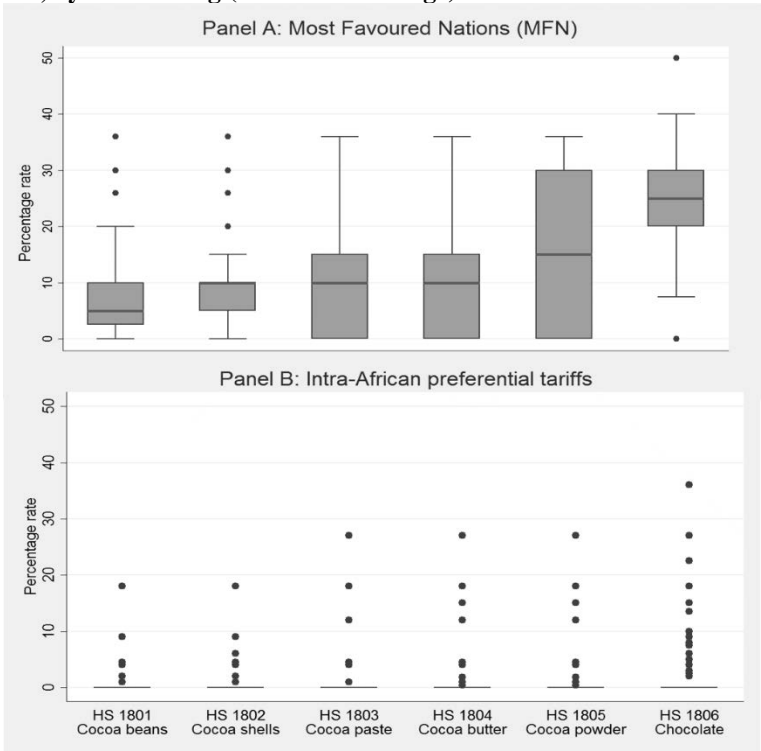
"Bean-to-bar" chocolate is also increasingly manufactured in countries of origin, whether for high-end export segments, or to cater for the small but rapidly expanding local demand, pulled by the rising African middle class. Examples of "bean-to-bar" African chocolate manufacturers include Chocolaterie Robert and Chocolaterie Menakao (Madagascar), '57 Chocolate and Niche Chocolate (Ghana), Uganda (Uganda), Diogo Vaz and Claudio Corallo (São Tomé and Príncipe) (CBI, 2019; Pilling, 2019).

Source: Author

While the above dichotomy is partly driven by the fundamentals of the cocoa value chain – especially in terms of market concentration, buyer-driven nature of the chain, importance of infrastructural and logistic bottlenecks – the prevailing trade policy has exacerbated these adverse conditions. As shown by the distribution of average tariffs levied by African countries on cocoa-related products (figure 7), the sector remains heavily protected, with evidence of tariff peaks (i. e. tariff rates of 15 per cent or above) and tariff escalation in relation to MFN rates (Panel A). Although preferential tariffs are significantly lower (Panel B), the existing REC (Regional Economic Communities) configuration does not lend itself to fully exploiting the scope for intra-African cocoa trade. Indeed, only final products (HS

1806) are intensively traded on a preferential basis in the region, with South Africa and Egypt being the entry points to SADC and to COMESA, respectively. This is aggravated by the lack of cumulation across African RECs, which makes downstream producers indifferent to the origin of inputs, unless they come precisely from within their own RECs (regional economic communities).

Figure 7: Average tariff levied by African countries on cocoa and cocoa preparations, by HS heading (2014-2016 average)



Source: UNCTAD secretariat calculations, based on data from TRAINS database (accessed October 2018)

Note: Tariff rates are aggregated at HS 4-digit level through simple average.

In a business dominated by few global players and with considerable scale economies, the relative success of Egypt and South Africa in attracting a significant presence of key manufacturers, acting as hubs for their respective sub-regions, confirms that large “regional-level addressable consumer markets is a precondition for the development of retail chocolate and couverture production” (ACET, 2014, p. 6). Figure 7 suggests, however, that fragmentation is still prevalent across

existing RECs, where MFN tariffs apply but also where the scope for intra-African trade is plausibly the highest. Hence, the strategic importance of the AfCFTA as a complement to sectoral industrial policies to engage more effectively manufacturing firms in promoting upgrading and local value addition is huge.

3.3 Cotton textiles and apparel

Since the industrial revolution, the textile and clothing industry has been regarded as the first rung in the light manufacturing ladder, deserving particular attention due to the size of its potential market and to its labour-intensive nature (which paves the way for labour reallocation across sectors). Cotton plays a critical role in this context, representing roughly 30 per cent of the worldwide textile fibres consumption, and was identified as one of the continent's strategic crops in the 2006 Abuja Food Security Summit (African Union, 2006).

Following the phasing out of the so-called Multifibre Agreement in 2005, the international textile and apparel industry has been characterised by heightened levels of competition and by the emergence of global value chains (GVCs). Internationalization has enabled lead firms to splinter and offshore production phases to better exploit cost differentials and comparative advantages, with market incentives replacing quotas as key drivers of international trade and investment flows (López Acevedo and Robertson, 2016; UNCTAD, 2018). These developments have underpinned the emergence of Asia as “the epicentre of export-oriented apparel production” (Gereffi et al., 2005, p. 91), in a fashion industry characterized by fast-changing consumer demand, and critical importance of timely delivery and quality assurance (PwC, 2008). Although their weight is eroding, developed countries have retained their role of the key final consumption market, accounting for about half of global apparel imports. In this context, foreign direct investment (FDI) has become one of the main drivers of insertion in textile and clothing value chains, with fiscal incentives and preferential access to key markets, representing the main determinants of lead firms' locational choices.¹⁸

In terms of structural characteristics of the chain, the upstream textile segment (i.e. yarn and spinning) remains relatively capital-intensive and with significant scale economies, while the apparel segment tends to be more labour-intensive and can in principle accommodate for unskilled workers (López Acevedo and Robertson, 2016). The degree of control exerted by lead firms along the value chain varies from captive arrangements, such as “cut-make and trim” (in which fabrics are

¹⁸ In the African context, preferential schemes such as EU's Everything But Arms (EBA) or US' Africa Growth and Opportunity Act (AGOA) have played a key role in this respect, given the weight of the corresponding consumer markets and the magnitude of related preferential margins (N'Diaye, 2010; UNECA and AUC, 2013).

sources and owned by the lead firms and the contractor is paid through a processing fee), to “original design manufacturing”, “full-package service providers”, or even “original brand manufacturing”, whereby contractors take up more complex and higher value-added functions, such as design, supply-chain coordination or even retailing of own-branded product (Gereffi et al., 2005; UNCTAD, 2018). The governance and control structure of the GVC critically affects development opportunities for the actors involved, be it in terms of product and process upgrading, or of functional, channel and intersectoral upgrading (*ibidem*).

Against this background, African textile and apparel firms have been confronted by two-fold challenges. On the one hand, limited domestic purchasing power and regional market fragmentation have left them largely unable to reach adequate economies of scale to sustain price competition. On the other hand, their GVC participation has been penalized not just by high production costs, but also by poor infrastructures, cumbersome trade procedures, and weak quality assurance frameworks, all of which undermined competitiveness in high-end market segments. As a result, the African textile and apparel sector has witnessed declining export revenues and job losses, with only few countries being able to capitalize on preferential market access (Njinkeu et al., 2013; UNCTAD, 2019b; UNECA and AUC, 2013).

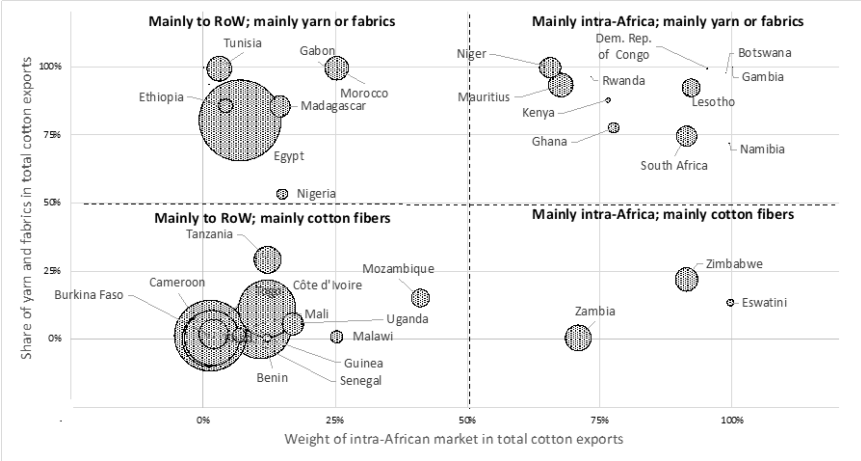
Africa’s weight in the international cotton and apparel market has structurally been circumscribed, especially if compared to Asia. According to FAOSTAT data, the continent produced 6 per cent of worldwide cotton lint, accounting for a market share of 5 and 2 per cent of global exports of cotton (HS 52 chapter) and apparel (HS 61 and 62) respectively, in 2015-2017. Notwithstanding this peripheral role, cotton represents a key export good and is a source of livelihood for some countries in the region, notably for the so-called “Cotton Four” – Benin, Burkina Faso, Chad, and Mali. Likewise, Africa’s apparel exports totalled nearly \$9 million per year, and the sector accounted for at least five per cent of merchandise exports in nine African countries out of 52 for which data is available.

As for other agricultural commodities, the analysis of the cotton value chain underscores wide untapped opportunities for linkage development and diversification. Some 70 per cent of Africa’s cotton exports are accounted for by primary intermediates (HS 5201-5203), such as cotton fibres; only 12 per cent take the form of yarn (HS 5204 to HS 5207), and 18 per cent of fabrics (HS 5208 to HS 5209). The composition of imports, conversely, is almost symmetric: 12 per cent is accounted for by primary intermediates, 16 per cent by yarn, and 72 per cent by cotton fabrics. As a result of this specialization pattern, if Africa is a net exporter of cotton fibres, it consistently reported a trade deficit for what pertains to yarn, and even more so to fabrics.

As a matter of fact, excepting Egypt, the largest cotton exporters – including the “Cotton Four” – are typically confined to the production of cotton fibres, and so are also most of the smaller exporters (figure 8). Africa’s integration in the

cotton GVC is thus driven mainly by forward participation – that is exports of raw material and intermediate inputs, mainly to Asia and to a lesser extent Europe. Southern Africa constitutes a notable exception to this pattern, in that regional value chains have acquired a certain depth, with Zambia and Zimbabwe exporting mainly cotton fibres, while Eswatini (Swaziland, renamed in 2018), Lesotho, Mauritius and South Africa are trading mainly yarn and fabrics. South African investors represent one of the main drivers behind these trends, as they increasingly operate in neighbouring countries, to take advantage of lower labour costs in the context of near-shoring strategies (Staritz et al., 2016; UNCTAD, 2018). In overall terms, however, the shallowness of regional integration is underscored by the fact that intra-African trade accounts for 15 per cent of cotton exports and barely 12 per cent of imports.

Figure 8: Exports of cotton (HS 52) by stage of processing and region of destination (2015-2017)

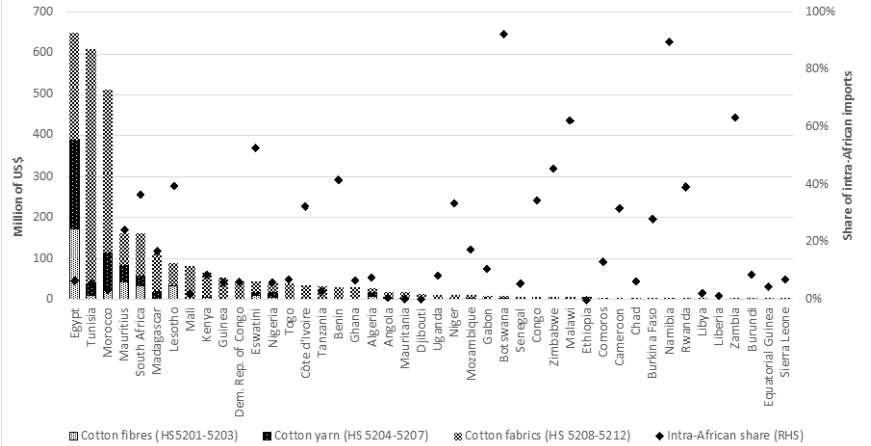


Source: Computed from ITC Trademap database (2019) **Note:** The size of the bubble is proportional to cotton export revenue; some country labels for minor exporters whose export revenue was lower than one million US\$ have been removed to enhance readability

Africa’s cotton imports are dominated by large apparel producers in Northern and Southern Africa, which predominantly source fabrics from outside the continent (figure 9 and figure 10). This occurs in the framework of GVCs, mainly geared towards supplying branded apparel products to developed markets, whereby lead firms provide the inputs to be processed, often under cut-make and trim arrangements (López Acevedo and Robertson, 2016; N’Diaye, 2010; UNCTAD, 2018). Over the 2015-2017 period, intra-African trade only accounted for 10 per cent of the continent’s apparel exports, and 17 per cent of its imports, underscoring the

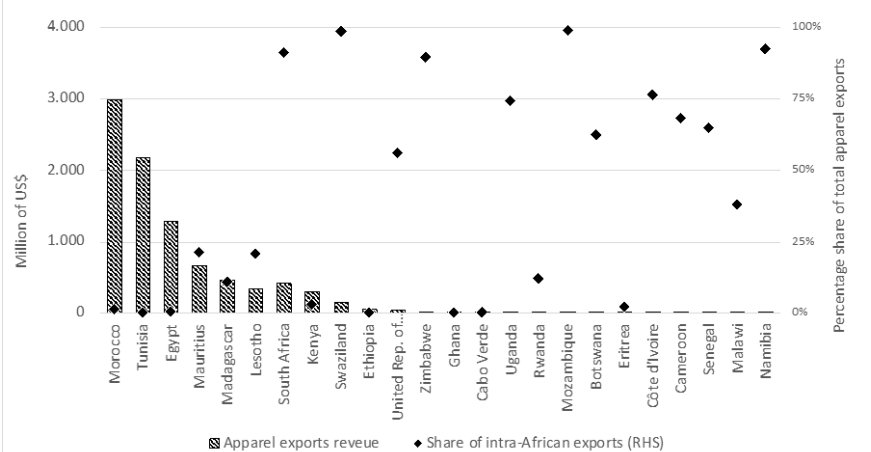
fact that Africa’s participation to the industry is essentially geared towards supplying non-regional markets (mainly through preferential access to developed countries).

Figure 9: Imports of cotton (HS 52) by stage of processing and region of origin (2015-2017)



Source: Computed from ITC Trademap database (2019)

Figure 10: Main apparel exporters – HS 61-62 (2015-2017)



Source: Computed from ITC Trademap database (2019)

Note: For readability purposes the graph is truncated to only report countries with an apparel export revenue exceeding one million US\$.

The above picture points to a poor record in implementing the Declaration of the Abuja Food Security Summit, which envisaged the strengthening of cotton regional value chains (AU, 2006). Not only the regional market remains comparatively small on a global scale, but major African markets and producers are weakly integrated with one another, except in the SADC region. Hence, African producers tend to be engaged at the extremes of the chain, either as suppliers of raw material, or in low-value activities of assembly cut, make and trim.

In this way, uneven progress towards regional integration has exacerbated the structural drivers of the decline of Africa's textile industry, leaving most firms with limited bargaining power in the context of captive value chains. With an eye to sustainable industrialization and SDG 9, such a shallowness of regional value chains represents a lost opportunity, in so far as regionally embedded chains tend to provide greater scope for upgrading (Staritz et al., 2016; UNCTAD, 2018). Moreover, this holds true not only in relation to market size and the traditional rationale for regional integration, but potentially also as it pertains to emerging trends, influencing Africa's apparel industry and related opportunities (see box 3 below).

BOX 3: Upgrading stories in Africa's cotton value chain

Beyond the traditional economies of scale argument, two emerging trends are potentially reshaping the rationale for pursuing regional embeddedness of key actors in Africa's value chain: the rise of sustainability standards, and the growing prominence of African fashion industry. Though not intrinsically linked to regional integration issues, these drivers lend themselves to be best harnessed in that context, as shown by recent examples in the continent.

Regional integration and sustainability concerns feature prominently in Tanzania's cotton to clothing strategy 2016-2020, designed to leverage cotton production as a springboard for more meaningful socioeconomic progress. (ITC, 2015). Similarly, in the case of Ethiopia sustainability standards were deliberately leveraged as part of the value proposition to successfully attract investments by PVH Corporation (PVH is one of the largest global apparel companies with over \$8 billion in revenues) – which owns brands such as Tommy Hilfiger and Calvin Klein – in the Hawassa Eco-Industrial Park (Mihretu and Llobet, 2017; Oqubay and Lin, 2020). Policy incentives and preferential market access considerations also played an important role for PVH's locational decision, but they were purposely geared towards ensuring strong links to the domestic and regional economy. While it may be too early to judge the concrete merits of this initiative and as some concerns have been raised in relation to working conditions, there are incipient signs that the strong emphasis on embeddedness is

providing an avenue to link cotton producers and Small and Medium Enterprises (SMEs) to the clothing value chain (Barret and Baumann-Pauly, 2019; Mihretu and Llobet, 2017).

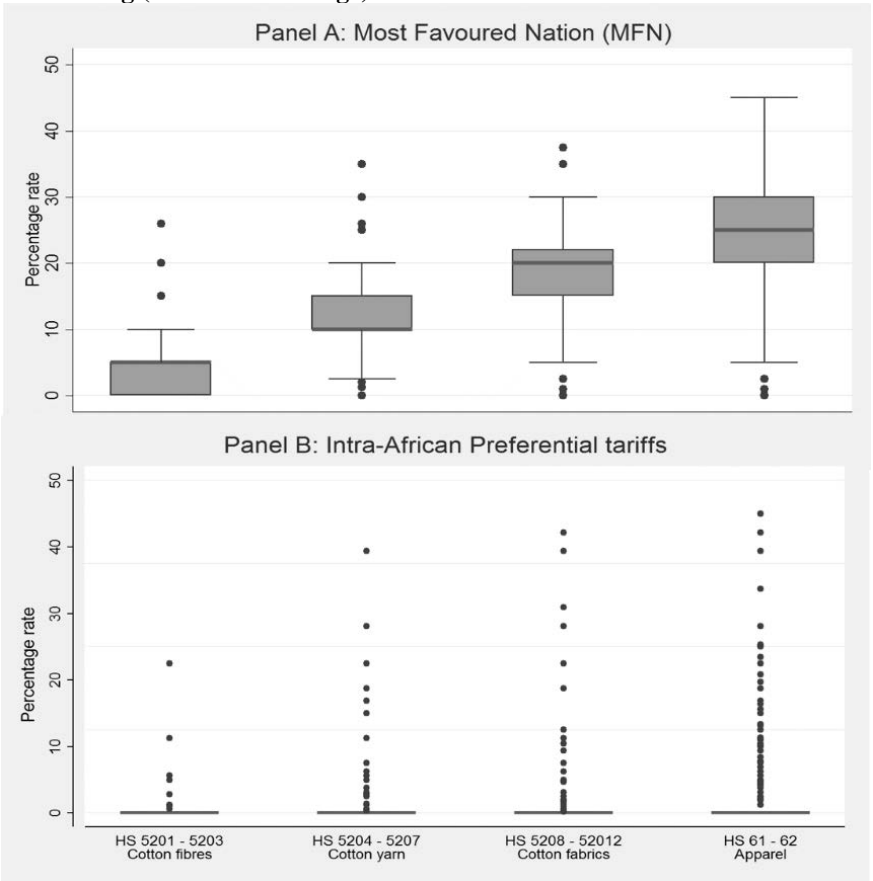
As attains to the boom of Africa's fashion and design industry, according to the African Fashion Foundation (AFF) the business on the continent is worth an estimated \$31 billion, with promising prospects both regionally – especially in countries such as Egypt, Ethiopia, Kenya, Nigeria, Senegal, and South Africa – and within the African diaspora (AFF, 2019; Rao, 2019). Companies such as African Fashion Houses (South Africa), Quophi Akotuah (Ghana), Tiffany Amber (Nigeria), or Tongoro (Senegal) are spearheading efforts to take advantage of this market, often sourcing materials from the continent as part of their African branding strategies (AFF, 2019; France 24, 2019).

Source: Author

Confirming the fragmentation of the regional market, the boxplot of MFN tariffs on cotton and apparel products (figure 11, Panel A) reveals high levels of protection, significant tariff peaks, and clear signs of tariff escalation; all of which tends to hinder viable regional value chains. Levels of protection are significantly lower when moving to preferential (mainly intra-REC) tariffs (figure 11, Panel B); yet existing RECs hardly provide enough scope for reaching adequate economies of scale, especially once non-tariff barriers and poor infrastructural provision are factored in.

Although these three groups of products have their own structure, the limits of their respective value chains in terms of Africa's industrialization process are obvious and need a careful analysis of possible interventions. It would be quite important to study successful actors in Africa at the company level, but also at the industrial policy level.

Figure 11: Average tariffs levied by African countries on cotton products, by HS heading (2014-2016 average)



Source: UNCTAD secretariat calculations, based on data from TRAINS database (accessed October 2018)

Note: Tariff rates are aggregated at HS 4-digit level through simple average.

4 The African Continental Free Trade Area (AfCFTA) and Commodity-based Industrialization: A Synthesis

Regardless of the specificities of each of the value chains considered, key commonalities emerge in relation to the interplay between commodity-dependence and untapped opportunities to harness regional integration. Although there is a great relevance of the cash-crop sectors for African countries, forward linkages with

agro-processing industry remain elusive, as most countries struggle to compete in the manufacturing stages, where scale economies and entrepreneurial capabilities play a large role. Hence, African economies remain confined to exporting low value-added goods, while increasingly resorting to imports of semi-finished or final products from the rest of the world. Excepting Southern Africa, regional value chains remain rather shallow and disjointed, at most stretching within existing RECs (regional economic communities).

In all three cases, the buyer-driven tendencies of the GVCs, along with market concentration in downstream segments, have tended to exacerbate a lopsided pattern of specialization. As a result, premature de-industrialization has taken place even in sectors where, in principle, African economies have (latent) comparative advantages. Meanwhile, GVC participation has triggered only limited upgrading opportunities, as epitomized by the developments in the textile and garments value chain (Morris and Fessehaie, 2014; Rodrik, 2018). Even in those countries that were able to boost their exports to key developed countries markets, thanks to preferential schemes such as the EBA or AGOA initiatives, these activities have typically taken place in the context of captive value chains, providing limited scope for productivity growth.

Admittedly multiple factors concur to explain this outcome, ranging from lack of investment and technological upgrading, to poor infrastructural provision, skill shortages, as well as misguided policies (Soludo et al., 2004; UNECA and AUC, 2013). After years of crisis and underinvestment in the 1980s and 1990s, the African manufacturing sector has struggled to cope with the increasing competition and the shifts in business practices brought about by the emergence of GVCs. The latter factor has increased the relevance of scale economies and entrepreneurial capabilities – from logistics and quality assurance, to marketing and R&D – making it harder for new entrants to contest the market to incumbents. Meanwhile, the poor state of hard and soft infrastructure in most African countries have weighed further down the competitiveness of local producers.¹⁹

Although trade-related policies are only one of the multifaceted drivers of this situation, the earlier analysis points to the fact that the fragmentation of the continental market has been counterproductive and ultimately at odds with industrial policy objectives. Not only the high levels of protection, combined with the presence of tariff peaks and tariff escalation, have prevented domestic manufacturers from reaching a minimum efficient scale, but they have also thwarted efforts to attract market-seeking investment by lead manufacturers, except for a few larger and more diversified economies.

¹⁹ According to data from Doing Business 2019, just to cite one example, African traders paid USD 290 more than the world average for border and documentary compliance, spending 76 hours longer (reported figures representing the average difference between the time/monetary costs of import and exports).

Fully harnessing the potential of intra-African trade as a springboard for sustainable industrialization would require the deepening and broadening of regional value chains, in the context of an integrated regional market with buoyant demand prospects. The strategic opportunity underpinning the AfCFTA should be regarded precisely in this perspective, as a critical step to take full advantage of a relative sophistication of intra-African trade, thus enhancing the consistency of trade and agricultural/industrial policies. The previous analysis suggests at least three concrete ways in which this could be achieved.

First, by reducing the high levels of protection across the continent (hence simultaneously lessening the distortions generated by the “spaghetti bowl” of partly overlapping REC memberships) the AfCFTA can broaden the scope to harness trade complementarities over and beyond existing RECs (regional economic communities). By itself, this may not be enough to reverse across the board Africa’s dependence on exporting commodities or its reliance on imported inputs and capital goods. Yet, even in the short/medium run, cheaper access to African intermediates could improve competitiveness in downstream segments and gradually unlock opportunities for processing in relatively less sophisticated supply chains: those in the “adjacent possible”, to borrow the terminology of Hausmann and Chauvin (2015). As noted earlier, agro-processing is arguably among the most promising areas in this respect, in so far as: (i) the scope for tariff cuts is relatively large, (ii) the sector is characterized by moderate levels of sophistication and capital-intensity, and (iii) it mainly focuses on consumption goods, whose demand is set to expand, as a result of demographic growth and of the emergence of an African middle class (Hausmann and Chauvin, 2015; Lin, 2012; UNECA, 2009; UNECA and AUC, 2013).

Secondly, the establishment of the AfCFTA, by forging a larger integrated market than existing RECs, provides an opportunity to harness greater economies of scale, which potentially stimulate investment in manufacturing capacities.²⁰ Market-seeking investors could be enticed even further by a concerted strategic use of tariff schedules, to provide meaningful preference margins to African products, especially in downstream segments of the value chain where tariff peaks are more frequent. Though some preference erosion is likely on the medium/long term, until then such strategy could partly offset higher production costs of African manufacturers, somewhat resembling a regional-wide infant industry protection.

²⁰ Refer to the earlier sections on cocoa and textiles/apparel for concrete examples of how market size and regional integration were instrumental in attracting investment in manufacturing stages. This was notably the case for South Africa, in relation to SADC market, and for Egypt in relation to Common Market for Eastern and Southern Africa (COMESA) and/or the Pan Arab Free Trade Area (PAFTA).

Thirdly, smooth operationalization of the AfCFTA permits to ensure greater alignment between the sequencing of trade liberalization and Africa's industrial policy objectives. Under the current scenario of uneven liberalization within and across African RECs, bilateral trade agreements with third (i.e. non-African) countries may result in a paradoxical situation, whereby some African producers face higher tariffs when exporting to other RECs within the continent, than their competitors from more developed third countries.²¹ Against this background, a rapid operationalization of the AfCFTA, as envisaged in the seventh meeting of African Ministers of Trade (which set a deadline for implementation by July 2020), could go a long way in ensuring that market liberalization occurs gradually and with a coherent sequencing: first at the regional level – where economic conditions are *relatively* less heterogeneous – and later on towards more developed third partners.

More broadly, the analysis of the three value chains considered highlights the importance of buttressing regional integration and trade reforms with regionally coordinated and sector-specific industrial policies, in order to address competitiveness in a holistic and inclusive manner. This will imply accounting for the fact that trade gains might be unevenly distributed and contingent on each actor's (country's) positioning and bargaining power within the chain. Smooth implementation of the regional agenda will thus hinge upon striking a delicate balance among competing interests, while maintaining the focus on the long-term objective of fostering sustainable industrialization. For instance, relatively more diversified economies could actively support the involvement of producers from poorer African countries in regional value chains. Particularly critical, with a view to temper the asymmetries along commodity-based value chains, will it be to engage lead firms and to account for their strategies, while also strengthening farmer-based organizations and fostering the insertion of Small and Medium Enterprises (SMEs) into broad regionally embedded chains.²² In this perspective, it might be advisable to utilize the AfCFTA as a platform to foster greater policy coordination at a regional level, especially in areas such as industrial collaboration, skill-pooling, R&D alliances, and greater circulation of specialised service providers.

²¹ Depending on the length of the transition period, this risk could materialize, for instance, in relation to African countries which have committed to liberalize their markets to European producers, in the context of the Economic Partnership Agreements (EPAs), or of Euro-Mediterranean partnerships (including large economies like Egypt, Morocco and South Africa).

²² Certification schemes could be useful in this respect, enabling the emergence of a broader range of more diversified products, especially in niche segments such as organic products, geographical indications, fair trade, and the like. This could improve the inclusivity of the value chain, even though there is considerable variability on the outcome of different certification schemes (FAO, 2018b).

5 Concluding Remarks

Overall, our reading of the evidence is that, if admittedly it is no silver bullet towards Africa's industrialization, the establishment of the AfCFTA represents an important step to enhance the consistency of the continent's trade policy framework to its agricultural/industrial policy objectives. As the examples of the three value chains examined here suggest, the uneven progress towards regional integration has so far constrained the scope for harnessing economies of scale and trade complementarity. This in turn has undermined efforts to foster greater inter-sectoral linkages between commodity sectors and manufacturing, leaving most African countries trapped in primary commodities dependence.

If duly designed and implemented, the AfCFTA presents an opportunity to redress this situation, leveraging the relatively higher sophistication and dynamism of intra-African trade to support the quest for industrialization. Tackling tariff and non-tariff barriers, however, will only go as far; unlocking opportunities for commodity-based industrialization will inevitably hinge upon an adequate mobilization of investment to tackle infrastructural bottlenecks and to promote technological and skill upgrading. Ultimately, the supply response to the stimulus provided by regional integration will be contingent on a broader range of productive investments, from irrigation and rural infrastructures, to up-skilling, R&D, and the like.

The above considerations point to the need to establish a mutually supportive relationship between regional integration and policies geared towards sustainable and inclusive industrialization (SDG 9), itself a key element of Africa's sustainable development agenda. In particular, the operationalization of the AfCFTA should be seen as a complement to other continentally agreed frameworks geared towards structural transformation, such as the Programme for Infrastructure Development in Africa (PIDA), the Comprehensive Africa Agriculture Development Programme (CAADP), and the commitment to the Accelerated Industrial Development for Africa (AIDA) strategy.

Seen in this perspective, as a crucial complement to other flagship initiatives set out in the BIAT (Boosting Intra-African Trade) Action Plan by the AUC (African Union Commission), the potential contribution of the AfCFTA to the attainment of SDG 9 stands out more clearly. The previous analysis has demonstrated the links between the former and the targets related to sustainable and inclusive industrialization (namely targets 9.2 and 9.B), with particular reference to the scope for the AfCFTA to pave the way for commodity-based industrialization and providing a platform for industrial policy coordination. Furthermore, by enabling African countries to reach higher economies of scale, thus potentially attracting greater investments, the AfCFTA can also be expected to support the achievement of SDG target 9.5 on technological upgrading. More broadly, a vibrant and more integrated regional market is also likely to enhance the viability of sustainable resilient and inclusive infrastructural investments (in line with SDG targets 9.1, 9.4,

and 9.A), as well as of stimulating greater financial deepening (encompassed under SDG target 9.3).

So far, the display of strong political will behind the AfCFTA is encouraging, and much ground has been covered in the negotiations. Now it is time to keep the momentum towards implementation, exercising flexibility and pragmatism to solve the inevitable trade-offs and allow for fine-tuning and policy experimentation. Beyond the technicalities of trade agreements, the litmus test of Africa's success in regional integration will ultimately transcend the mere trading sphere and depend on its supportive role in unlocking structural transformation.

References

- ACET, 2014. The Cocoa Agroprocessing Opportunity in Africa. African Center for Economic Transformation (ACET), Accra (Ghana).
- AFF/ African Fashion Foundation, 2019. African Fashion Foundation. URL <https://africanfashionfoundation.org/>.
- AFP/Agence France-Presse, 2019. Kenya tea producers turn over a new leaf as prices stumble. France 24. URL <https://www.france24.com/en/20191231-kenya-tea-producers-turn-over-a-new-leaf-as-prices-stumble>
- Anderson, J. E., van Wincoop, E., 2003. Gravity with Gravitas: A Solution to the Border Puzzle. *Am. Econ. Rev.* 93, pages 170–192.
<https://doi.org/10.1257/000282803321455214>
- Anga, D. J.-M., 2016. Internalizing the cocoa value chain in producing countries.
- AU/African Union, 2006. Declaration of the Abuja Food Security Summit.
- Barret, P., Baumann-Pauly, D., 2019. Made in Ethiopia: Challenges in the Garment Industry's New Frontier. NYU Stern Center for Business and Human Rights, New York.
- Bouët, A., Cosnard, L., Laborde, D., 2017. Measuring Trade Integration in Africa. *J. Economic Integration*, 32, pages 937–977. <https://doi.org/10.11130/jei.2017.32.4.937>
- Brühlhart, M., 2009. An Account of Global Intra-industry Trade, 1962–2006. *World Economy* 32, pages 401–459. <https://doi.org/10.1111/j.1467-9701.2009.01164.x>
- CBI, 2019. Exporting semi-finished cocoa products to Europe. CBI - Centre for the Promotion of Imports from developing countries, The Hague, Netherlands.
- CBI, 2018. A guide to product development for cocoa exporters. CBI - Centre for the Promotion of Imports from developing countries, The Hague, Netherlands.
- CBI, 2016. What requirements should tea meet to be allowed on the European market? CBI - Centre for the Promotion of Imports from developing countries, The Hague, Netherlands.
- CBI, 2014. Promising export markets for Kenyan tea packed at origin. CBI - Centre for the Promotion of Imports from developing countries, The Hague, Netherlands.

- Christensen, S., 2019. Cocoa buyers agree to floor price proposed by Ghana, Ivory Coast [WWW Document]. Reuters. URL <https://www.reuters.com/article/us-cocoa-ivory-coast-ghana-idUSKCN1TD20G> (accessed 10.18.19).
- Christiaensen, L., Demery, L., Kuhl, J., 2011. The (evolving) role of agriculture in poverty reduction—An empirical perspective. *Journal of Developing Economies*, 96, pages 239–254. <https://doi.org/10.1016/j.jdeveco.2010.10.006>
- DAFF, 2016. A profile of South African rooibos market value chain. Department for Agriculture Forestry and Fisheries (DAFF) - Republic of South Africa, Pretoria.
- DAFF, 2013. A profile of South African black tea market value chain. Department for Agriculture Forestry and Fisheries (DAFF) - Republic of South Africa, Pretoria.
- de Melo, J., Nouar, M., Solleder, J.-M., 2017. Integration Along The Abuja Road Map: A Progress Report. (WIDER Working Paper 2017/103). UNU-WIDER, Helsinki.
- Depetris Chauvin, Nicolas, Ramos, M.P., Porto, G., 2016. Trade, growth, and welfare impacts of the CFTA in Africa.
- FAO, 2018a. Emerging trends in tea consumption: informing a generic promotion process. Presented at the Intergovernmental Group on Tea - 23rd session, Committee on Commodity Problems, FAO, Hangzhou, China.
- FAO/Food and Agriculture Organization, 2018b. Fostering sustainability in tea production and trade: Assessing the impact of certification schemes on farm income, inclusive rural development and market access. Presented at the Intergovernmental Group on Tea - 23rd session, Committee on Commodity Problems, FAO, Hangzhou, China.
- FAO/Food and Agriculture Organization, 2014. Developing sustainable food value chains – Guiding principles. Food and Agriculture Organization of the United Nations (FAO), Rome.
- Gereffi, G., Humphrey, J., Sturgeon, T., 2005. The governance of global value chains. *Review of International Political Economy*, 12, pages 78–104. <https://doi.org/10.1080/09692290500049805>
- France 24, 2019. Across Africa - Tiffany Amber: 20 years of Nigerian Ready to Wear. France 24. URL <https://www.france24.com/en/across-africa/20190306-fashionweek-chad-refugees-tiffany-amber-folake-coker-fespaco-georja-calvin-sm>
- Hausmann, R., Chauvin, J., 2015. Moving to the Adjacent Possible: Discovering Paths for Export Diversification in Rwanda (No. 294), CID Working Papers. Center for International Development at Harvard University.
- ICCO/International Cocoa Organisation, 2018. ICCO Quarterly Bulletin of Cocoa Statistics (No. Vol. XLIV, No. 2, Cocoa year 2017/18). International Cocoa Organisation (ICCO), Abidjan, Côte d'Ivoire.
- IMF/International Monetary Fund, 2019. Sub-Saharan Africa Regional Economic Outlook: Recovery Amid Elevated Uncertainty. International Monetary Fund (IMF), Washington D. C.
- ITC, 2015. United Republic of Tanzania cotton-to-clothing strategy (sector development strategy). International Trade Centre (ITC), Geneva, Switzerland.

- ITC Trade Map Database, 2019. URL <https://www.trademap.org/Index.aspx?AspxAutoDetectCookieSupport=1>.
- Kamau, S., 2015. Tea firms eye variety, value addition for higher revenue. *The East African*. URL <https://www.theeastafrican.co.ke/business/Kenya-tea-firms-eye-variety--value-addition-for-higher-revenue--/2560-2675852-ldwv7jz/index.html>.
- KETEP/ Kenya Tea Packers Limited, 2019. Company History. Kenya Tea Pack. Ltd. KETEP. URL <https://ketepa.com/company-history/>.
- Kihara, G., 2011. Value added tea lifts volume of Kenya's exports. *Business Daily*. URL <https://www.businessdailyafrica.com/markets/Value-added-tea-lifts-volume-of-Kenya-exports/539552-1204820-fg7iuo/index.html>.
- Lin, J. Y., 2012. *New Structural Economics: A Framework for Rethinking Development and Policy*, 1 edition. ed. World Bank Publications, Washington, D.C.
- Loconto, A., 2012. Value Chains and Chains of Values: Tracing Tanzanian Tea, in: *Local Agri-Food Systems in a Global World: Market, Social and Environmental Challenges*. Cambridge Scholar Publishing, Newcastle upon Tyne, pp. 195–214.
- López Acevedo, G., Robertson, R. (Eds.), 2016. Stitches to riches? apparel employment, trade, and economic development in South Asia, *Directions in development Poverty*. World Bank Group, Washington, D.C., USA.
- Mevel, S., Karingi, S., 2013. Towards a Continental Free Trade Area in Africa: a CGE modelling assessment with a focus on agriculture, in: *Shared Harvests: Agriculture, Trade, and Employment*. International Labour Office and United Nations Conference on Trade and Development, Geneva, Switzerland, pp. 281–324.
- Mihretu, M.E., Llobet, G., 2017. Looking beyond the horizon: A case study of PVH's commitment to Ethiopia's Hawassa industrial park (No. 117302). The World Bank, Washington D.C.
- Monroy, L., Mulinge, W., Witwer, M., 2013. Analysis of incentives and disincentives for tea in Kenya, *Monitoring of African Food and Agricultural Policies*. Food and Agriculture Organization of the United Nations (FAO), Rome.
- Morris, M., Fessehaie, J., 2014. The industrialisation challenge for Africa: Towards a commodities-based industrialisation path. *J. Afr. Trade* 1, 25–36. <https://doi.org/10.1016/j.joat.2014.10.001>
- Naudé, W., 2009. Geography, transport and Africa's proximity gap. *Journal of Transport Geography*, 17, pages 1–9. <https://doi.org/10.1016/j.jtrangeo.2008.04.011>
- N'Diaye, A., 2010. Influence des stratégies locales dans les chaînes globales de valeur. *Revue Française De Gestion*. Pages 141–159.
- Njinkeu, D., Lohi, J., Djiofack, C. Z., 2013. Trade Facilitation and African Industrialization in the New global Order: An Agenda for Action for Textile and Apparel Industry, in: Stiglitz, J. E., Yifu, J. L., Patel, E. (Eds.), *The Industrial Policy Revolution II: Africa in the 21st Century*, International Economic Association Series. Palgrave Macmillan UK, London, pp. 412–454. https://doi.org/10.1057/9781137335234_17
- OAU/Organization for African Unity, 1991. Treaty establishing the African Economic Community.

- OAU/Organization for African Unity, 1979. Declaration and resolutions adopted by the ordinary session of the assembly of heads of State and Government.
- OAU/Organization for African Unity, 1963. Charter of the Organization of African Unity.
- Oqubay, A., Lin, J.Y. (Eds.), 2020. *The Oxford Handbook of Industrial Hubs and Economic Development*, Oxford Handbooks. Oxford University Press, Oxford, New York.
- Pilling, D., 2019. The African farmers taking on big chocolate. *Financ. Times FT*.
- Rao, P., 2019. Battling the damaging effects of 'fast fashion.' *Africa Renewal*.
- PwC/ PricewaterhouseCoopers, 2008. Global sourcing shifting strategies: A survey of retail and consumer companies. PricewaterhouseCoopers (PwC).
- Rodrik, D., 2018. New Technologies, Global Value Chains, and the Developing Economies. Pathways for Prosperity Commission Background Paper Series No 1, University of Oxford, Pathways for Prosperity Commission.
- Sandrey, R., 2017. African production and trade of coffee and tea in perspective: What are the implications for continental trade liberalization?
- Saygili, M., Peters, R., Knebel, C., 2017. African Continental Free Trade Area: Challenges and opportunities of tariff reductions.
- Signé, L., 2018. The potential of manufacturing and industrialization in Africa. Africa Growth Initiative at Brookings, Washington D.C.
- Soludo, C., Ogbu, M. O., Chang, H.-J., 2004. The Politics of Trade and Industrial Policy in Africa: Forced Consensus?. International Development Research Centre (IDRC), Ottawa.
- Staritz, C., Morris, M., Plank, L., 2016. Clothing Global Value Chains and Sub-Saharan Africa: Global Exports, Regional Dynamics and Industrial Development Outcomes (International Trade Working Paper No. 2016/16). Commonwealth Secretariat, London, United Kingdom.
- UNCTAD/ United Nations Conference on Trade and Development, 2019a. Key Statistics and Trends in Regional Trade in Africa. United Nations Conference on Trade and Development (UNCTAD), Geneva.
- UNCTAD/ United Nations Conference on Trade and Development, 2019b. Economic Development in Africa Report 2019: Made in Africa – Rules of Origin for Enhanced Intra-African Trade. United Nations, New York and Geneva.
- UNCTAD/ United Nations Conference on Trade and Development, 2018. The Least Developed Countries Report 2018: Entrepreneurship for structural transformation - Beyond business as usual, The least developed countries report. United Nations Conference on Trade and Development (UNCTAD), New York and Geneva.
- UNCTAD/ United Nations Conference on Trade and Development, 2016. Cocoa Industry: Integrating Small Farmers into the Global Value Chain. UNCTAD, New York (NY) and Geneva. <https://doi.org/10.18356/cfb75b0e-en>
- UNCTAD - Trade Analysis Information System (TRAINS) Database, 2018. URL <https://databank.worldbank.org/reports.aspx?source=UNCTAD--Trade-Analysis-Information-System-%28TRAINS%29>.

- UNCTADstat Database, 2019. URL <https://unctadstat.unctad.org/EN/>.
- UNECA/ United Nations Economic Commission for Africa, 2015. Economic Report on Africa 2015: Industrializing through trade. United Nations Economic Commission for Africa, Addis Ababa.
- UNECA/ United Nations Economic Commission for Africa, 2009. Economic Report on Africa 2009: Developing African agriculture through regional value chains. United Nations Economic Commission for Africa (UNECA), Addis Ababa.
- UNECA/ United Nations Economic Commission for Africa, AU/African Union, AfDB/African Development Bank, 2017. Assessing Regional Integration in Africa VIII: Bringing the Continental Free Trade Area About, Assessing Regional Integration in Africa. United Nations Economic Commission for Africa, African Union and African Development Bank, Addis Ababa, Ethiopia.
- UNECA/ United Nations Economic Commission for Africa, AU/African Union, AfDB/African Development Bank, 2013. Assessing Regional Integration in Africa VI: Harmonizing policies to transform the trading environment, Assessing Regional Integration in Africa. United Nations Economic Commission for Africa, African Union and African Development Bank, Addis Ababa, Ethiopia.
- UNECA/ United Nations Economic Commission for Africa, AUC/African Union Commission, 2013. Economic Report on Africa 2013: Making the most of Africa's commodities: Industrializing for growth, jobs and economic transformation. United Nations Economic Commission for Africa (UNECA), Addis Ababa.
- Valensisi, G., Karingi, S., 2016. From global goals to regional strategies: towards an African approach to SDGs. *African Geographical Review*, pages 1–16. <https://doi.org/10.1080/19376812.2016.1185738>
- Valensisi, G., Lisinge, R., Karingi, S., 2016. The trade facilitation agreement and Africa's regional integration. *Canadian Journal of Development Studies/ Revue Canadienne D'études Développement*, 37, pages 239–259. Access: <https://doi.org/10.1080/02255189.2016.1131672>
- Vanzetti, D., Peters, R., Knebel, C., 2017. Non-tariff measures: lifting CFTA and ACP trade to the next level.
- Wambui, T.W., 2015. Tea Trade in Kenyan Markets: Effects of Marketing Strategies on sustainable domestic market and return to the small-holder tea Enterprise., in: *Proceedings of the First International Conference on Tea Science and Development*. Presented at the Karatina University: First International Conference on Tea Science and Development, Karatina, Kenya.

Making Foreign Direct Investment Work for Inclusive and Sustainable Industrialization in Africa

By John Ouma-Mugabe and Albert Edgar Manyuchi¹

1 Introduction

There is a resurgence of political and public policy attention to industrialization in Africa. The African Union (AU) and regional economic communities (RECs) such as the East African Community (EAC), the Economic Community of West African States (ECOWAS), and the Southern African Development Community (SADC) have adopted strategic plans for industrial development. In 2008, African Heads of State and Government adopted the AU Action Plan for Accelerated Industrial Development of Africa (AIDA). At national and regional levels, several African countries have recently adopted industrial, investment and innovation policy frameworks to promote the industrialization of their economies.

The recent continental, regional, and national policy initiatives are driven by the recognition that industrialization and innovation through domestic and foreign investments are engines of economic transformation and sustainable development. Africa's challenges of persistent poverty, unemployment, and economic over-dependency on raw natural resources for export can, to a large measure, be addressed through inclusive and sustainable industrialization. However, many Sub-Saharan African countries have low levels of industrial productivity and some are experiencing even de-industrialization (Nanivazo and Marcelin 2019, p. 3, Tregenna 2015, p. 11; Tregenna 2016, p. 105).

There are various explanations or reasons for low levels of industrialization and for deindustrialization of Africa. Academic studies such as Stiglitz, Lin, and Patel (2013), and policy reports such as UNECA (2013) and UNIDO (2016) provide analysis of factors that account for low industrialization of Africa. The factors include weak industrial policy frameworks, poor infrastructure, macroeconomic policy distortions, and FDI policy frameworks equipped with monopoly restrictions, such as exclusive exploration rights.

This chapter focuses on the measures that will improve the effective use of FDI inflows to promote inclusive and sustainable industrialization in Africa. It discusses Africa's approaches to and policy measures for FDI, the FDI-sustainable

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development nexus, and the industrial and innovation policy instruments used by several African countries. Emphasis is on ways and means of configuring FDI inflows to support diversification of economies through small and medium enterprises (SMEs) in manufacturing sectors. We argue that the extent to which African countries will be able to harness and to efficiently use FDI for inclusive and sustainable industrialization depends on their abilities to design and to implement policy mixes that build endogenous innovation capabilities to diversify and to increase the technological content of their economies. Such policy mixes must target the traditional informal sectors of economies largely inhabited by SMEs and should ensure that social and environmental failures or distortions are deliberately addressed.

Making FDI work for inclusive and sustainable industrialisation has direct and indirect outcomes. FDI can support or contribute to the attainment of Sustainable Development Goals (SDGs), especially SDG 9—with emphasis on inclusive and sustainable industrialization. It indirectly contributes to the achievement of other related SDGs such as SDG 8 —Decent Jobs and Growth, SDG 12 —Sustainable Production and Consumption, SDG 13 —Climate Protection, and SDG 16 —Peace, Equity and Strong Institutions.

The rest of this chapter after section 1 with the Introduction is organized as follows. The next section two is an overview of Africa's economic growth trends and experiences with FDI and industrialization. It shows that economic growth and FDI inflows of the past two decades have not had any significant impact on the structures of most African economies. In other words, there is no evidence that they have contributed to industrialization, poverty reduction, and job creation. Poverty, unemployment, and ecological degradation persist in most of Africa.

The third section proposes conceptual contours for studying or analysing FDI-led inclusive and sustainable industrialization. Through a review of literature, it identifies industrial, investment and innovation policy instruments and institutional arrangements that some Asian countries have used to spur industrialization and economic development in the past three decades or so. We suggest that African countries should engage in innovation and industrial policy learning from Asia.

Section four reviews policy instruments for FDI and industrialization in Africa. It argues that there are mismatches or a lack of coherence between different industrial, investment and innovation policy instruments used by many African countries. African countries have not configured or organized their industrial, investment and innovation policy instruments in such ways as to implement policy mixes that promote inclusive and sustainable industrialization.

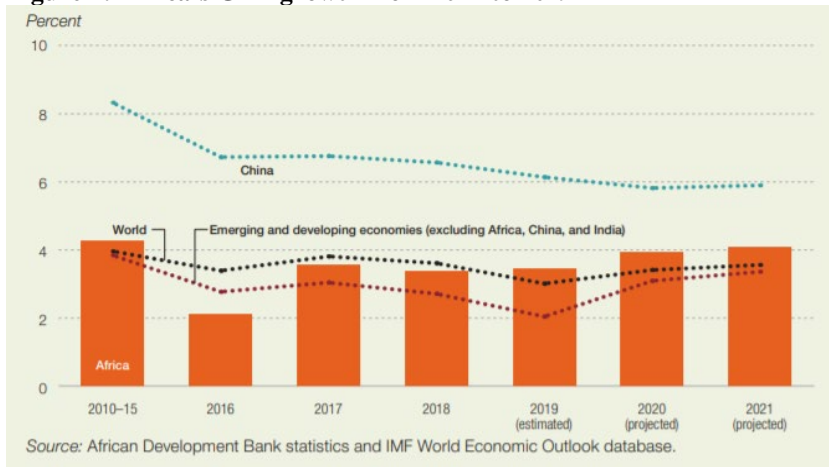
The last two sections five and six give Policy Recommendations and Conclusions. Section five outlines proposals or suggestions for improving policy mixes and the effectiveness of FDI inflows to promote inclusive and sustainable industrialization in Africa. We put emphasis on building capacity for policy design and

implementation, on investing in policy learning, on introducing measures that will direct FDI inflows to a diverse range of sectors and promoting measures at SME-based innovation activities that are socially and environmentally sustainable. Section six presents the Conclusions by highlighting major outcomes of the chapter.

2 Africa's Experiences with Foreign Direct Investment (FDI) and Growth

The past 15 years were the epoch of Africa's economic growth. During the first decade of the 2000s, at least 20 African countries had economic growth rates averaging four percent per year. In 2012, 16 African countries were among the world's fast-growing economies (UNECA, 2013). According to the African Development Bank's (AfDB's) recent outlook, the continent's economic growth was 3.5 percent in 2018 and was projected to be 4 percent in 2019 and 4.1 percent in 2020 (AfDB, 2019). The Africa Economic Outlook 2020 reports that Africa's Gross Domestic Product (GDP) growth has been above the world's average since 2011 (AfDB, 2020), and this above the world average growth may continue into the foreseeable future (although all these projections were done prior to the Corona epidemics). The continent's GDP growth rate from 2011 to 2019 as well as the projections to 2021 are shown in figure 1 below.

The economic growth has been uneven, with some countries achieving much more rapid growth than others. In 2019, North Africa contributed with 44 percent to Africa's growth buoyed by Egypt, while West Africa contributed with 28 percent what is a result of Nigeria's recovery from an economic recession, while Eastern Africa's and Southern Africa's contribution to growth respectively shrunk to 20 percent and to 4 percent from the previous year's contribution of 32 percent and 7 percent respectively (AfDB, 2020). There remains a small rest for Central Africa.

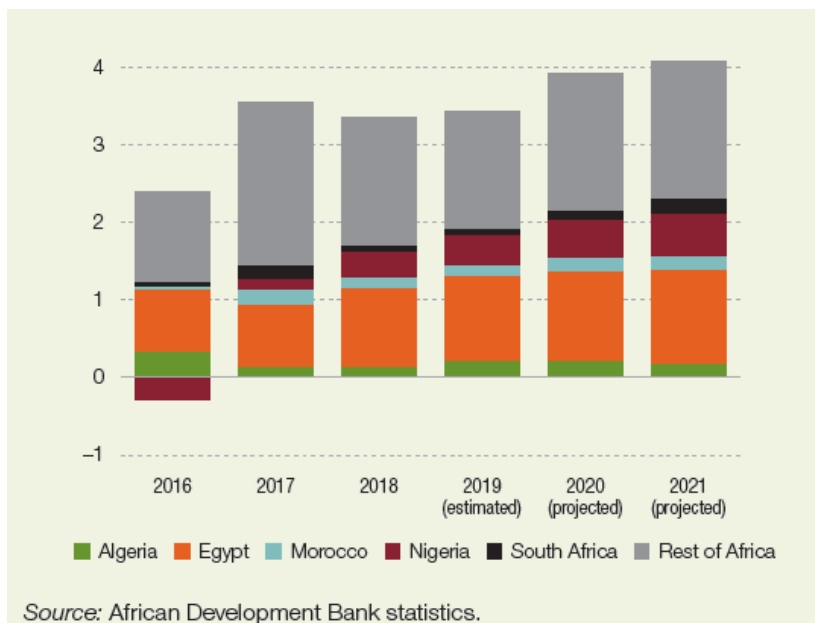
Figure 1: Africa's GDP growth from 2011 to 2019

Source: AfDB 2020, page 17 (figure 1.1 from the report is here reproduced)

Higher growth rates in Africa's largest economies, namely Algeria, Egypt, Morocco, Nigeria, and South Africa, helped sustain an above 4 percent GDP growth rate on the continent over the past decade. The African Economic Outlook 2020 reports that lower than expected growth rates in these five African largest economies would negatively affect the overall economic growth outlook of the continent (AfDB, 2020). Figure 2 shows the contribution of Africa's five largest economies to the overall growth of the continent. In fact, the five countries jointly contributed 55 percent of the continent's overall GDP growth in 2019.

However, the above world average economic growth of the past decades in Africa has not made any significant dent on poverty, social exclusion, unemployment, and sustainable development of African countries. It is largely based on or driven by commodity exports to Asian countries, such as China (AAS/African Academy of Sciences, 2018).² As UNECA (2013, p. 5) asserts, "[w]hile sustained growth has contributed significantly to rapid economic transformation in other parts of the world, in Africa it has been observed that the relatively good growth performance has not been inclusive, as millions of Africans are still caught in the poverty trap, largely because of failure to diversify sources of growth in times of continued reliance on primary commodity exports."

² This type of growth and development of exports now impacts on the living standards because of the Corona pandemics.

Figure 2: Contribution of Africa's largest economies to the continent's GDP

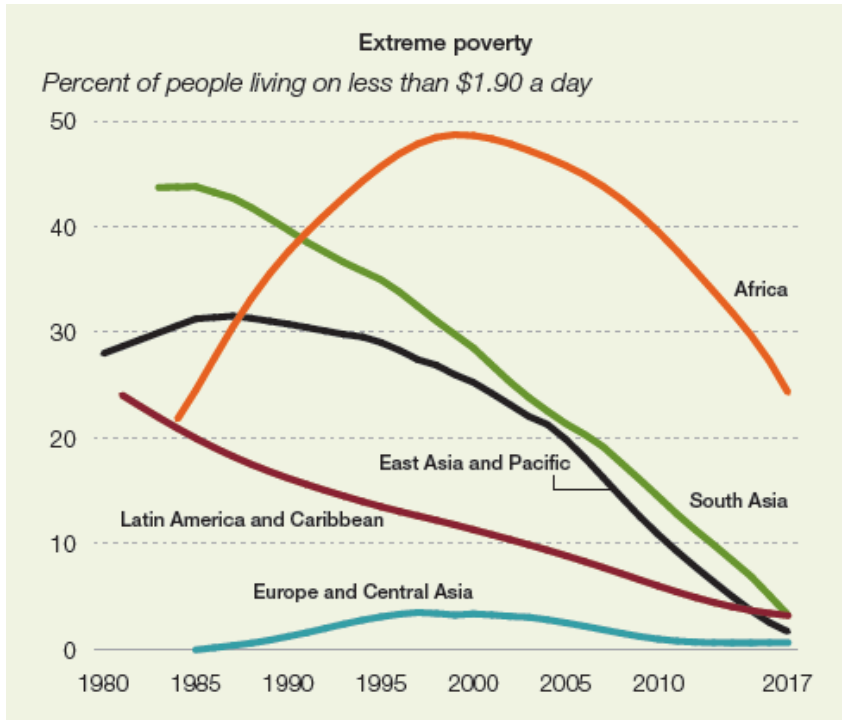
Source: AfDB 2020, page 20 (figure 1.5 from the report is here reproduced)

African countries face complex economic, social, and environmental challenges. The continent has a relatively weak manufacturing base. According to Boly and Kéré (2017, p. 56), “Africa’s manufactured exports grew by 14.3% between 2006 and 2010, what was above the world average (5.3%), but this growth has slowed to 3.3% in the period 2010–2014, slipping even below the world average growth rate at 5.5%. Africa had the lowest manufactured exports per capita among the world regions at US\$ 218 (current values) in 2014, compared with US\$ 883 (current values) in Asia and US\$ 1,099 (current values) in Latin America.”

According to a recent study, “the ecological footprint of most of the African countries is expected to double by 2040 under the business-as-usual scenario. More than 640 million Africans have no access to energy, giving an electricity access rate for African countries at just over 40 percent, which is the lowest in the world (Mebratu, 2019a, p. 41). Increased extreme weather events are potentially associated with climate change, and weather variability will disproportionately affect the continent because of weak systems and structures for resilience and adaptation. Food and nutritional insecurity, persistence of diseases such as malaria, tuberculosis (TB) and HIV and AIDS, youth unemployment, social exclusion, and environmental degradation are major sustainable development challenges for the

continent. As shown in figure 3 below, Africa is the leading continent in terms of populations living in conditions of extreme poverty.

Figure 3: Situation of extreme poverty in Africa and in other continents-1980 to 2017



Source: AfDB, 2020, page 32 (figure 1.18 from the report is here reproduced)

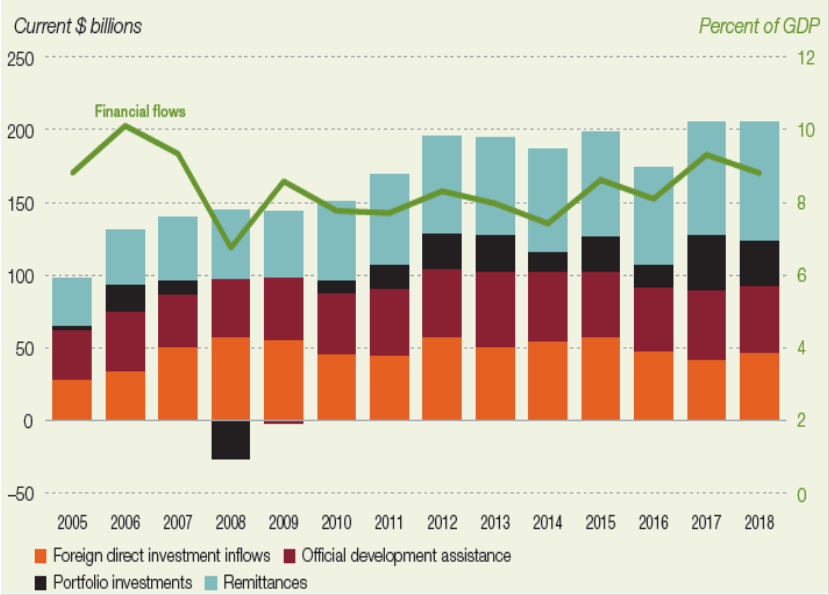
Although Africa generally experienced the longest episodes of sustained economic growth between 2000 and 2014 since the 1960s, “relatively few [countries] have posted significant declines in extreme poverty and inequality, which remain higher than in other world regions” (AfDB, 2020, p. 31). This means that the growth that African countries experienced during the period between 2000 and 2013 was not inclusive. According to the African Economic Outlook 2020 “Growth is generally considered inclusive if its benefits are widely shared across all the segments of the population—that is, if it simultaneously reduces extreme poverty and inequality. Growth will reduce poverty if the mean income or consumption of the poor rises and inequality if the welfare of the poor grows faster than that of the rest of the country” (AfDB, 2020, p. 31).

Many African countries have not experienced inclusive growth. The African Economic Outlook 2020 categorised growth periods into 2005 to 2010, and 2010 to 2017 and they found that “In Benin and Zambia, growth was neither pro-poor nor inclusive in both periods, while Egypt remained the only country with a pro-poor but non-inclusive growth in each subperiod. Only seven African countries had both pro-poor and inclusive growth in each subperiod. Côte d’Ivoire, Djibouti, and Togo improved the inclusiveness of their growth, while Ghana, Liberia, Madagascar, and Niger had growth that was pro-poor and inclusive in the first subperiod, but anti-poor and non-inclusive in the second” (AfDB 2020, p. 33).

Foreign direct investment (FDI), industrialization and innovation are engines of structural transformation of African economies. FDI inflows are critical for both technological innovation and for industrialization in Africa. It is in this respect that many African countries have adopted policies, regulations, and institutions to promote FDI. They have also entered into various bilateral and multilateral investment agreements on FDI. Foreign direct investment to African countries during colonial times was less diverse, flowing from transnational companies (TNCs) from developed countries of the West to Africa. This situation did not change much during the period soon after the countries attained independence. However, with time, there has been more diversity in the sources of FDI to African countries, including additional flows from TNCs from emerging and other developing countries. The African Economic Outlook 2020 reports “sources of FDI [to Africa] are becoming more diversified. Investors from the United States, United Kingdom, and France still have the largest stock of direct investment in Africa, but the Netherlands, Italy, China, Singapore, India, and South Africa are among the top 10 investors” (AfDB, 2020, p. 27).

The situation of FDI flows to Africa is quite complex and reports produced by the United Nations Conference on Trade and Development (UNCTAD) show that FDI inflows to Africa have, in general, increased over the past two decades or so. In 2001 the volume of FDI inflows to Africa was estimated at about US\$ 18 billion and in 2018 it was US\$ 46 billion (UNCTAD 2019). The African Economic Outlook 2020 report also shows that financial flows to Africa, including FDI, have increased over the period 2005 to 2018 (see figure 4 below). Remittances and Official Development Assistance (ODA) still play a great role in overall inflows to Africa.

Figure 4: Inflows of capital including FDI to Africa between 2005 and 2018



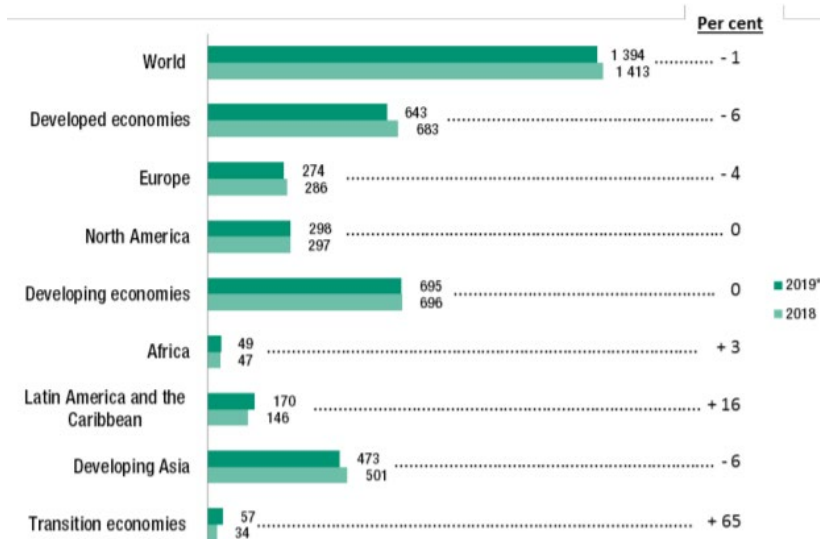
Source: AfDB, 2020, page 26 (figure 1.12 from the report is reproduced here in this chapter)

Despite this trend, in comparison to other continents, Africa continued to receive the least inflows of FDI (figure 5).

The inward flows of FDI are also uneven amongst the African countries. UNCTAD (2019) reports that, over time, the North Africa region received the highest inflows of FDI, followed by the West Africa region, while the least FDI-recipient region in Africa was Central Africa. In addition, inward flows of FDI concentrated in a few countries within these regions. For example, while in Southern Africa, South Africa was the leading recipient of foreign direct investment, in North Africa Egypt and Morocco received significant volumes of the FDI inflows to this region. Sector penetration of FDI flows is skewed as well. The African Economic Outlook 2020 reports “FDI [to Africa] is still concentrated in primary sectors, but greenfield investments in 2018 were more concentrated in services (34 percent) and manufacturing (44 percent). Manufacturing projects jumped 60 percent in 2018 to \$33 billion, particularly in higher-skill industries and natural resource processing” (AfDB 2020, p. 27). Table 1 provides a snapshot of the situation concerning FDI to Africa. Of importance, albeit not the composite picture, are

the greenfield investments, but reported are the announced greenfield projects between 2017 and 2018. Some trends are highlighted in the table 1, but the current circumstances of the Corona epidemics may change the picture completely.

Figure 5: FDI inflows by region, 2018 and 2019 (Billion US\$)



Source: UNCTAD, January 2020, page 2 (figure 2 from the report is reproduced here).

Several academic studies have analysed the contribution of FDI to structural transformation and sustainable development in Africa (see for example Gui-Diby 2014, Kiviyiro and Arminen 2014, and Dupasquier and Osakwe 2006). The studies show that FDI's impact on sustainable development in Africa is mixed—positive in certain aspects and negative in others. According to Gui-Diby (2014, p. 255) “it can be concluded that FDI inflows towards African countries have had a significant impact on economic growth during the past 30 years. However, this effect was not identical during the overall period. In fact, during the period from 1980 to 1994, the impact of FDI on economic growth was negative while it was positive for the period from 1995 to 2009. ...The positive impact for the period from 1995 to 2009 can partially be explained by the improvement of the business environment and the contribution of resource-based industries to economic growth due to the export of commodities. Policy makers are therefore advised to design policies aimed at attracting foreign investors.”

Table 1: Announced greenfield projects by project, 2017-2018 (Millions of US\$)

Sector/industry	Africa as destination		Africa as investor	
	2017	2018	2017	2018
Total	83 044	75 722	5 278	8 579
Primary	10 587	16 795	-	2
Mining, quarrying and petroleum	10 587	16 778	-	2
Manufacturing	20 583	32 996	2 864	2 890
Chemical and chemical products	6 175	11 006	1 229	1 128
Coke and refined petroleum products	1 472	6 480	9	-
Food, beverages and tobacco	1 990	4 982	124	65
Metals and metal products	1 078	3 919	-	195
Services	51 874	25 932	2 414	5 687
Business services	2 539	5 291	680	1 306
Construction	5 667	4 789	192	1 420
Electricity, gas and water	37 073	5 697	29	969
Transport, storage and communications	3 656	4 243	444	342

Source: UNCTAD, 2019, page 35 (Table C from the report is reproduced here)

Kiviyiro and Arminen (2014) examined the impact of FDI on energy consumption, carbon emission, and economic growth in selected African countries—the Republic of Congo, the Democratic Republic of Congo (DRC), Kenya, South Africa, Zambia, and Zimbabwe. Their main finding is that in countries with relatively weak environmental regulations and institutions and low levels of technological development, e. g. the Republic of Congo and the Democratic Republic of Congo, FDI inflows tend to increase energy consumption and carbon emission. Dupasquier and Osakwe (2006) provide an analysis of the factors that influence the performance of FDI inflows to Africa. They identify and discuss factors such as political and macroeconomic uncertainty, poor physical infrastructure, low growth rates of real per capita output, high dependence on commodities, and corruption and weak governance as key impediments to FDI-based or FDI-led growth and to structural transformation of Africa. All these studies conclude about the specific conditions why, when, and how FDI translates into sustainable growth and development.

Few studies have explicitly focused on the FDI-industrialization nexus in Africa. Some authors (Lall and Wangwe, 1998; Veloso and Soto 2001; and Szirmai

2012) discuss the critical role of FDI in African industrialization but do not really provide insights on what impact FDI inflows have historically had on industrialization of the countries. One of the most recent and empirically rich academic analysis of the impact of FDI inflows on industrialization of African countries is Gui-Diby and Renard (2015). Using panel data from 49 African countries for the period 1980-2009, they conclude: “FDI inflows did not have a significant impact on countries’ industrialization. ...[O]ne reason for the failure of FDI to contribute to industrialization could be governments’ failure to establish an enabling environment for FDI to catalyse industrialization. This situation resulted in hosting resource-seeking FDI inflows and the existence of weak or no links between MNCs and local enterprise” (Gui-Diby and Renard, 2015, p. 53).

There is now growing attention by African governments to leverage FDI inflows that promote industrialization, inclusive economic growth, and environmental sustainability (UNECA, 2013). However, there is limited research on what constitutes inclusive and sustainable industrialization and how FDI inflows can best promote it in Africa. In the next section, we propose elements of a conceptual approach to analysing FDI-led inclusive and sustainable development.

3 Conceptualising FDI-led inclusive and sustainable Industrialisation

First, what is ‘inclusive and sustainable industrialization’? This concept or notion is found in the United Nations Agenda 2030 for Sustainable Development Goals (SDGs), and is explicitly incorporated in SDG 9, focussing on Industry, Innovation, and Infrastructure. SDG 9 is about building resilient infrastructure, promoting *inclusive and sustainable industrialization*, and fostering innovation. The SDG 9 is also aligned to aspiration 4 (Transformed Economies) in African Union’s (AU’s) Agenda 2063 that focuses on sustainable and inclusive economic growth, science, technology and innovation (STI)-driven manufacturing, industrialization and value addition, and economic diversification and resilience. Table 2 below highlights the key underlying features of the UN Agenda 2030 with the SDG 9 and AU’s Agenda 2063. The table also shows the similarities in wording, tasks, targets, and definitions.

Table 2: Key features of the UN SDG 2030 Agenda and the AU Agenda 2063	
UN Agenda 2030 with SDG 9 on: Industry, Innovation, and Infrastructure	African Union Agenda 2063 with aspiration 4: Transform, grow and industrialise our economies through beneficiation and value addition of natural resources.
9.1) Develop sustainable, resilient, and inclusive infrastructures;	Implementing the African Industrial Development Action Plan, the African Mining Vision at country, regional and continental level, fast-tracking the establishment of the Centre for African Mineral Development;
9.2) Promote inclusive and sustainable industrialization;	Implementing joint cross-border investments to exploit shared natural resources;
9.3) Increase access to financial services and markets;	Promoting social dialogue, sectoral and productivity plans, and regional and commodity value chains to support the implementation of industrial policies at all levels, with focus on micro-, small- and medium enterprises (MSMEs) and Agribusinesses;
9.4) Upgrade all industries and infrastructures for sustainability;	Establishing Commodity Exchanges for strategic African products;
9.5) Enhance research and upgrade industrial technologies;	Developing strategies to grow the African blue/ocean and green economies;
9.A) Facilitate sustainable infrastructure development for developing countries;	Developing the African private sector through engagement and a conducive climate, fostering Pan-African businesses through the growth of regional manufacturing hubs and scaled-up intra-Africa trade;
9.B) Support domestic technology development and industrial diversification;	Enhancing the Productivity Agenda for Africa, as an essential engine for industrialization, progressively enhancing the competitiveness of the continent in the global economy; and
9.C) Promote universal access to information and communication technology.	Promoting macro-economic policies that facilitate growth, employment creation, investments and industrialisation.

Source: Authors 2020

As shown in table 2, there are some areas of convergence and divergence between the SDG 9 targets and the AU Agenda 2063 aspiration 4. However, both documents, the UN Agenda 2030 and the AU Agenda 2063 do not provide an explicit or clear definition of what constitutes “inclusive and sustainable industrialization”. There is also a quite limited intellectual and policy discourse on what constitutes inclusive and sustainable industrialization, at least in the context of African countries. Mebratu (2019b) and AfDB (2017) provide insights into some of the characteristics of what should be inclusive and sustainable industrialization in Africa. Mebratu (2019b) focuses on ecological or environmental sustainability dimensions of industrialization, emphasizing the importance of promoting cleaner production systems. AfDB (2017) lays emphasis on issues of economic inclusivity in industrialization, ensuring that structural transformation spurs economic diversification, generates employment, and that its economic benefits are distributed across society. Economic inclusivity and ecological sustainability relate to advanced production systems to stay productive in the national, the regional and the world economy.

The United Nations Industrial Development Organization (UNIDO) has been at the forefront of popularizing the concept and providing policy guidance on inclusive and sustainable industrialization. In the Lima Declaration, adopted by UNIDO’s member states in 2013³, inclusive and sustainable industrialization is conceived as having three interrelated pillars of sustainable industrialization—social, economic, and environmental sustainability. It emphasizes the role of industrialization in sustainable development. Inclusivity in industrialization is largely about ensuring that all people in all countries, in all sectors (both private and public), and all social groups participate in structural transformation and have equitable distribution of its benefits. Sustainable industrialization is about ensuring industrial activities that do not cause environmental damage, for example through pollution and excessive exploitation of environmental resources. It is supposed to reduce dependence on natural resources so that future generations can exploit them later. In addition, sustainable industrialization is also one that creates sustainable jobs or employment. Thus, it is about long-term economic development. Sustainable jobs/sustainable employment and jobs based on inclusive industrialization are therefore “two sides of the same coin”.

While there are several targets under SDG 9, our focus in this study is mainly on target 9.2—promote inclusive and sustainable industrialisation, defined as,

³ See on details of the Lima Declaration: <https://www.unido.org/who-we-are/inclusive-and-sustainable-industrial-development/lima-declaration>

“promoting inclusive and sustainable industrialization and, by 2030, significantly raising industry’s share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries” (see details in: United Nations Sustainable Development Agenda 2030⁴). The indicators under this target include manufacturing value added as a proportion of GDP and manufacturing employment as a proportion of total employment.⁵ However, the role of FDI could also be added as an indicator because of effects on manufacturing value added and manufacturing employment.

Foreign Direct Investment (FDI) is key to the promotion of inclusive and sustainable industrialization. First, it can be a source of new environmentally-sound technologies, particularly in low-income developing economies. There is a large body of academic literature on how some developing countries have been successful at acquiring environmentally-sound technologies, for example of renewable energy ones, through FDI inflows (Manyuchi, 2016). Through FDI, developing countries can access new advanced manufacturing technologies, such as 3-D printing. In addition, they can be exposed to cutting-edge research and development (R&D) on a wide range of environmental technologies. Second, FDI can stimulate domestic entrepreneurship and support human capital formation, thus creating new jobs and helping to reduce poverty. A relatively rich body of literature (e.g. Lloyd 1996) shows that East Asian countries, such as South Korea, effectively used FDI to create new enterprises and employment opportunities through diversification of economic activities.

To achieve FDI-led inclusive and sustainable industrialization, African countries need to conceive and to build an appropriate institutional infrastructure and to design and to implement a mix of policy instruments that explicitly articulate inclusivity and sustainability considerations. Such policy instruments should incorporate inputs from the citizenry. Their design criteria include “openness, sustainability, New Industrial Revolution (NIR) readiness and inclusiveness” (UNCTAD 2018, p. xiv). In addition, the policy instruments should demonstrate “policy coherence, flexibility and effectiveness” (UNCTAD 2018, p. 27). Therefore, FDI flows to Africa can help to implement policies as targeted by SDG 9.2.

In the next section, we review current national investment, innovation, and industrial policies of several African countries to determine whether they have provisions for promoting inclusive and sustainable industrialization.

⁴ See about the SDGs: <https://www.un.org/sustainabledevelopment/development-agenda/>

⁵ See about the indicators related to SDG 9: <https://medium.com/sdgs-resources/sdg-9-indicators-37abf502a1ce>

4 African Industrialization and Investment Policy Instruments

4.1 Industrialization policy instruments

African countries have designed a variety of policy instruments for promoting FDI and industrial development. Some of these instruments have relatively long histories, going back to the colonial eras (Mkandawire 1988, p. 5). It is not possible, and it is not the task of this study, to review all these instruments. In general, there are three main categories of policy instruments adopted by Africa. There are: explicit FDI policies and FDI regulatory frameworks; there are industrial policies, regulations, and frameworks; and there are innovation policy frameworks. Trade policy frameworks also tend to be used to promote FDI and industrialization; these could be considered as part of the industrial policies group.

In the 1960s and 1970s, most African countries promoted industrialisation through import substitution policy measures, and many countries did not have explicit FDI policy frameworks. Import substitution industrialization (ISI) strategy is about reducing, regulating, or restricting FDI and imports through trade and economic policy measures that promote domestic production of industrial products. Government provided direct support and tariff protection to local industries. Import quotas, special preferential licensing for goods, and subsidized loans to local infant industries are some of the explicit policy measures that governments have deployed. Countries that have experimented with ISI strategies include Botswana, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, South Africa, Zambia, and Zimbabwe.

The extent to which ISI strategies have promoted industrialization in general, and even inclusive and sustainable industrial development, is an issue of further detailed academic inquiry. However, scant empirical research and policy studies show that the countries' experiences with ISI are varied. For example, Otoo (2013) shows that West African countries, more specifically Ghana and Nigeria, have not been successful in deploying import substitution policies to advance industrialization. He identifies weak domestic entrepreneurial capabilities and state bureaucracy and corruption as some of the factors accounting for the failure of import substitution policies in these countries. Page (2017) provides various country experiences with ISI and shows that Ethiopia and Mauritius have had success with import substitution policies. There has been structural change and the creation of manufacturing enterprises in these countries following the import substitution policies.

UNCTAD (2019) analyses factors that have influenced the success of special economic zones (SEZs), where governments provide fiscal and regulatory incentives and infrastructure support to domestic enterprises. It shows that an increasing number of African countries are establishing SEZs, and that Kenya, Nigeria, South Africa, Egypt, Ethiopia, and Cameroon have the highest number of SEZs on the continent. The policy objective of establishing SEZs is generally "to build, diversify and up-

grade industries by attracting FDI” (UNCTAD 2019, p. 137), and specifically to “enhance manufacturing and exports in low-skill, labour-intensive industries such as garments and textiles, while some countries are targeting diverse sectors and higher value addition” (UNCTAD 2019, p. 149). There is just no adequate up-to-date documented evidence of the success of African SEZs, in terms of their contributions to poverty reduction, social inclusion, and environmental sustainability. Despite the various incentives and the strong government support, “the consensus from previous research is that African zones have generally underperformed, with the significant exception of those in Mauritius and the partial exception of those in Kenya and possibly Madagascar and Lesotho” (Farole 2011, p. 1). According to UNIDO (2019), Ethiopia has developed a policy of industrial parks that has been yielding positive results for the country. The report points out that the country has increased its export of garments and has created more jobs in the industrial parks. However, trade facilitation and skills shortages have hampered greater positive outcomes from the industrial parks.

South Africa has applied a mix of policy measures to steer SEZs towards inclusivity and sustainability objectives. The main policy instrument governing SEZs in the country is the Special Economic Zones Act No. 16 of 2014. The Act requires that the Government through its agencies can establish a SEZ as a public entity or through a public-private partnership. South Africa does not permit wholly private-owned SEZs. The Act provides for equal treatment to investors in the zone regardless of their origin. It provides incentives for investors located in the zone, including a preferential 15 per cent corporate tax rate, building allowances, employment tax incentives, the establishment of a customs-controlled area, and the 12I tax allowance⁶ for greenfield and brownfield investments in the zone. The Act also provides for a one-stop-shop to facilitate business entry, registration, and reporting. There are some positive aspects of the SEZs in South Africa. Some of them create employment, especially in areas not located in the previous industrial hubs of the country. This facilitates inclusion of the unemployed into the sphere of economic activities of the country. Second, they adhere to the principles of good environmental management. Environmental Impact Assessments (EIAs) and Environmental Management Reports (EMRs) are mandatory requirements for establishing and managing SEZs. These EIAs and EMRs are critical in ensuring environmental sustainability.

There have been experimental projects on environmentally friendly industrial parks in Africa. South Africa and Morocco have participated in developing and implementing eco-parks. The main thrust of eco-parks is to encompass social, economic, and environmental ethos in operations located in the industrial parks. Eco-parks push industrial development towards inclusive and sustainability ethos.

⁶ See on these 12I tax allowance instruments and the related documents: https://www.thedti.gov.za/financial_assistance/financial_incentive.jsp?id=45&subthemeid=26, and: <https://www.iea.org/policies/3451-12i-tax-allowance>

Many African countries have renewed focus on broader industrial policy instruments. According to Monga (2017), there “is now wide recognition among researchers that the type of industrialization that can foster such positive structural transformation does not occur spontaneously. Smart industrial policy—defined as a policy by which governments attempt to shape the sectoral allocation of the economy—must be in place to correct market failures (situations where markets by themselves do not lead to efficient, or desirable, resource allocations) or even to correct other government failures (public policies that excessively “distort” resource allocations). But industrialization and industrial policy are still controversial—especially in times of rapid technological developments and changing economic production structures.” (Monga, C., p. 20, in: AfDB 2017)

Since the beginning of the 2000s, many African countries have increased attention to the design and implementation of explicit national industrial policies. For example, Ethiopia adopted a new Industrial Development Strategy in 2003 that put more emphasis on the role of the private enterprises and on public-private partnerships in industrialization, export-led industrialization, labour-intensive industrial activities, public participation in industrial policy design and implementation, and ensuring environmental sustainability. The key thrust of Ethiopia’s industrial policy between 2003 and 2018 was to ensure that finance, technology, and human resources are utilised effectively and efficiently to increase industrial outputs. Through this strategy, Ethiopia has significantly reduced state ownership and control of manufacturing enterprises. It has attracted increased FDI inflows in sectors such as agriculture (horticulture), energy, services (hospitality), and telecommunications. According to Ogubay (2017), between 2002/2003 and 2010, the number of enterprises in formal manufacturing tripled and industrial output growth averaged more than 10 percent annually. Therefore, the industrial policy of Ethiopia post-2000 has been very successful, especially in increasing manufacturing output.

In 2007, South Africa conceived a formal industrial policy, namely the National Industrial Policy Framework (NIPF), and operationalised it through the Industrial Policy Action Plan (IPAP) (DTI 2007a and b). The government has published other IPAPs since then (DTI 2010; 2011; 2014; 2017). The initial NIPF put emphasis on value-added manufacturing processes, transition to a knowledge economy, labour-absorbing industrialisation, participation of the previously disadvantaged groups, and incentivised interventions in the automotive, clothing, textile, and chemicals sectors (DTI 2007a). Subsequent IPAPs targeted more sectors. The various IPAPs favourably consider inflows of FDI in industrialisation. For instance, the incentives provided for the automotive industry target FDI firms,

such as MB⁷, Toyota, VW, BMW, Ford, BAIC⁸, BAW⁹ and Isuzu (DTI 2017, p. 34). While the incentives for the agro-processing industry targeted direct investment firms such as Nestlé and Unilever, in the polymer and cosmetics sectors Sasol Polymers and Unilever also benefited (DTI 2017, p. 35). The incentives helped firms to create more jobs, to increase productivity, and to export their products. For ArcelorMittal South Africa, increasing the general rate of customs duty on primary steel products to 10%, imposing tariffs on a range of downstream products, and deploying various (tax) rebates assisted to keep the company operational. This is an example how trade policy measures support industry, at least short-term and medium-term.

South Africa's IPAPs demonstrate a desire to move the industrial development trajectory towards inclusive and sustainable industrialisation, even though in a rather uncoordinated manner. Three approaches indicate a measured shift towards inclusive and sustainable industrialisation—the discourses on the green economy (GE) and the knowledge-based economy (KBE) as well as the special economic zones (SEZs)' policies and implementation processes. South Africa has acquiesced to the green economy (GE) discourse and has developed some policies aimed at achieving this. Although the Department of Environmental Affairs champions the green economy, the key caveat is mainstreaming this into the country's industrial policy. We found that the country attempted to mainstream the notions of a green economy in industrial policy. For instance, the various IPAPs promote a green economy by alluding to “green import substitution” and “green export promotion” (Mudombi and Wood, 2016). With regards to “green import substitution”, the IPAPs identify “renewable energy, organic agriculture (agro-processing), biofuels, buses and electric vehicles, biogas, waste management, nuclear energy (advanced manufacturing), bio-composites, water and sanitation, and platinum-related opportunities as key sectors” (PAGE 2018, p. 26). Also, with regard of “green export promotion” some actions are underway.

Kenya adopted the ‘Sessional Paper No. 9 of 2012 on the National Industrialization Policy Framework/NIPF 2012-2030’ in 2012. The policy framework recognizes the importance of regional or geographical inclusivity (inclusion of historically marginalized regions and communities) in industrialization, and the need to uphold environmental protection and efficient resource utilization. It also emphasizes the importance of promoting economic inclusivity by directing capital and technology to rural SMEs. However, it only makes passing reference to FDI

⁷ See: <https://www.mercedes-benz.co.za/passengercars.html?group=all&subgroup=see-all&view=BODYTYPE>

⁸ See: <https://www.baic.co.za/>

⁹ See: <https://www.bawsouthafrica.co.za/>

and does not provide a clear link between measures to attract FDI and industrialization. The Industrial Transformation Programme (ITP) of Kenya, submitted in July 2015, gives some further details about the strategies and policies for industry development.¹⁰

In addition to national policy instruments for industrialization, African countries have adopted regional and continental protocols or strategies. They include the East African Community Industrialization Policy (EACIP) 2012-2032, the SADC Industrial Development Policy Framework (IDPF), and the AU Action Plan for the Accelerated Industrial Development of Africa (AIDA). These regional and continental policy instruments contain both explicit and implicit provisions on inclusive and sustainable industrialization. For example, the East African Community Industrialization Policy (EACIP) 2012-2031 vision statement reads as “a globally competitive, environment-friendly and sustainable industrial sector initiative, capable of significantly improving the living standards of the people of East Africa by 2032.” This statement is consistent with SDG 9 targets on inclusive and sustainable industrialization. The EAC policy framework also contains provisions requiring the support of environmentally-sound and socially responsible foreign direct investment (FDI). Investment projects into the EAC are to be subjected to environmental and social impact assessments (ESIAs) before they are approved by the relevant authorities.

Regional and continental industrial policy measures are also articulated in regional trade agreements, such as COMESA and the Agreement Establishing the African Continental Free Trade Agreement (AfCFTA). For example, AfCFTA has specific objectives on the promotion of industrialization in Africa. Its Article 3(g) aims “to promote industrial development through diversification and regional value chain development; agricultural development and food security.” The treaty affirms the “right of State Parties to regulate within their territories and the State Parties flexibility to achieve legitimate policy objectives in areas including public health, safety, environment, public morals and the promotion and protection of cultural diversity”, and this is consistent with the SDGs in general. All these national, regional, and continental approaches for future-oriented industrial policies should facilitate the path towards inclusive and sustainable industrialization patterns.

4.2 Investment Policy Instruments

Just as with industrial policies, there is a surge of interest in the design and implementation of investment policy frameworks in Africa. According to UNCTAD

¹⁰ See more about policies and strategies of Kenya: <https://www.industrialization.go.ke/index.php/media-center/blog/376-kenya-s-future-lies-in-industrialisation>

(2019), at least 40 African countries had adopted explicit investment policy frameworks by 2018. Fifty-three African countries are members of the Multilateral Investment Guarantee Agency (MIGA), 45 countries are members of WTO, and at least 50 countries have signed many Bilateral Investment Treaties (BITs). Many African countries have established investment promotion agencies and regulatory frameworks.

Manyuchi (2017) provides a succinct analysis of the kinds of national policy instruments and institutions that most African countries use to promote and to govern FDI. FDI policy instruments include laws, regulations, and strategic plans. Countries that have enacted investment laws include Mozambique, Kenya, Ethiopia, Ghana, Nigeria, Namibia, and Botswana. The laws stipulate conditions under which FDI inflows are to be governed. Most of the laws have provisions requiring that social and environmental impact assessments must be conducted before investment projects are approved.

For example, Mozambique's Investment Law (Law No 3/93 of 24 June 1993) and Regulations on Investment Laws (Decree No. 43/2009 of 21 August 2009) contain elaborate provisions on the protection of the environment. Article 26(1) of the Law No 3/93 states that: "[i]nvestors, and subsequently their companies, shall, in the process of elaboration, implementation and operation of their investment projects, carry out and submit the relevant studies and evaluations of the environmental impact and of any pollution and sanitation concerns that may result from their activities and the damages and/or wastes of their undertakings."¹ Kenya's Investment Promotion Act 2004, Chapter 485B, and the Investment Promotion Regulations, 2005 have specific provisions requiring foreign investment projects to be subjected to social and environmental audits. Investment projects are supposed to be licensed after environmental impact certificates are issued by the National Environmental Management Authority (NEMA) and the Kenya Investment Promotion Council (KIPC).

However, the question is how relevant such laws and regulations are for guiding FDI policies in African countries, and if industry development is then becoming more inclusive and sustainable if the countries have such laws and regulations. The problem is also if the domestic industries are also subjected to the same laws, regulations, and practices.

4.3 Challenges to FDI-led inclusive and sustainable industrialization

As show above, many African countries have policy instruments to promote FDI that leads to inclusive and sustainable industrialization. The quality and effectiveness of the instruments need to be comprehensively reviewed. In general, there are several challenges to an FDI-led inclusive and sustainable industrialization process in most African countries. The challenges include:

- Weak policy implementation and law enforcement capacities,
- Weak policy mixes or coherence between policy instruments, particularly between investment policies on the one hand and social and environmental ones on the other,
- Governance deficits, including corruption,
- Weak institutional linkages within governments, particularly between ministries of trade and industry, finance, and social and environmental affairs,
- Low technology absorption capabilities, including shortage of technical skills and poor physical infrastructure, and
- Poor linkages between foreign companies and domestic ones, particularly SMEs.

While the above points relate to FDI host countries, it is also important to explore the roles that home countries have in directing FDI towards inclusive and sustainable industrialisation. There are no studies that have explored this vital topic. It is a truism that FDI flows into sectors that provide the highest returns possible. However, host and home countries have a role to play in ensuring that FDI penetrates priority economic sectors. As stated before, FDI flows to Africa are mainly into extractive sectors. Policy measures that facilitate FDI flows into manufacturing and services sectors are essential. Constant interactions with home countries to promote manufacturing and services FDI should be a priority for African countries. FDI flows to Africa have not penetrated the SMEs or the informal sectors of African countries because of unfavourable or non-existent policies in this regard. Without FDI, it is difficult for start-ups to be supported in most countries of Africa because they must depend on government or private sector funding. FDI into SMEs and informal sectors may enable start-ups to open and to grow. SMEs and informal sectors represent huge markets with great commercial value, and therefore FDI will show interest in these two sectors if there is government and private sector guidance.

5 Recommendations on making FDI work for inclusive and sustainable industrialization

5.1 Building capacity to design and implement systemic policy instruments

To help build African countries' capacities for designing and implementing policy instruments and mixes for FDI-based inclusive and sustainable industrialization, training courses and workshops for government officials should be developed by universities and international agencies, such as UNCTAD and UNIDO. Such training should be hands-on giving the participating officials practical lessons in policy design, monitoring and evaluation, and implementation. However, strengthening policy capacities should not be a precondition for policy implementation since capacity building takes time. It is vital that governments mobilize and utilize existing policy capacities that may be outside ministries and departments. Such capacities may be residing in private sector, universities and think tanks, and should be mobilized to help design implementation plans and to support policy monitoring and evaluation, while at the same time helping to strengthen governmental policy capabilities.

5.2 Investing in policy learning

Policy learning is about drawing and using lessons from prior policy failure and successes. It aims at avoiding continuous policy failures and enhances policy effectiveness. African countries will need to invest in learning about and drawing lessons from investment and industrial policies that have proved successful at promoting FDI-led inclusive and sustainable industrialization in other regions of the world. They can engage in learning from successful FDI and industrial policies of countries such as Singapore, South Korea, and Taiwan as well as Latin American cases. They should also invest in learning about cases where FDI and industrial policies have not worked for inclusive and sustainable industrialization. The learning process on policies that worked should inform the African policymakers at reforming FDI and industrial policies to achieve SDG 9.

5.3 Improving institutional linkages and policy coherence

To strengthen policy coherence and to promote the design as well as the implementation of appropriate policy mixes, coordination between different government ministries (and/or departments), and between public and private sectors, are critical. In this regard, inter-ministerial committees on inclusive and sustainable industrialization should be created by governments and should have representation from private sector and civil society. The remits of the committees would include

promoting the implementation of SDG 9 in general, and the alignment of FDI and industrial policies with social, economic and environmental sustainability goals.

5.4 Building FDI links to and financing of SMEs

Weak links between foreign companies (particularly multinational companies) and SMEs is one of the obstacles to inclusive and sustainable industrialization in many African countries. To address this challenge African governments should design and implement policies and programmes that require foreign companies to engage in mentoring of domestic SMEs. Such programmes should include the transfer of skills and of environmentally-sound technologies from foreign companies to SMEs. This would be consistent with SDG 9.3 that is about linking SMEs to global value chains. With the right policy-mix, FDI can play an important role in supporting start-up enterprises on the continent.

6 Conclusion

In this chapter, we focused on how to make FDI work for inclusive and sustainable industrialisation. Sustainable and inclusive industrialisation forms part of SDG 9 of the UN SDGs. This chapter had a limited focus and did not cover the entire aspects of SDG 9. In this chapter, we emphasised that FDI can spur inclusive and sustainable industrialization in Africa, and promote the attainment of SDG 9 in general, through mixes of investment, industrial and innovation policies. Traditional or conventional policy approaches to FDI are not suitable for inclusive and sustainable industrialization. Learning from fresh and innovative approaches, which are applied in Asia and in other African countries, is of great relevance. To design and to implement appropriate policy mixes, most African countries need capacity-building, including training courses, and promotion of policy learning as well as the establishment of new forms of institutional arrangements to cross the boundaries of departments, of ministries, and of private and public institutions. Improving institutional coordination and policy coherence as well as promoting FDI-SMEs linkages are crucial for the attainment of SDG 9 in Africa. Informal sectors can also become part of the networks, via platforms and digital instruments. The digital transformation in Africa can support policy learning and the implementation of new policies with a focus on SDG 9.

References

- AAS/African Academy of Sciences, Nairobi, Kenya, 2018. Africa Beyond 2030. Leveraging Knowledge and Innovation to Secure Sustainable Development Goals. African Academy of Sciences (AAS), Nairobi, Kenya
- AfDB/African Development Bank, 2020. African Economic Outlook 2020. Abidjan, African Development Bank.
- AfDB/African Development Bank, 2019. African Economic Outlook 2019. Abidjan, African Development Bank.
- AfDB/African Development Bank, 2017. Industrialize Africa: Strategies, Policies, Institutions and Financing. Abidjan, African Development Bank.
- AU/African Union, 2013, The Africa We Want, Agenda 2063. African Union Commission/AUC.
- Boly, A., and Kéré, E., 2017. Inclusive and Sustainable Structural Transformation in Africa, Forging Ahead, in: AfDB/African Development Bank, 2017. Industrialize Africa: Strategies, Policies, Institutions and Financing. Abidjan, African Development Bank
- DTI/Department of Trade and Industry, 2007a. National Industrial Policy Framework, Pretoria: Department of Trade and Industry.
- DTI/Department of Trade and Industry, 2007b. Industrial Policy Action Plan. Pretoria: Department of Trade and Industry.
- DTI/Department of Trade and Industry, 2010. 2010/11 – 2012/13 Industrial Policy Action Plan, Pretoria: Department of Trade and Industry.
- Department of Trade and Industry/DTI, 2011. Industrial Policy Action Plan 2011/12 - 2013/14. Pretoria: Department of Trade and Industry.
- Department of Trade and Industry/DTI, 2012. Industrial Policy Action Plan 2012/13 - 2014/15. Pretoria: Department of Trade and Industry.
- DTI/Department of Trade and Industry, 2014. Industrial Policy Action Plan: Economic sectors and employment cluster, IPAP/Industrial Policy Action Plan 2014/15 - 2016/17, Pretoria: Department of Trade and Industry.
- DTI (2017): Industrial Policy Action Plan: Economic sectors and employment cluster, IPAP/Industrial Policy Action Plan. 2018/19 - 2020/21, Pretoria: Department of Trade and Industry.
- Dupasquier, P. and Osakwe, P. (2006): Foreign direct investment in Africa: Performance, challenges, and responsibilities. In: *Journal of Asian Economics*, 2006, vol. 17, issue 2, pp. 241-260.
- Farole, T., 2011. Special economic zones in Africa: Comparing performance and learning from global experience, Washington, D.C.: World Bank.
- Gui-Diby, S., and Renard, M., 2015. Foreign Direct Investment and the Industrialization of African Countries, in: World Development, Vol. 74, pp. 43-57, access: <http://dx.doi/10.1016/j.worlddev.2015.04.005>

- Gui-Diby, S., 2014. Impact of foreign direct investments on economic growth in Africa: Evidence from three decades of panel data analyses, *Research in Economics*, 68, pp. 248–256.
- Harrold, P., Jayawickrama, M., and Bhattasali, D, 1996. Practical Lessons for Africa from East Asia in Industrial and Trade Policies, World Bank Discussion Paper 310, Washington D. C.
- Kiviyiro, P., and Arminen, H., 2014. Carbon dioxide emissions, energy consumption, economic growth, and foreign direct investment: Causality analysis for Sub-Saharan Africa. *Energy* 74 (2014), pp. 595-606.
- Lall, S., and Wangwe, S., 1998. Industrial Policy and Industrialization in Sub-Saharan Africa, in: *Journal of African Economies*, 7(0): pp. 70-107.
- Lloyd, P., 1996. The Role of Foreign Direct Investment in the Success of Asian Industrialization, in: *Journal of Asian Economics*, Vol. 7, No. 3, pp. 407-433
- Manyuchi, A. E., 2017. African Structures for Governing Foreign Direct Investment: A Critique. In: *Strategic Review for Southern Africa*, Vol 39, No 1.
- Manyuchi, A. E., 2016. Inward foreign direct investment and transfer of environmentally sound technologies in Angola. *SAfr J Sci./South African Journal of Science*, 112(7/8), access: <http://dx.doi.org/10.17159/sajs.2016/20150391> and: <https://www.sajs.co.za/article/view/3537>
- Mebratu, D., 2019a. Transformative Leapfrogging to a Wellbeing Economy in Africa, in: Mebratu, D. and Swilling, M., editors, 2019. *Transformative Infrastructure for Development of a Wellbeing Economy in Africa*. African Sun Media, Stellenbosch, South Africa.
- Mebratu, D., 2019b. Inclusive and Sustainable Industrial Development for Africa, pp. 115-145, in: Mebratu, D. and Swilling, M., editors, 2019. *Transformative Infrastructure for Development of a Wellbeing Economy in Africa*. African Sun Media, Stellenbosch, South Africa.
- Monga, C., 2017. Industrialization: A Primer, in: AfDB/African Development Bank, *Industrialize Africa: Strategies, Policies, Institutions and Financing*. Abidjan, African Development Bank.
- Mkandawire, T., 1988. The Road to Crisis, Adjustment and De-Industrialisation: The African Case, *Africa Development / Afrique et Développement*, Vol. 13, No. 1, On Crisis & Democracy, pp. 5-31.
- Mudombi, Sh./Ch. Wood, Developing green trade and industry opportunities in South Africa, Development Dialogue, TIPS, Pretoria, South Africa, 22 November 2016, Trade and Industrial Policy Strategies (TIPS), PAGE/ Partnership For Action On Green Economy, PDF/Lecture Presentation
- Nanivazo, M. and Marcelin, I., 2019. Can export promotion agencies stem the deindustrialisation in Sub-Saharan Africa, *Governance for Structural Transformation in Africa*, pp. 189-220.
- Ogubay, A., 2017. Ethiopia: Lessons from an experiment, in AfDB/African Development Bank, 2017. *Industrialize Africa: Strategies, Policies, Institutions and Financing*. Abidjan, African Development Bank.

- Otoo, K., 2013. Industrialization Policies in West Africa. Friedrich-Ebert-Stiftung, Cotonou-Benin.
- Page, J., 2017, Industrial Policy in Africa: From State Leadership to the Investment Climate, pp. 82-100, in: AfDB/African Development Bank, 2017. Industrialize Africa: Strategies, Policies, Institutions and Financing. African Development Bank.
- PAGE/Partnership For Action On Green Economy, 2018, A Green Economy Industry And Trade Analysis: Assessing South Africa's Potential, Copyright: DEA/Department of Environmental Affairs/DTI/Department of Trade and Industry/DST/Department of Science and Technology/UN Environment/UNEP/United Nations Environment Programme, UNIDO/United Nations Industrial Development Organization
- Republic of Mozambique, 1993. Law on Investment (Law No. 3/93).
- Stiglitz, J. E., Lin, J., and Patel, E. editors, 2013. The Industrial Policy Revolution II: Africa in the 21st Century. International Economic Association (IEA), Palgrave Macmillan Publishers.
- Szirmai, A., 2012. Industrialization as an engine of growth in developing countries, 1950-2005. In: Structural Change and Economic Dynamics, 23(4) December, pages 406-420
- Tregenna, F., 2015. Deindustrialisation, structural change and sustainable economic growth, Johannesburg: UNU-MERIT Working Papers.
- Tregenna, F., 2016. Deindustrialisation: An issue for both developed and developing countries, in: Weiss, J. and Tribe, M. (Eds), Routledge Handbook of Industry and Development, New York: Routledge.
- UNCTAD/United Nations Conference on Trade and Development, January 2020, Issue 33. Investment Trends Monitor. New York and Geneva: United Nations.
- UNCTAD/United Nations Conference on Trade and Development, 2018. World Investment Report 2018: Investment and New Industrial Policies. New York and Geneva: United Nations.
- UNCTAD/United Nations Conference on Trade and Development, 2019. World Investment Report 2019. Special Economic Zones. United Nations Conference on Trade and Development, Geneva.
- UNIDO/United Nations Industrial Development Organization, 2019. The G20 Initiative on "Supporting Industrialization in Africa and LDCs", Review of Progress. Vienna, UNIDO.
- UNIDO/United Nations Industrial Development Organization, 2016. Industrialization in Africa and Least Developed Countries, Vienna, UNIDO.
- UNECA/United Nations Economic Commission for Africa, 2013. Industrialization for an Emerging Africa. Issues Paper for the Sixth Annual Meetings of the ECA Conference of African Ministers of Finance, Planning and Economic Development and AU Conference of Ministers of Economy and Finance. Addis Ababa, Ethiopia: United Nations Economic Commission for Africa.
- Veloso, F. and Soto, J. M., 2001, Incentives, Infrastructure, and Institutions: Perspectives on Industrialization and Technical Change in Late-Developing Nations. Technological Forecasting and Social Change, 66: pages 87-109

Unit 2: Sustainable Development Goal Nine and Achievements by Countries, Sectors and Targets

Assessing the Performance of SDG 9 Targets for Financial Services and Agriculture, Energy and Transport Infrastructure, Mining and Social Welfare – An Introduction

Anthony Ifeanyi Ugulu¹ and Karl Wohlmuth²

1 The Issues

The importance of sustainable infrastructure and innovation for the growth and development of the African continent

The lack of a supportive infrastructure in Africa leads to a loss of business productivity by as much as 40%, making Africa the least productive continent in the world (United Nations, 2020a, 2020b). Attaining the requisite socio-economic and technological progress necessary for sustainable growth will be paramount to the long-awaited development of the African continent. Focussed investments into a more sustainable infrastructure in key sectors, such as energy, transport, mining, and agriculture would help to hasten the speed of industrialisation while creating employment in the region. Commonly observed unsustainable infrastructure is the reason why, despite being rich in many mineral resources, African countries are yet to reach the levels of national wealth and regional development which is expected. As the global emphasis shifts to more sustainable development, which is a development that supports efficiency in resource utilisation taking into consideration future generations in the use of scarce resources, Africa is presented with far-reaching opportunities for social, economic, and environmental transformation.

Due to the significance of stable electricity supply and its link to industrial development, the transformation of the continent would need to push this important sector, but in a specific way through the promotion of renewable energy supplies and through energy-saving investments. Covering all economic sectors and all regions of a country, but also looking at cross-country supplies, will help Africa to overcome this barrier to inclusive growth and sustainable development. It is well known that the absence of stable electrical power significantly affects firms' ability to properly function, as no modern business can effectively operate without uninterrupted electricity. Unreliable power systems can hinder the competitiveness of industries, both locally and internationally. Unstable grid power

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networks increase the costs of trading which are then passed on to consumers. Some businesses that are not well established have been taken over by the more dominant businesses with more capital. Many firms in Africa, especially small and medium-scale enterprises (SMEs), have been priced out of the market as a result of their inability to sustain their businesses by using private electricity generation, which can be much more expensive than grid distributed electricity. An unattractive business environment hugely undermines economic growth and impacts negatively on employment. Small and large businesses that are unable to meet the demands of their clients lose out to stronger and more prepared competitors. Hence, regular power supply does not only help to create job opportunities, but it also sustains them. The prevailing immature electricity infrastructure in Africa has negatively impacted firms' productivity by as much as 40% (United Nations 2020a, 2020b). This infrastructure sector is of key importance for Africa's competitiveness at local, regional, and global markets.

In a continent where only 53% of the inhabitants have access to grid-supplied electricity, Africa remains the most deprived one in terms of electricity access and quality of power supply (Infrastructure Consortium for Africa/ICA, 2020a, 2020 b). With roughly half of the population without access to stable electricity supply, socio-economic and human development initiatives become severely constrained. Numerous projects have been embarked upon in the continent since 2012 in sectors that range from roads, water, mining, and energy to transport, but much progress has not been reported, due in part to the frequent electricity outages. From recent statistics, it is evident that efforts are being made to ensure the transformation of the region to improve livelihoods and the quality of life of the people. What is also obvious is that much more needs to be done before any meaningful change can be seen and the Sustainable Development Goals (SDGs) of the Global Agenda 2030 are met, particularly in the transport, energy, and mining sectors.

For a continent where many countries are involved in the extractive industries, reliable and affordable transport becomes crucial. This is not the case in Africa. For instance, in the mining industry, where there is a widespread lack of quality roads and where there exists a sub-standard rail infrastructure, the costs of transporting extracted minerals are quadrupled, making for expensive extraction costs and revenue losses that could have been avoided. According to a Deloitte report (Deloitte 2015), as much as US\$500 million were stated as losses incurred because of poor infrastructure from projects such as the Mayoko Iron Ore project³ in the Republic of Congo (RoC). With such huge financial losses and accompanying social costs, the reason for the slow pace of development in Africa becomes clearer.

³ See on the dimensions and developments of the mining project in the Republic of Congo (RoC): <https://www.mining-technology.com/projects/mayoko-project/>; see also: <https://www.mining-technology.com/news/newsexxaro-sells-mayoko-iron-ore-project-in-congo-5021689/>

Such obstructive infrastructure problems only serve to undermine the industry, making for more market exits than entries. This has limited the growth for many mining countries in Africa, like Ghana with large deposits of gold, Cameroun, a country rich in bauxite, Zambia, a country with large copper mining, and South Africa, a country known for diamond, gold, and coal mining. These transportation difficulties faced in the mining sector are in addition to the daily challenges which are presented by electricity and energy shortages.

Transportation and energy demand are inextricably linked, as the transport sector accounts for the most energy demand of the OECD countries. This energy demand situation from the transport industry can also be observed in developing countries (United Nations, 2020a, 2020b). A key downside of this trend is that most of the energy demand in the transport sector is from combustible fossil fuel which is used to run most of the vehicles.⁴ Many countries have recognised the need to change to renewable energy sources and some now make use of cleaner fuels and of electric vehicles (EV), so helping to combat the negative effects of climate change. It becomes evident that efficient transportation networks and transport systems are a key requirement on the path to prosperity. The role of efficient transportation for industrial development and for economic growth is widely documented. Carefully designed and positioned road and rail networks and reliable public transport systems would be necessary to facilitate national, regional, and international trade in Africa. The transport infrastructure gap in Africa has hindered growth and made many affected countries less competitive. This has effectively limited the scope of conducting business activities in many industries, including energy, mining, and agriculture, sectors from which many of these countries generate their revenues.

Undoubtedly, the anticipated changes in the electricity and transport sectors would be vital for the required socio-economic progress to begin to materialise. Without reliable electricity all the SDGs, including the goals of ending poverty, will become harder to achieve. Furthermore, the reliance on carbon sources for electricity generation and transportation creates negative externalities or market shocks, as the damage to the environment is not accounted for in its pricing (Sovacool, 2009). Shifting to low carbon sources and to renewable energy systems, such as solar and wind energy, would help to negate the impact of demand shocks as large price variations for fuels have created macroeconomic policy adjustment problems. Similarly, having sustainable transport systems which rely less on fossil fuels, such as electric vehicles, would lead to healthier societies with less pollution and to a quicker transition to cities of the future. A shift to a lower fossil fuels-based economy, where innovative infrastructures that are low in carbon emissions

⁴ See on the fact that the transport sector in Sub-Saharan Africa depends to 99% on fossil liquid fuels (in 2015): http://energywatchgroup.org/wp-content/uploads/2019/03/EWG_LUT_Global100RE_All-Sectors_SSA_results_overview.pdf

are invested in, would be fundamental to meeting the SDG goals and targets of the Global Agenda 2030 and beyond.

Underpinning all the SDGs and the Global Agenda 2030 goals and targets is the need to protect the environment to help mitigate climate change. Africa remains one of the most vulnerable locations prone to global warming effects. In many rural locations in Africa, trees are still felled for fuelwood, constituting a legacy of degradation as trees serve as a sink helping to absorb carbon dioxide (CO₂) (Nicol et al., 2012). Moreover, using wood for fuel and kerosene for cooking can be dangerous, as harmful smoke and fumes are inhaled by the users. These traditional energy sources are not only heavily polluting but are environmentally destructive. Their unabated use would inadvertently result in a degraded environment with economic and social implications. For example, the unquantifiable negative externalities would result in an increased cost burden for governments and society as people become ill from atmospheric pollutants. As a result of inadequate infrastructure and poor policy choices, Africa is still ill-equipped to deal with health crises and the consequences of climatic change, such as drought, food scarcity and pandemics.

However, decades of slow economic growth and development, using unresponsive infrastructure in Africa, can be corrected by beginning to support more modern energy and electricity generation technologies and more energy-efficient transport, roads, and rail infrastructure over the conventional ones. Introducing and promoting novel infrastructure in vital sectors, like mining and agriculture, have the potential to reduce inequality, and to boost manufacturing industries through innovative technologies, thereby creating employment particularly for the local workforce. Such infrastructure investments will make communities and cities more sustainable through less environmentally polluting production activities, thus helping to grow economies while contributing to mitigating climate change.

Pace of infrastructure development, hindrances, and prospects for the development of African nations

Creating and developing innovative infrastructure in key industries, including mining, agriculture, transportation, and energy and electricity generation and supply would be fundamental to the drive to meet the developmental needs of the African continent. The current pace of infrastructure development is much slower than will be required for the attainment of the socio-economic progress necessary to advance the quality of life and the welfare of the continent's large population. Although there have been some promising steps in the energy and mining sectors (to affect poverty eradication, to combat hunger, to raise clean energy provision, to make possible education in rural areas, to reduce pollution, to protect water sources, etc.), when compared to other regions of the world, African countries have made the least progress in relation to achieving the SDG 2030 goals and targets.

Reports by the African Union Commission (AUC) and the OECD show that inadequate and poor roads, rail, and transport infrastructure systems in Africa have resulted in lower overall productivity levels by up to 40% (AUC/OECD, 2019). In terms of the roads network coverage, compared to the world average of 944 km per 1000 km² (which is equivalent to 7 km per 1000 inhabitants), roads infrastructure in Africa was only at 204 km per 1000 km² (which is roughly 3.6 km of roads per 1000 inhabitants). With this infrastructure gap, the challenges which deficient infrastructure presents to businesses in Africa becomes clearer. Here lies one of the major differences in firms' productivity between Africa and Asia. Over the course of 18 years, i.e. from 2000-2018, the Africa-to-Asia labour productivity ratio fell by 17% (AUC/OECD, 2019), and there are worsening prospects. With such losses come along increased unemployment rates in relevant sectors that are normally boosting the economies. Better infrastructure and investment prospects would lead to an expansion of economies because many firms would want to take advantage of the business opportunities presented.

Of importance is also the level of funding for infrastructure investments in the continent. The proportion of infrastructure investment (as a proportion of GDP) in Africa has stayed at 3.5% since 2000. In China, it is 7.7% of GDP. It is estimated that Africa would need to double this amount if it is to close the gap in infrastructure investment (McKinsey, 2020). According to the Programme for Infrastructure Development in Africa (PIDA), it is estimated that Africa will require infrastructure investment of about \$360 billion by the year 2040 (PIDA, 2020) to accelerate growth. The anticipated investments cover sectors which are including 236 projects in the transport industry and 54 energy projects. To meet the infrastructure targets, it is expected that a minimum of \$130 billion is invested on a yearly basis until the year 2025 (ICA, 2020a, 2020b). There has been a steady rise since 2016 when the amount invested was \$66.9 billion, as it was \$100 billion in 2018. Close to half of the yearly expenditure on infrastructure development in the last few years was made in Western and Eastern Africa, with a majority (75%) of projects on the transport and energy sectors (McKinsey, 2020). However, this is still under the projected minimum of \$130 billion spending per annum.

The most notable developments in relation to achieving the SDG goals and targets in Africa can be observed in Northern African countries (SDG Center for Africa/SDGC/A and Sustainable Development Solutions Network/SDSN, 2018). Based on a survey of 54 African countries, Tunisia recorded the most impressive progress to date with the topmost average index score of 61.6, performing highly on SDG metrics that includes ending poverty (SDG 1) and affordable and clean energy access (SDG 7). Equally of note is the progress shown by Morocco which is next to Tunisia in the index score ranking. Other SDG areas where the Northern African countries performed positively includes promoting economic growth and decent jobs (SDG 8), transition to more sustainable cities (SDG 11), encouraging

responsible consumption (SDG 12), and facilitating partnerships and regional integration (SDG 17). The greatest improvements for these North African countries were in climate action (SDG 13) and in maintaining terrestrial ecosystems (SDG 15). Continuing on this right trajectory, it is anticipated that the Northern Africa region will meet the SDG 1 goal to end poverty while making considerable progress in related goals, such as advancing health care (SDG 3) and developing industry, innovation and infrastructure (SDG 9). The only country that shows a regression in terms of meeting the SDG 1 goal and its targets of ending poverty is Libya. The trend for sustainable cities (SDG 11) is one that the Northern Africa region is unlikely to achieve given the current trends. The situation in Sub-Saharan Africa is quite different.

In general, Tunisia, Egypt and Gabon are the only countries in Africa that show promise in their implementation of SDG 7 (affordable and clean energy access). Using the same measurement index, countries in Southern Africa performed better than Eastern and Western African countries, with an average index score of 54.8 (Sustainable Development Goals Center for Africa/ SDGC/A and Sustainable Development Solutions Network/SDSN, 2018). Except of Botswana and Mauritius, other countries in this region are on track to meet their SDG 13 climate change goal. Reasonable progress was also recorded for the region in terms of SDG 9. Of the 54 recently surveyed countries, about 81% of the countries are yet to put concrete measures in place to enable them to meet the SDG 9 goal of the Global Agenda 2030 goal and its targets of moving towards a more sustainable and innovative industry with supporting infrastructure. However, Algeria, Tunisia, Egypt, Gabon, Morocco, Cote d'Ivoire, Botswana, and South Africa are making steady improvement towards meeting SDG 9 on industry, innovation, and infrastructure. This is an encouraging number of countries performing well on SDG 9.

Specifically, for Egypt, Morocco, and South Africa, using the energy sector as an example, commendable increases were observed in the total amount of renewable energy (RE) installations for electricity and heat provision. In Egypt, from the years 2016 to 2019, there was a 60% increase in RE investments with a current total capacity at 5972 MW (International Renewable Energy Agency/IRENA, 2020). About half of this comes from hydropower and the remainder is largely from wind energy. Likewise, in Morocco there was an increase of the total installed RE capacity of 2406 MW in 2016 to 3264 MW in 2019. Morocco invested mostly in wind energy (WE) and in concentrated solar power (CSP). Ethiopia is another country that recorded an impressive increase (by 68%) in installed RE capacity from 2016-2019, but most of their investments are in hydropower which can be susceptible to water levels. The only Southern African country growing its RE size is South Africa, which recorded an installed capacity of 6167 MW in 2019, what is a 32% increase from 2016. This country is one of the leading African and developing countries in solar thermal installations and

CSP. Eastern and Western African countries' contributions were minimal. Approximately 72% of the total number of surveyed countries for the Africa SDG Index and Dashboard Report (SDGC/A and SDSN, 2018) indicate that the countries Nigeria, Zimbabwe, Sudan, and Cameroon have not shown encouraging signs towards promoting an affordable and clean energy future for her citizens. Overall, regarding SDGs 7 and 9, Uganda, Zambia, and Zimbabwe were the least performing countries based on the latest assessment (SDGC/A and SDSN, 2018).

Some of the issues cited as hindering investment in energy, transport, and mining infrastructure which result in sub-optimal growth include a lack of political will, short but unconstitutionally prolonged presidential governance periods, often changing political governance tenures, unnecessary bureaucracy, widespread corruption, mismanagement of funds, irregularities in project management design and implementation flaws, poor technical expertise, and general delivery incompetence. This is the reason why despite availability of budgetary funds, the required funds are not being used optimally on the projects. In other words, the allocated funds are not fully spent by the project design and implementation teams. Such problems would make the multinational/multilateral firms and agencies wary to invest their hard-earned capital in African countries that are considered high risk. The implication of short but unconstitutionally prolonged political tenures is that the wrong projects are likely to be prioritised, making for poor infrastructure choices that are unsustainable. But, with clarity of purpose and a commitment to improve its economies and the lives of her people, short-lived and politically changing government tenures should not considerably alter the growth and development plans. Any government that takes over from another one can continue to pursue the same agenda alongside its own preferences or newly set goals.

Notwithstanding the less-than-desired record of the region, many countries in the continent appear committed to incorporating the key SDGs in their national development initiatives. This is because a large number of governments in Africa have begun to understand that embedding SDG 9 and other related goals into its country-wide development strategies is a prerequisite for the realization of its own growth agenda as well as meeting the 2030 SDG goals and targets. A 2018 study by the SDG monitoring group found that out of the 11 country case studies, 90% agreed of having linked their national strategy to the SDGs while 70% stated of having an action plan that will enable the implementation of the SDGs (SDGC/A and SDSN, 2018). In addition, 5 countries had set aside a budget that reflects an incremental financing of some of the SDGs. This positive outlook is believed to be associated with the continent's experience with goal-oriented development planning, such as reflected in the earlier Millennium Development Goals (MDGs) programme (SDGC/A and SDSN, 2018).

The post-COVID-19 health crisis would present another opportunity for African countries to rise and to take their place on the world stage. It would necessitate amongst other things prioritising the SDG 3 ("ensure healthy lives and promote

well-being for all at all ages”) and SDG 9, and embedding this in the national development plans. Repurposing local industry in Africa to care more for health sector products is now becoming an important industrial policy issue.⁵ Both SDGs are of critical importance to the attainment of other SDGs as these are interdependent as regards the successful delivery of other goals. Adding SDGs 1 and 7, we can say that SDGs 1, 3, 7, and 9 may be looked in context, especially after COVID-19. Simply put, without an efficient energy and electricity supply and a supportive infrastructure, other goals cannot be achieved; repurposing of manufacturing industry towards SDG 3 will depend on energy supplies. Repurposing manufacturing industry towards SDG 1 (no poverty) requires that frugal innovations become part of the industrial policy framework in Africa; this was discussed in a chapter to Unit 1. Therefore, SDGs 7 and 9 should be key ones to realize SDGs 1 and 3; they rank high and need to be prioritised in the Africa region’s infrastructure investment decisions. But, all the 17 SDGs need to be developed simultaneously, but in a context-specific programme approach. It only means that in all times more resources should be channelled to the most important projects, ensuring accountability at the stage of its implementation. Whichever SDG plans countries choose to prioritise based on their national development targets, it would be necessary to apply it strategically at the federal, state, and local government levels. It would equally be vital to ensure that private sector actors and institutions and other non-governmental bodies representing the civil society are also consulted and included during the implementation phase to encourage fuller participation.

The need for better national and regional policy choices and international co-operation

To surmount the infrastructure deficit would necessitate making changes to the ways the numerous infrastructure-related challenges are addressed. Changed priorities, better policy choices, and a systematic and more targeted approach to investment intentions need be rigorously pursued. Changing course to a more self-determined and focused path would lead to a realisation of greater value from the assets of the continent’s broader portfolio. As the governments of the continent organise to have in place a fully operational African Continental Free Trade Area (AfCFTA) to become a large single market of global relevance for the unrestricted

⁵ See on the “repurposing of manufacturing for health in Africa” issue the following reports: <https://oecd-development-matters.org/2020/05/26/repurposing-africas-manufacturing-a-means-to-address-medical-equipment-shortages-and-spur-industrialisation/>; and: <https://www.unido.org/news/covid-19-critical-supplies-manufacturing-repurposing-challenge>; and: <https://www.mckinsey.com/featured-insights/middle-east-and-africa/reopening-and-reimagining-africa>; and: <https://institute.global/sites/default/files/inline-files/Tony%20Blair%20Institute%20C%20A%20Guide%20to%20Repurposing%20Manufacturing%20to%20Create%20Medical%20Equipment%20in%20Africa.pdf>

movement of goods and services, additional urgency is placed on the infrastructure challenge. There will be need for increased cooperation between the African countries' governments and within the countries a cooperation of governments and the private sector, but also between the African economic regions (regional economic communities) and between Africa and the international level. Although there is some progress with the AfCFTA, a lot of effort is still necessary.⁶

It is well known that most of the African regions which have planned investments in transport, energy, and mining projects have been delayed or came to a full halt because of the absence of the relevant supporting infrastructure. Also, where the necessary infrastructure is in existence, the progress can be unsatisfactory; the under-performance is due to underinvestment, bad management, or lack of maintenance, or because of all these factors. For instance, in the mining sector, while there is continued interest by local and foreign investors to expand their respective portfolios, e.g. at BHP Billiton⁷, the lack of supportive infrastructure has presented huge impediments to their business expansion plans (Deloitte, 2015). Overhauling the infrastructure of the countries would be crucial to achieving some sort of leverage in trade in areas that include road transport, telecommunication, and energy sectors.

Crucially, the power sector of most African countries has operated at under-capacity levels for decades, presenting immense difficulties for most business activities. For the mining sector, for instance, power supply charges account for up to 40% of total mining processing costs (Deloitte, 2015). This is particularly so for countries like South Africa whose major electricity company ESKOM supplies electricity to other nearby mining countries, like Botswana, Namibia, Mozambique, Zambia, and Zimbabwe.⁸ Overall, while this is a sign of cooperation and a supportive system, it clearly shows that electrical power failure in South Africa affects regional progress. What this means is that major improvements to regional production networks would be required to facilitate trade and to grow businesses. Cooperating with countries around one's border enables firms to integrate more easily into regional value chains, especially in sectors like mining and agriculture

⁶ See on the state of affairs: <https://openknowledge.worldbank.org/handle/10986/34139>; the 2020 study from the World Bank "The African Continental Free Trade Area: Economic and Distributional Effects" is also reviewed in Unit 3 of this volume. Income could be boosted by 7 percent (nearly \$450 billion, in 2014 prices and market exchange rates), with very positive implications for employment, industry and trade.

⁷ See on BHP Billiton; the Australian Broken Hill Proprietary Company Limited (BHP) and the Anglo-Dutch Billiton plc were forming a dual-listed company: <https://www.bhp.com/our-approach/our-purpose/>

⁸ See on ESKOM with the founding name Electricity Supply Commission: <https://www.eskom.co.za/Pages/Landing.aspx>, and: <https://www.news24.com/Tags/Companies/eskom>

where many of the local workforce is employed. Creating supportive environments that are deemed attractive by investors would encourage foreign direct investments, further impacting the economies positively. The current intra-African trade agreements can be strengthened by removing barriers related to the tariff structure and because of trade systems leading too often to associated uncertainties for potential exporters. Also, making the administrative processes of exports less bureaucratic and less cumbersome and putting in place the relevant roads, rail, and ports infrastructure would result in enhanced productivity of the African continent.

Other barriers to market entry and related regulations, including ease of conducting business, need to be tackled. For the mining sector, for example, the difficulties faced by prospective investors in terms of acquiring licenses and permits have contributed to lessened interest in the extractive industries of Africa. Evidence (from KPMG 2016) indicates that out of 9 mining countries in Africa, including South Africa, Botswana, Namibia, Democratic Republic of Congo/DRC, Congo, Tanzania, Ghana, and Zimbabwe, only Mozambique could be regarded as having registered an improvement in the ease of carrying out business ratings between the years 2014-2015 (KPMG, 2016). Some new findings for Doing Business 2020 give evidence that some countries, among them some mining exporters, did reforms. Such countries with reforms are Democratic Republic of Congo, Gabon, Guinea, Kenya, Nigeria, Zambia, and Zimbabwe; they were reforming some aspects of relevance for ease of doing business.⁹ But Mozambique has not continued with its reforms as to the Doing Business 2020 report. But the full list of Sub-Saharan African (SSA) countries for Doing Business 2020 shows that not too much has changed and that reforms are not always continued.

Unnecessary red-tape and high corporation taxes can act as disincentives to investment. The focus should be to encourage more participation. However, there should be a focus on trading high value goods to accelerate economic development in the continent. For rapid growth in smarter manufacturing, industrial productivity advances and greater competitiveness through increased integration into the global value chains (GVCs) would be necessary. Having access to the GVCs allows the countries to benefit from integration and participation. GVCs allow it firms located across different countries to participate at various stages of production depending on the production characteristics of firms and countries. Globalisation drives companies and firms to restructure their operations across countries and regions through outsourcing and the offshoring of its production activities (OECD, 2020a). To this end, policies that deepen regional integration are a key requirement for proper participation in GVCs which leverage multinational enterprises' presence, thereby helping to bring SMEs into GVCs. Under this system of

⁹ See on IFC/World Bank's Doing Business Report for 2020: <https://www.doingbusiness.org/content/dam/doingBusiness/pdf/db2020/DB20-FS-SSA.pdf>

international production, trade and investments, firms aim to optimise the diverse processes of their production by locating the different stages across dispersed sites.

Clusters of private sector firms are also better able to access business services when they strategize, cooperate, and focus on areas of the maximum advantage. This improves linkages, specialisations, and skills. For example, in Kigali in Rwanda the firms that have adopted such strategies have doubled their business values as they focus on areas where they are competitively advantaged. Trading arrangements as the above-mentioned ones help to improve and to strengthen collaboration between national and multilateral institutions that include banking and finance companies providing loan facilities. Multilateral agencies can also enrich infrastructure investment projects by sharing their skills and expertise. An example of the outcome of such a cooperation is the 4,500 km highway linking Algiers in Algeria to Lagos in Nigeria.¹⁰ Technical and political support from both countries involved led to the successful progress recorded to date. Lower-scale development projects would demand that a more bottom up approach is adopted instead of the top-down strategy that most African nations tend to follow.

Increasing trade of goods and services between regions would also be necessary to transform economies in Africa. When there are only few countries that produce goods and services that can be traded with one another, it hinders linkages and results in regional trade imbalances. An example of this situation can be observed in Southern Africa where most countries depend on goods produced in South Africa while they do not produce many goods demanded by South Africa. In difficult trading environments or in a recession, this can disadvantage over-reliant countries. For example, since March 2020 the South African government has - in response to the COVID-19 health crisis - cut gold mining operations to 50% of the operational capacity (BBC News, 2020). For countries that rely directly or indirectly on South Africa's gold mining activities, such a fall in output could have damaging consequences, especially for the citizens of neighbouring countries that may depend on work there for securing their livelihoods.

Progress on delivery of financial services for productive sectors is important, especially for small industries

Financial services matter for small industry development and for agriculture and agribusiness development in Africa. This is also recognized for SDG 9 as a target relates to finance inclusion issues for small industries. The fact is that not more than 30 percent of agricultural products are processed in developing countries, while in high income countries a percentage of 98 percent is reached. A key factor to explain this low percentage is the scarcity of finance for farms, and rural and urban small industries. Farm entrepreneurs and rural and urban entrepreneurship

¹⁰ See on the progress of this road project: <https://www.theafricareport.com/30615/the-4500km-lagos-algiers-road-takes-a-step-closer-to-reality/>

are limited by low availability of finance and by the lack of financial products and of financial innovations. Innovations in these enterprises are blocked by the lack of finance, as new equipment, funds for developing new products, and support by R&D cannot be provided. All this affects innovations to improve products and services for middle and upper classes, but frugal innovations for the Bottom Of The Pyramid (BOP) households and firms are suffering even more. Innovative financing mechanisms are needed as the number of small enterprises is growing, so that the demand for long-term access to capital markets increases as well.¹¹

It is necessary to develop new forms of finance which go beyond the traditional banking mechanisms and which comprise not only the single enterprise but the whole value chain where small and medium-sized enterprises are linked to each other. This relates to economic sectors and firms: agriculture production and processing of agricultural products, industry with all forms of urban and peri-urban industrial small and medium-sized enterprises, comprising in all sectors the formal and the informal enterprise segments. Not only small and medium-sized enterprises (SMEs) in developing countries, also in Africa, suffer from such finance constraints: Evidence shows that also the small enterprises in European countries have seen such problems after the global financial crisis (GFC) of 2008/09. Data show the decline of funding from the side of the banks to the European SMEs since the GFC. The proportion of successful loan applications from the SMEs has declined in practically all European Union (EU) countries.¹² Data for Asia show similar trends, but data for Africa are scarce (the situation may be even worse than in other global regions). But Africa benefits now from financial innovations, such as using mobile credit facilities via mobile phones, and this even in remote regions. The M-Pesa facility in Kenya has given such opportunities to a growing number of households, microenterprises, and small enterprises. M-Pesa can be used not only for payments and transfers of money, but also for getting microloans (beside of many other functions of the mobile phone as for getting work, medicine, advice, access, and for voting). The group-based solidarity approach compensates for the lack of collateral, so that all types of cooperatives and producers' organisations have access to finance products. The financial sector in Africa is now restructuring rapidly by moving to new finance media, but also to new forms of partnerships and collaborations which help to increase the share of SMEs in accessing loans. Specific initiatives, such as ESG and impact investors, play now a role, not only in developed countries but also in Africa.¹³ Their funding is related to climate protection and biodiversity, job protection and poverty reduction, food security and

¹¹ See on these issues: https://stats.unctad.org/Dgff2016/prosperity/goal9/target_9_3.html

¹² See figure 9. 11 in the study by UNCTAD: https://stats.unctad.org/Dgff2016/prosperity/goal9/target_9_3.html

¹³ ESG is an abbreviation for "Environmental, Social and Governance", and relates to in-

nutrition, water management, irrigation and sanitation, democracy and good governance, economic reforms and market development, etc.).¹⁴

Related to finance for targets of SDG 9, there are two objectives mentioned: First, increasing long-term finance for public-private partnerships in transportation, renewable energy, and communications infrastructure. Second, to contribute to the development of resilient cities and trade, to ensure that infrastructure investments are environmentally sensitive and respond to the needs of low-income users, women and other marginalized groups (including persons with disabilities, indigenous persons, racial and ethnic minorities, and older persons).¹⁵ Examples of funds with origin from developed countries are mentioned, like Swedfund (related to job creation in the local textile industry in Ethiopia), Munich Re (related to sustainable insurance based on ESG (Environmental, Social and Governance) principles, such as for infrastructure projects), and Aviva (related to investment in low-carbon infrastructure). Inclusive finance for production cooperatives and producers' organizations is organized and supported by FAO, which helps them to get loans and to organize own funds for investment into sustainable agriculture. As an example, financial instruments are targeted to producers' organizations in Niger since 2009.¹⁶ Around 800 cooperatives and input shops owned and managed by the cooperatives are supported (FAO, 2018, p. 23). More than half of the agricultural villages of Niger are reached by well-priced and good quality inputs. Yields of sorghum and millet have increased considerably. For around 180,000 farmers a credit guarantee fund was made effective to increase access to agricultural credit. Accessing commercial credit by cooperatives is a viable solution, but some federations of cooperatives use also own funds for their sustainable investment programmes. In fact, also banks are learning how to cooperate with producers' organizations. Also, for urban industrial ventures such collective forms of support may be useful to get access to commercial credit. Some support was given by UNIDO and other UN organizations. Economic diversification is a result of these initiatives for producers' organizations, as the finance constraint is overcome.

vestments and investors based on such principles. ESG principles are integrated into investment analysis and portfolio construction, and there is some evidence that investors who work on such a basis have potential long-term performance advantages. Impact investment is a general term for investing with the intention to improve well-being, by investing for good intentions.

¹⁴ See: https://sustainabledevelopment.un.org/content/documents/9789CRT046599%20SDG_Financial%20Services_29sep_WEB-1.pdf

¹⁵ KPMG and United Nations Global Compact (UNGC), September 2015, SDG Industry Matrix, Financial Services, information for SDG 9 at Box p. 32; access: <https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/05/sdg-financial-services.pdf>

¹⁶ See: <http://www.fao.org/3/I9900EN/i9900en.pdf>

The Sustainable Development Goals Center for Africa (SDGC/A) became a pivotal role for facilitating the provision of finance for realizing the SDGs in Africa (SDGC/A, 2017), by designing national and sectoral SDG plans, by supporting finance plans and finance institutions, by advice when accessing international funding of action to realize SDGs in Africa, and by the training of staff from governments and private sectors for handling SDG funding.¹⁷ Domestic and international public and private actors have a role in financing the SDGs in Africa, and all financial sources, funds, and intermediaries have a role to play (SDGC/A, 2017). Important is also the Action Platform: “Financial Innovation for the SDGs” to explore innovative instruments which have the potential to direct private capital towards critical sustainability solutions. It is based on the United Nations Global Compact (UNGC), but in cooperation with the Principles for Responsible Investment (PRI) and the United Nations Environment Programme Finance Initiative (UNEP FI).¹⁸ The purpose is to guide impact investment strategies which support SDGs, also in Africa. As the ESG and Impact Investments gain in importance, all such initiatives play a role for realizing the SDGs in Africa. Impact investments are growing in Africa, also those which are related directly to SDG 9.¹⁹ Some examples show the increasing relevance. Injaro is an impact-oriented fund manager who is focussing on agribusiness opportunities in West Africa. Targeted are individuals who earn a daily wage of USD 2 or less and smallholder farmers who cultivate less than 2 ha of land and provide/derive products/services to/from their investee companies. Assessments of such investments consider social impact factors, e.g. potential job creation, income provision of goods and services for the target groups, and potentially increasing local sourcing of inputs (IP/FERDI, October 2016, p. 39).

Other examples with relevance to SDG 9 are impact investments in the key infrastructure sectors of Africa, such as power, transport, irrigation, water and sanitation, and information and communication technologies (IP/FERDI, October 2016). To mention a project in infrastructure, Investisseurs et Partenaires (I&P), with InfraMed, have launched I&P Africa Infrastructure (IPAI). This is a fund which is dedicated to supporting a wide range of small infrastructure projects in Africa, such as an oil residue recycling unit, a hospital project, a programme for photovoltaic panels on carports, a desalination plant, a hydropower facility, and some cotton biomass power plants. Information and communication technologies (ICTs) also are important in IPAI. ICTs can accelerate progress towards achieving

¹⁷ See: https://sdgcafrica.org/wp-content/uploads/2017/03/sdg-financing-for-africa_key-propositions-and-areas-of-engagement-.pdf

¹⁸ See: <https://www.unglobalcompact.org/take-action/action-platforms/financial-innovation>

¹⁹ See IP/FERDI, October 2016: <https://ferdi.fr/dl/df-HF85ftaqPtr7fs2g8wRJq3kA/study-investing-in-development-in-africa-how-impact-investment-can.pdf>

the SDGs and will lower the cost of doing so, notably in health, education, and agriculture, but also in the energy and water sectors by helping to monitor and to reduce consumption. ICTs can also make production processes more efficient, will facilitate the collection and exchange of information, and may help to create, to organize and to strengthen communities (IP/FERDI, October 2016, pages 50-52). It may be interesting to see the long-term outcome of the initiative and the long-term viability of these projects.

Another example of an impact investment fund, which is fostering innovation as the second element of SDG 9, is the eVentures Africa Fund (eVA Fund). This Fund invests in small and medium sized African internet-related companies. It is said that the eVA Fund has invested in Verviant, a Kenyan-based software and web development company, and in MoboFree, one of the leading African mobile social market places that allows people to buy, to sell and to swap products online. Over 3 million users are – as reported - registered on MoboFree. Their portfolio also includes Nomanini, a South African-based payments platform provider. Nomanini was solving the problem of distributing mobile prepaid services in townships and rural areas. Their product enables informal market entrepreneurs, who are working within their local community, to print and to sell airtime easily. So, relating to key targets of SDG 9, rural communities can conveniently access and participate profitably in this massive and essential mobile services value chain (IP/FERDI, October 2016, pages 50-52).

All these examples show that the discussion about SDGs and the focus on SDG 9 have stimulated the delivery of financial services to key economic sectors in Africa. Domestic public and private investment and impact investment play a role in many of the successful projects.

African countries are making strides towards the anticipated future

Despite the slow pace of change, various countries in Africa have been progressing towards the attainment of their own nationally set goals and the broader SDG 2030 goals and targets. Two of the countries that have created a feasible implementation plan and have to date maintained a steady course on their design and implementation of the SDG plans are Ghana and Rwanda (SDGC/A and SDSN, 2018). These countries would serve as a benchmark that other countries can imitate in creating and implementing their SDG initiatives. In the case of Ghana, the government has revealed rigorous efforts through the design and introduction of a 3-step coordinated structure of institutions that runs from the president's office to other government departments, down to the civil society organizations. They include specifically the SDGs Implementation Coordination Committee (ICC)²⁰, the High-Level

²⁰ See: <https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Ghana-inaugurates-Technical-Committee-for-SDGs-and-Agenda-2063-implementation-576178>

Ministerial Committee (HLMC) on the SDGs²¹, and the National Technical Steering Committee/NTSC (SDGC/A and SDSN, 2018). The objectives of this arrangement are to make for a more integrated and coordinated approach where all the key actors and associated members can effectively collaborate knowing their roles and responsibilities. An example of a linked member under the ICC is the Ghana Statistical Service (GSS) which has been given access to collect, analyse, and report relevant data while providing capacity support to other government institutions. To educate the citizens, the government has harmonized its centralized coordination with targeted and regular public awareness campaigns on the importance of the SDGs as well as combining this with the state development goals. Such a clear structure signifies a determination to get it right while allowing for accountability. With the above structure and formation, the Ghanaian government is monitoring and reporting its progress towards the achievement of the collective SDGs.

In Rwanda, a combination of a top-down and a bottom-up approach to SDGs implementation has been adopted. Using the *Imihigo* strategy which is a results-based form of performance contract, the country is primed to ensure that the plans are not only comprehensive but allows for accountability (SDGC/A and SDSN, 2018).²² Originally, the *Imihigo* concept which was introduced in 2006 applied to local government projects but has been tied to international development schemes merging together local and international programmes such as the SDGs. Comparable to the structure of Ghana, the Rwandan Government created a Steering Committee (SC) and a National Partnership Group (NPG), chaired by the Ministry of Finance and Economic Planning (MFEP).²³ The Rwandan government's goals, targets and indicators are taken from diverse national schemes, like the Vision 2020 and the Economic Development and Poverty Reduction Strategy (EDPRS) programmes, which are then aligned with the SDGs of the Global Agenda 2030. Another important element of the Rwandan government's approach is the inclusion of citizens in consultation meetings, thereby ensuring that their voices are heard and considered in the decision-making process. Lessons learned are also documented and evaluated for replication purposes. As part of this assessment, a technical team was created to examine performance and to record progress every 2 years. Largely, this implementation structure has made for orderliness in the

²¹ See: <https://www.myjoyonline.com/news/high-level-ministerial-committee-meet-to-review-sdgs/>, and: <https://newsghana.com.gh/first-meeting-of-the-high-level-ministerial-committee-on-the-sdgs/>

²² See more on this approach of Rwanda: <http://www.thinktankinitiative.org/content/ipar-rwanda-evaluating-performance-contracts-imihigo-improve-lives-rwandans>

²³ See on this partnership approach: <https://openknowledge.worldbank.org/handle/10986/34109>

drive towards a more sustainable economy for both Rwanda and Ghana, with these two countries serving as a benchmark for other African countries.

In relation to progress towards meeting the general SDGs, North African countries represent the region with the most promising trends to date as exemplified by Tunisia, Morocco, Egypt, and Algeria. The countries appear to be doing this for more practical reasons as the region has not established specific green goals. These countries have shown good progress on SDG 7 (energy access) and moderate progress in many of the other SDGs, including SDG 9 (industry, innovation, infrastructure), SDG 13 (climate action), and SDG 15 (life on land). On trends, Tunisia has out-performed other countries in Africa with the highest average index score of 61.6, followed by Morocco. If sustained and supported, Northern African countries would be on track to meet the SDG 9 target and having almost attained SDG 1 (ending poverty). As mentioned earlier, the Northern African countries of Algeria, Tunisia, Egypt, and Morocco have recorded impressive progress in terms of meeting SDG 9 targets with substantial infrastructure investments in sectors like energy generation, mining, and the transport sector. In Southern Africa, Botswana and South Africa are the leading nations while Gabon represents progress in Central Africa. The West African country Cote d'Ivoire is also on course, especially in the construction industry. Together, these countries present viable models that other less-performing countries can emulate by adopting a clearly stated and designed implementation programme like those of Ghana and Rwanda.

The way forward in the 4th industrial revolution and the post COVID-19 pandemic

The essential reform that will enable the African continent to achieve the SDG 9 goals and the eight targets calls for a change in strategy to one that favours the promotion of modern and novel technologies in combination with enabling policies to improve businesses and healthcare systems for all the citizens. The 4th industrial revolution presents opportunities to fast-track solutions to overcome poor quality education, poor service delivery, and climate change vulnerability. Without such preparations and investments into the digital infrastructure, 3D printing, and Artificial Intelligence (AI), a large proportion of the population would be left behind, further widening the skills gap rather than closing it. A paradigm shift towards the use of innovative technologies would close the digital divide and reduce the prevalent inequality. With a fast growing population, it is estimated that the African continent will have one of the largest workforce in the world by 2030 (Ndung'u and Signé, 2020), a situation which if aligned with the required infrastructure to raise the skills would present great opportunities for economic transformation. This would also mean a shift to more automation in manufacturing and industrial processes; the quality of products and services and the export opportunities would improve.

For the agriculture and agro-industry sector, the 4th industrial revolution will create avenues to apply future farming practices where modern farming techniques, such as precision agriculture, are encouraged and widely adopted. With a high proportion of the continent's workforce in the agriculture sector, it would mean better and easier farming methods bringing in more income for the mostly rural workforce with close to 50% engaging in farming (Ndung'u and Signé, 2020) and livestock management. As an increasing number of countries embrace the digital age and the Internet of Things (IoT), food waste is significantly cut by increased application of data in farming practices, so making for optimum output. In the healthcare sector more investment in IT use would make it easier to monitor serious health conditions and the restocking of essential medicines when shortages are noticed, using the state-of-the-art data recording and stock replenishing systems. Even in crisis management, IT use would result in faster response times as illnesses are more swiftly identified and treated which can be lifesaving. Making mobile telephone systems widely available would help transmit information quickly, using all the possible mobile mediums saving lives in life-threatening situations. Promoting IT use in health care would help to transform health care facilities and care provision in Africa. Closing the skills gap would arise from ensuring quality education, providing supportive infrastructure, and investing heavily in research and development projects. Slowly introducing these technologies would prepare the African population for times when more high-tech systems become available.

Other measures to help bring about infrastructure project success includes improving the commercial viability of projects, providing adequate regulatory frameworks and support, reducing risks (perceived and actual), providing financing, and ensuring a conducive environment to attract private sector investments. Also, an approach is discussed of reallocating finance provided by the government so that projects like water supply, housing, and transport with lower returns are funded by government while other more lucrative or commercially viable projects are left for the private sector investors. Kenya and Ethiopia have successfully employed this approach in affordable housing provision while the management of the development is outsourced to the private sector. Moreover, concerted efforts between the governments and the private sectors, deeper regional cooperation, and intensified capacity-building would be required before the infrastructure gap can begin to narrow. This is a keyway to reach the desired levels of infrastructure improvement and societal advance. Regional cooperation would make it possible for unhindered and easy movement of goods across borders. The timely delivery of construction projects would be more likely guaranteed when there are reliable, efficient, and affordable transport networks. As nations strive to combat the effects of climate change and global warming, a faster transition to more sustainable transport modes, roads construction, and energy generation and use is encouraged. Aside of business facilitation via the presence of appropriate delivery networks for

goods, other benefits of sustainable transport include convenient transportation, cleaner air quality, and an overall reduction in harmful atmospheric emissions.

This also means that the health and wellbeing of citizens can be enhanced through more sustainable transport infrastructure. Improving transport infrastructure in Africa would further make for enhanced integration of communities, improved social equity, seamless urban-rural linkages, and more contribution to economic growth from the rural populace. As the world recovers from the COVID-19 health crisis, it becomes more urgent for Africa to consider ways to transition quickly to more energy-efficient transport systems, such as electric vehicles (EV) for mass transit purposes and the construction of vehicles that use low-emission fuels. Because many infrastructure projects are capital-intensive, most governments are unable to singlehandedly fund these. There is therefore a need for increased involvement of financial institutions that can provide low-cost loans to individuals and businesses when required.

The high costs of infrastructure investment are the reason why only 42% of infrastructure project financing in the last decade came from national governments and 24% were from donor agencies and African institutions, while China provided 23% of the funds. The transport sector took 42% of the amount invested for infrastructure while energy sector investments represented about 30% (ICA, 2020a, 2020b). The remainder went to smaller projects like community water supply. The funding from China has continued to increase with rising repayment interest for the borrowing countries. This is evidenced by countries like Ghana, Kenya, and Nigeria where a considerable amount of mining, rail, and roads construction works have been awarded to Chinese firms. In Kenya, for instance, the 485 km Mombasa-Nairobi Standard Gauge Railway that had costs of \$3.6 billion in 2017 was almost entirely financed by the China EXIM Bank, which provided over 90% of the funds (ICA, 2020a, 2020b). In the mining sector, Canada-listed companies provide the largest funding in mineral exploration in Africa. This is followed by Hong Kong-listed companies. Of about 8 financiers, only the Johannesburg stock exchange is African owned, but it is providing the least amount of funding per million spent (Deloitte, 2015). On the other hand, the private sector in Africa has been responsible for the least (2.8%) amount of financing of infrastructure projects. This reluctance could be borne out of wanting to minimise the risk of revenue loss in uncertain conditions due to the socio-political environment in African countries. Other practical reasons could be linked to the fact that close to 80% of the infrastructure projects in Africa tend to fail at the feasibility and planning stage (McKinsey, 2020).

To minimise the need to borrow from China at high repayment costs, African countries would have to engage more with the private sector. Likewise, it would be important to liaise with regional countries and multinational international agencies that can provide better and cheaper financing, using mechanisms such as the very successful results-based funding or financing (RBF). Essentially, RBF is a

tool for development cooperation. It is an innovative and effective approach that involves providing lending to an agent who takes responsibility for achieving pre-defined results. Under this system, funding is only released when the pre-determined results have been achieved and independently verified (World Bank, 2020a, 2020b; OECD, 2020b). A key benefit of RBF is that it helps to control inefficient spending and to tackle bottlenecks which have posed a longstanding challenge in infrastructure investments in Africa. However, its advantages come from well-designed and implemented RBF initiatives (World Bank, 2020a, 2020b). Many development institutions resort to RBF as a method to ensure the effectiveness of their aid to a developing country (World Bank, 2020a, 2020b). RBF incentivises development projects and has proven successful in its application to many sectors including education, health, and energy. Countries like Kenya and Ghana have benefitted from such mechanisms. While Kenya used it to provide water utilities, in Ghana it helped to facilitate the adoption of low-cost solar energy systems (World Bank, 2020a, 2020b). It is a financing approach, worth considering for accelerating investments in infrastructure to meet the SDG 9 targets as set.

2 The Contributions

The first chapter of Unit 2 deals with **Financial Inclusion, Innovation and Agricultural Development in Nigeria**. This is a country case study done by the three authors **Reuben Adeolu Alabi, Adebowale Bakare and Timilehin Victoria Alabi**. This chapter has relevance for financing rural and urban small enterprises as financial inclusion determines the capability to operate and to grow. The target 9.3 reads as follows: “Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets”. Two indicators are mentioned: First, the proportion of small-scale industries in total industry value added, and second, the proportion of small-scale industries with a loan or line of credit. Investments and innovations depend on access to finance, and therefore this target 9.3 is important for the rural and urban areas, as well as for the sectoral interdependencies. With a case on Nigeria one of the leading African economies is considered, a country that has a lot of potentials in its agriculture sector although these are not used properly and not at all fully.

One of the reasons for Sustainable Development Goal (SDG) 9 is to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Specifically, one of the targets of SDG 9 is to increase the access of small-scale industrial and other enterprises (including farming) to financial services, including affordable credit, and allowing for their integration into value chains and markets. The financial inclusion as stated in the eight SDG 9 targets as number three is important for the agriculture sector because it will significantly

enhance the operations of the small rural enterprises, the incomes of the rural poor and especially the rural working poor, and it will enhance the accessibility of all agricultural actors to a wide range of financial services and products that are necessary to diversify their means of living, to enlarge their supplies to the rural markets, to raise and diversify their incomes from agricultural production, to provide for food security, and to eliminate poverty traps. In this sense financial inclusion will benefit all the actors in rural areas.

As noble as the SDG 9 goal and its targets are, they do not offer a plan for how to achieve such laudable targets, indicators, and objectives. As the global society moves towards the implementation of the 2030 Global Agenda for Sustainable Development, a study of this nature is relevant to provide the hands-on experience of identifiable ways and methods that will be instrumental to achieving the goals set by the international community, especially the ones that have to do with financial inclusion, industrialization, infrastructure development, and innovation and technological progress in Nigeria. Therefore, this chapter is set to achieve the following objectives: (1) Examining the growth, nature, and structure of financial inclusion in Nigeria. (2) Analysing the determinants of the growth of financial inclusion in Nigeria. (3) Comparing the financial inclusion in Nigeria with the situation of other African countries with a higher financial inclusivity. (4) Investigating the role of innovation, infrastructure, and industry on financial inclusion in Nigeria, and vice versa the effects of financial inclusion on realising the SDG 9 goal. (5) Determining the effect of financial inclusion on agricultural productivity in Nigeria.

The chapter made use of descriptive statistics to analyse the data from 36 States of Nigeria, including the Federal Capital Territory (FCT), spanning the period of 2008 to 2018. The relevant data considered are the maize yield and other development indicators, such as income poverty, illiteracy, unemployment, underemployment, and food insecurity. To establish the role of infrastructure on financial innovation adoption and financial inclusion in Nigeria, the chapter estimates the correlation coefficient between financial innovation, infrastructure development and financial inclusion in Nigeria. The authors use rural accessibility to electricity and coverage of mobile phones as indicators of infrastructure and use adoption of mobile money (MM) and of the Automatic Teller Machine (ATM) as financial innovations. The results of the study show that the financial inclusion rate which stood at 47% in 2008 had increased to 63% in 2018 in Nigeria, which is however lower than that of South Africa, Rwanda, Kenya, Uganda, and Tanzania with financial inclusion rates of 93%, 89%, 83%, 78%, and 72% respectively. This implies that there is much room for Nigeria to improve its financial inclusion rate despite the progress that has been made in the past decade.

The analysis by Nigerian states reveals that Gombe state has the lowest financial inclusion rate of only 24% while Lagos state has the highest financial inclusion rate of 85%. The financial exclusion is a major problem in the rural areas of

Nigeria as it is shown that the financial exclusion in rural areas (46%) is more than twice that of the urban areas (22%) in 2018. The results reveal further that the financial exclusion rates among the female and the male are 33% and 41% respectively in 2018, while the rate of decrease of financial exclusion is lower among the female (6%) than among the male (10%). This suggests that the gender financial gap in Nigeria may continue to widen over time. The financial exclusion rate among farmers is 52% which is higher than the estimated 37% average financial exclusion rate which was estimated for Nigeria. This may imply that farmers need special financial facilities that may be tailored to their specific needs because of the nature of farming activities. The chapter is rich in examples what can be done to raise the inclusion rate of farmers.

The examination of the relationship between financial inclusion and the maize yield shows that financial inclusion is positively correlated with maize yield in Nigeria. Financial inclusion has negative but significant correlation with illiteracy in Nigeria. Based on the investigation of the role of the infrastructure on the adoption of financial innovations the study finds that access to rural electricity has a positive and a significant correlation with formal banking. Accessibility to rural electricity has a positive relationship with the use of mobile money, of mobile phones and of ATMs. Use of mobile phones has a positive and a significant correlation with the use of formal banking institutions and financial inclusion in Nigeria. The use of ATMs has a positive and a significant relationship with formal banking which may in turn affect financial inclusion positively. However, the use of ATMs has a significant but a negative relationship with the use of MM. This implies that as the more people adopt the use of MM, the less they use ATMs.

The chapter has six sections. After the Introduction (section 1) there is a section 2 on the growth, the nature, and the structure of financial inclusion in Nigeria. Section 3 covers issues relating to Financial Inclusion and Agricultural Activities in Nigeria, to understand the specific importance of financial inclusion for agriculture development. Section 4 is on Financial Innovation, Rural Infrastructure and Financial Inclusion as a basis for the development of viable Agricultural Value Chains in Nigeria. Section 5 discusses the relevance of Sustainable Development Goal 9, of Financial Innovation and of Financial Inclusion for Nigeria's Agricultural Development, while section 6 is on Conclusions and Policy Recommendations.

The study concludes by making recommendations on how to translate opportunities that are available for financial innovation in Nigeria to economic opportunity. More than this, most of the results have some importance also for micro, small and medium enterprises in urban areas, especially in smaller and intermediate cities. The link of financial inclusion to innovation, industry, and infrastructure is presented in various examples and in some informative boxes.

The second chapter in Unit 2 of Volume 22 for 2020/2021 with the title **Making Capital and Institutions work for Developing Agro-industries in Sudan** is

authored by **Yagoub Elryah and Nadia Hassan**. The chapter is also a case study, addressing the issues of developing agro-industries in Sudan through new approaches and policies that are based on the linkages inherent in SDG 9 between industry, infrastructure, and innovation. It is remarkable that all the eight targets of SDG 9 have relevance for this field of research and development (R&D) interest. The basic question is how Sudan can mobilize capital and institutions in such a way that the agricultural potentials of the country can be used for food security, for industrial processing, for modernization, and for exports. It is always emphasized that the comparative advantage of the Sudan is with agricultural products, but till now the country is exporting a lot in raw form, not in processed form. After many decades gone since Sudan's independence, this situation is highly unsatisfactory. New approaches, like structural development economics, endogenous growth theory, and innovation economics, when applied to developing countries give some answers how this can be achieved, and how comparative advantages can be turned to competitive advantages of sectors and firms. SDG 9 gives a guide on linking the build-up of innovation capacity, the development of infrastructure, and the industrialization path of a country with such abundant endowments of agricultural and livestock resources.

The purpose of this chapter is therefore to identify the importance of human and physical capital and of the set of institutions which is needed to sustain development in Sudan. It is a considerable challenge to policymakers to map out the compatibility between national policy priorities and Sustainable Development Goals (SDGs). It is argued that capital and institutions play a highly significant and continuous role in implementing and achieving the SDGs. New growth theories highlight the importance of mobilizing the stock of knowledge, the different forms of capital, and the various forms of institutions. Therefore, the link between growth factors and sustainable development goals (SDGs) is discussed, using various aspects of new growth theories. One of the most important questions regarding the interactions between SDG 9 and the new growth theories is why sustainable industrialization is one of the most important determinants of a country's economic transformation. With SDG 9 there is also a link to innovation capacity and infrastructure development. The chapter starts with reviewing the economic theories that underlie the targets and indicators of the SDG 9. It is often neglected in the discussion about the role of the SDGs that current economic and social theories have played a role in formulating and presenting the SDGs; the formulation of SDG 9 is a good point as various growth and development theories are bundled together. Therefore, attempts are made in the chapter to shed some lights on the New Structural Economics (NSE) framework with respect to the sustainable development goals. Endogenous growth theory (EGT) and New Structural Economics (NSE) are considered in the light of SDG 9 targets.

NSE is an amalgamation of various development ideas and schools, even of conflicting development conceptions; it is comprising structural change through

orienting development policy on comparative advantages but based on an active public industrialization policy. The idea is to learn from successful emerging countries, not only focussing on the characteristics of already highly developed industrial countries. Development policy should focus on exports based on comparative advantages and on a steady upgrading process of the orientation on comparative advantages. The upgrading process never ends and necessitates a state being active in this direction. The state is involved in developing the infrastructure to allow for this upgrading process and should support pioneering investors and new sectors with future export potential. But with regard of SDG 9, it becomes clear that the linkages to the other SDGs matter. All this is discussed in the chapter, which outlines the fact that NSE is of relevance for implementing SDG 9, but that complementary action is requested with regard of other SDGs (working on climate protection, reduction of poverty and inequality, creation of decent jobs, prevention of conflicts, and establishment of good governance systems, etc.). The chapter addresses the change of the comparative advantages of Sudan's agro-industries and the role of the Sudanese state in changing the economic structures. Also, the Sudanese plans for developing and reforming the economy and the agriculture sector are evaluated for the period 2015-2019, by assessing the proposed policy measures through the lens of the eight SDG 9 targets. The challenge for Sudan is to build a political consensus to develop agro-industries based on coherent policies and frameworks to support agribusiness in a long-term vision.

This chapter therefore sets out to increase the understanding of the role of human and physical capital, of natural resources, and of institutions for achieving inclusive economic growth and sustainable development of agro-industries. It is structured into six sections. *Section one* gives an Introduction. The main purpose of the chapter is outlined in the Introduction, to give a comprehensive and complete picture of the status of SDG 9 in the context of interlinkages with other important SDGs. It is argued that understanding better the process of structural change of an LDC like Sudan through the lens of SDG 9 can give important insights about agricultural sector and development policies.²⁴ *Section two* focuses on the relevance of economic theories of growth and structural transformation that underlie the targets and indicators of the sustainable development goal (SDG) 9, pertaining to infrastructure development, innovation and industrialization for the case of Sudan. It is an attempt to explain the discrepancies between theories applied and practices implemented for the case of developing agriculture and agro-industry in least developed countries when looked at from the perspective of SDG 9. The discussion in the chapter has revealed questions on the applicability of economic concepts which are derived from new growth and structural change theo-

²⁴ See on the LDC inclusion criteria for Sudan: <https://www.un.org/development/desa/dpad/least-developed-country-category-sudan.html>

ries. Issues were raised how to reconcile the application of new growth and development theories with the aim to preserve LDCs' ownership of development concepts and initiatives. *Section three* is investigating the new structural economics (NSE) approach and its application with respect to the sustainable development goal (SDG) 9 and its eight targets. It is argued that a new structural economics (NSE) approach can be helpful to investigate the impediments to inclusive growth and sustainable development in an economy which is based on comparative advantages of the agriculture sector and related primary goods exports which are waiting for a higher degree of processing. *Section four* presents the case of Sudan's industrialization as a representation of an LDC case, focussing on the potentials of agro-industry development. This section presents an overview of Sudan's efforts for developing and reforming the economy towards industrial development, with a focus on agro-industries. The data on structural change in Sudan reveal how important a NSE approach is for the structural transformation process. It is asked why the agro-industrial development process was so weak despite the huge agricultural potential of the country and the remarkable human resources available. A development path for the agro-industry sector is envisaged, also by assessing crop-specific details for comparative advantages. *Section five* is based on discussions and analyses of the last economic reform programme (ERP) of Sudan for the period 2015-2019. Focus is on economic reform measures in regard of the issues of convergence with and the divergence from the SDG 9 targets; special consideration is given to SDG 9 targets 9.1 to 9.5. It is a check of real developments concerning the SDG 9 targets against development plans and proposals proclaimed for Sudan but considering new growth theories and new structural economics approaches as theoretical backgrounds. *Section six* gives the conclusion of the study, followed by the main findings and policy implications. These six sections give evidence about a country with large agricultural potentials but with severe problems to utilise these resources for sustainable development, for agro-processing, and for higher value-added exports. The "Sudanese Revolution" with the start of December 2018 may be the political step towards economic progress. The transition period may be long and the process itself embarrassing.²⁵

The third chapter to Unit 2 has the title **Improving Electricity Access in Africa using Decentralised Solar Photovoltaic Systems: The Case of Urban Lagos, Nigeria**, and it is authored by **Anthony Ifeanyi Ugulu**. The chapter is one of two case studies highlighting the expansion of renewable energy systems in Africa. While this study is focussing on urban Lagos, the chapter four presents a case study on Cameroon. So, the urban and rural areas of African countries are part of analysing the basic infrastructure which is needed to industrialise and to innovate. For developing rural and urban industries, energy supply is a precondition. Also,

²⁵ See the SERG paper Number 44 on the "Sudanese Revolution" by Professor Samia Nour: http://www.iwim.uni-bremen.de/sudan_economy_research_group/

for innovations in firms and government offices, especially to handle the digital transformation, access to electricity is a precondition.

Concerning socio-economic development, Africa faces the challenges of increasing electricity access for its citizens and firms and of limiting carbon emissions. To achieve these two objectives would require making ambitious energy policy choices through an energy transition from conventional fuels to renewables. The chapter argues that the cost of photovoltaic (PV) modules continues to decline while electricity tariffs and fuel prices continue to rise, so that there is good reason to support the spread of PV modules. The study investigates the barriers to and the motivations for urban household adoption of off-grid PV systems in Nigeria. It is quite important to analyse the household decisions towards investing into PV modules. The barriers to and the motivations for adoption of such modules are of interest to get a firm basis for policies and support measures. Empirical survey results indicate that the biggest hurdle facing investment in PV is capital costs and lack of finance. So, the comparisons with alternatives matter. The chapter reveals that PV is near cost-competitive with both centrally distributed electricity and the use of private generators, thereby attaining grid parity. The findings were used by the author to develop a verified model for promoting PV uptake and diffusion. This model will aid households, energy consumers, and policy makers to easily make adoption decisions, using metrics such as household size and income. This is the policy-oriented base of the study; it should give advice to households with different income sources and levels, to energy consumers, also micro-, small-, and medium-sized firms, and to policymakers at federal state, and local government levels. The chapter so confirms that the PV potential will bridge the national (and the regional and local) electricity supply and demand gap sustainably. Unconnected regions should benefit from such a source of energy, but also grid-connected areas may have advantages from such additional sources of electricity. Recommendations for widening electricity access to unconnected regions are provided. The policy implications are detailed; the opportunities for countries being comparable to the study area are highlighted.

A case study for Nigeria is of great interest, because of the economic strength of the country and because of the need to react to the rapid urbanization and to develop agriculture and the rural communities. Nigeria has, as reported, a low per capita electricity consumption of 144 kWh/per capita compared to 5,129 kWh/per capita in the UK or even 4,198 kWh/per capita in South Africa. This low-level grid electricity access and the inadequate electricity supply to end-users hinder socio-economic growth; policy action is awaited from the households, the farmers, and the firms. And the heavy reliance on conventional fuels and combustible energy sources creates an environmental threat to the health and the safety of the citizens in Nigeria.

This study focuses on the Sustainable Development Goal 9, but also aligns with the SDGs 7, 8, 11, 12, and 13. The focal point of this study is however on

SDGs 7 and 9. SDG 7 is geared towards significantly raising the global share of renewable energy sources (RES). SDG 7 is ambitious; by the year 2030, universal access to affordable and cleaner energy sources should be the norm also for less developed countries. It is further targeted that by 2030 international cooperation on cleaner energy research and technology development and on energy efficiency should be encouraged. SDG 7 has the target to expand the energy infrastructure for distributing energy services, such as electricity, in developing countries; expansion should be in line with the national programmes of support.

SDG 9 is aimed at facilitating the development of sustainable infrastructure (including electricity) through increased financial support (via affordable credit and special funds) and of technological innovation for less developed countries (also in Africa). SDG 9 specifically targets finance to small-scale industries; they should benefit from upgrading the existing energy infrastructure. It is also targeted to retrofit these industries to make them more sustainable. Regarding Nigeria, the retrofit of industries with a high potential to achieve SDG 9 refers to two sectors - the solar PV cell and module sales, marketing and manufacturing industry and the building construction industry. Looking at both goals collectively, SDG 7 and SDG 9 target that by the year 2030 the use of RES in countries like Nigeria should have increased substantially so that the expected diversity in the national energy mix is really generated. Investments in solar PV technologies can enable this to quickly materialise. Through learning-by-doing and learning-by-using, the industries involved can gain a good share of the market by being early entrants. Using Lagos State, Nigeria as a case study, this chapter investigates the factors which are hindering the off-grid urban solar photovoltaic (PV) adoption. It addresses important issues related to making electricity more affordable and promoting cleaner energy. In this way, it can be expected that the gap in power supply between the urban and rural areas in Africa can be reduced and that living standards can be improved for citizens by working for the UN's sustainable development goals 7 and 9 and the related targets by the year 2030.

In terms of industrialisation, small and medium enterprises (SMEs) are the largest job creators employing between 50-60% globally, and this share is even greater in Africa when micro enterprises of the informal sector are included. In UN reports it is stated that constraints due to weak energy infrastructure in Africa impact the productivity of firms by as much as 40%. Nigeria's vision 20:2020 agenda and the target year of 2030 for SDGs 7 and 9 initiatives remind us that it is vital to stimulate domestic technology development through a stimulating policy environment. Using modern energy technologies to advance the power sector in Nigeria has the potential to reduce inequality and poverty and to boost manufacturing industries providing for innovative technologies, thereby creating employment, particularly for the local workforce. The informal manufacturing sector can also play a role in this direction. Such energy infrastructure investments will make

communities and cities more sustainable through less environmentally polluting power generation and consumption, and so will help to mitigate climate change.

These are responsible actions that align with SDG 7 through to SDG 13 (combat climate change) which the African Development Perspectives Yearbook seeks to contribute towards with this new volume. And the SDG 9 is vital to the vision to increase electricity access in Africa while improving supply through sustainable infrastructure investments.

This chapter contributes primarily to SDG 9 on innovation capacity, industrialization, and infrastructure development. The study is structured as follows. After the introductory section 1, Section 2 analyses the current situation of electricity supplies and the energy scenarios for Nigeria; focus is on the socio-economic and environmental implications. Section 3 touches on renewable energy policies in Nigeria and the conceptual background of technology adoption and of relevant innovation studies. This is followed by the research methodology in section 4. Section 5 presents the analysis and the results. Section 6 is on the design of a PV promotion framework, following the levelized cost of electricity (LCOE) calculations. Section 7 concludes the report with suggestions for policy. This study is followed by another study on renewable energies, related to Cameroon, a country richly endowed with hydropower installations.

The fourth chapter in Unit 2 has the title **Renewable energy consumption and economic growth in Cameroon** and is authored by **Yves Andre Abessolo, Eric Patrick Feubi Pamen, and Joël Fabrice Bilao**. The objective of this paper is, according to the group of authors from Cameroon, to highlight the causal relationship between renewable energy consumption and economic growth in Cameroon. More precisely, the long run and the short run causality between Renewable Energy Consumption and Gross Domestic Product Growth are investigated over the period 1971 to 2014. The three authors analyse the energy situation and the economic background of Cameroon. They use a Vector Error Correction Model (VECM) to discuss this relationship; the data situation explains the limits of the analysis to the period 1971 to 2014. It is indicated that there is a long-term causal relationship between the key variables. The result of the VECM estimation shows that renewable energy consumption causes GDP growth in the long run, meaning that an increase in renewable energy consumption leads to more GDP growth in the long run. No causal relationship was however found in the short run. Therefore, the authors recommend an increase in public investment in the renewable energy sector in Cameroon. However, it is noted that the renewable energy sector (RES) includes all types of hydropower, and Cameroon has a lot of such projects in planning. Relative to this subsector of renewable energies, the other sources of RE are still small, but can also be expanded.

Cameroon is an interesting case for such a study of the RES. It is a developing country located in Central Africa, with a total population of 25 million. A huge

proportion of this population is still suffering from “energy poverty”, because access to electricity in the country is rated at 61.4% of the population. To become an emergent country by 2035, as envisaged, the government of Cameroon has formulated its strategy in a “Vision 35”, a document that forecasts the total GDP and the GDP per capita of Cameroon. The GDP is expected to grow at a rate of 9% between 2010 and 2035. But, apart from the year 2015 when Cameroon registered a GDP growth rate of 5,6%, the economic performance of the three years 2016 - 2018 has been declining at more than three percent, which is very far from the target of a 9% growth rate. Concerning the environment situation, in the Intended Nationally Determined Contribution (INDC) which was submitted by Cameroon to the United Nations (UN), the determination was to reduce greenhouse gas (GHG) emissions by 32% in view of the 2035 reference scenario. This reduction was aimed at by supplying 25% of the total electricity generated (TEG) in the country from renewable energy (RE). In this scenario, hydropower plays a dominating role.

The study has to do with the SDG 9 and its application to Cameroon. Energy enhances investment, innovation and new industries which can create jobs and encourage growth. To achieve sustainable development and to alleviate poverty, the United Nations (UN) have put in place seventeen Sustainable Development Goals (17 SDGs). Whereas goal number 7 is on promoting clean and affordable energy, goal number 9 relies on building resilient infrastructure, promoting sustainable industrialization, and fostering innovation. These goals are essential to developing countries like Cameroon because investment in infrastructure is crucial to achieving economic growth; it is therefore important to lay emphasis on SDG 9 and its eight targets. Energy infrastructure is key for industrialisation, and therefore investment in public (and privately financed) infrastructure sets the cornerstone for economic growth and development. Countries which are investing more in public infrastructure than others may have a competitive advantage for attracting economic activity (if other ease of doing business factors, such as finance and rule of law, are working well). Businesses as the engines of economic growth use public infrastructure in their production processes in much the same way as labour or private capital. This is a basic theoretical belief of the authors of this study. If the existing infrastructure is insufficient, business production will be hindered, thereby affecting negatively economic growth and development. Energy as a central pillar in economic activities also needs to follow the process of innovation, being an element of SDG 9 too.

Renewable energy plays an important role in meeting the needs of a country in terms of sustainable development. Many people cook or heat their homes with polluting fuels like wood or other biomass, resulting in indoor and outdoor air pollution which causes widespread health hazards. The transport sector and the industrial production sector, but also the agricultural sector and many services branches, use fossil fuels and are polluting the air and the workshops. Informal

producers are also dependent on such fuels; when they use outdated vehicles and equipment, the demand for fuels and the pollution will be high. Cameroon is putting strategies in place to become an emergent country by 2035; this growth perspective will also lead to more demand for energy. The energy sector is therefore an essential instrument for Cameroon's government authorities to meet this challenge. The country has great energy potentials for the development of renewable energies, such as wind, biomass, solar, and hydro power, all of which exist in abundance. These resources make Cameroon an attractive place for investors in the renewable energy sector.

Also, in Cameroon smart energy systems (SESs) are discussed as important elements to make the Vision 2035 a realistic option; SESs are founded on the idea of basing future energy systems on variable renewable energy sources. The production of energy from renewable energy sources (wind turbines, photovoltaic, solar thermal, hydropower, etc.) can become the main base of energy. RES can contribute to overcome energy poverty, as Cameroon has a relatively low access rate to electricity. As part of the 2035 Vision, the government of Cameroon aims to improve the access to electricity for people and for industries by quadrupling the generation capacity; to increase the use of renewable energy in electricity production, especially in areas with difficult grid connections; and to make energy efficiency a national priority. This can only be made possible through investment in energy infrastructure and industrialisation, a reason why emphasis should be laid on SDG 9.

In view of the above, the objective of the empirical work in this chapter is to study the causal relationship between renewable energy consumption and GDP growth in Cameroon. More precisely, it is of importance to show that investment in renewable energy infrastructure is at the heart of Cameroon's take-off. To achieve this objective, a VECM (Vector Error Correction Model) modelling approach is used. While section 1 sets the theme through an Introduction, the section 2 presents a literature review on the energy and economic growth nexus. Section 3 highlights the specificities of energy development and energy infrastructure in Cameroon. The section 4 provides the overall methodology employing the VECM approach in the econometrics analysis, which is followed in section 5 by the discussion of the results and findings of the research. Section 6 discusses policy recommendations, and section 7 gives the conclusions of the study. While these two chapters focus on energy infrastructure, the next two chapters consider transport and mining sectors in the context of SDG 9.

The fifth chapter in Unit 2 has the title **The Roads System in Sudan: Importance for Sustainable Development and Inclusive Growth**; it is authored by **Hassan Ali Gadkarim**. When analysing SDG 9, transport sectors have a great role. Transport systems link economic regions, provide for personal mobility, facilitate agricultural and industrial production, encourage trade and other services, are important for health provision, and make possible international cooperation

and exchanges. The roads system is one branch of the transport sectors beside of railways, waterways, se and air transport. For Sudan, the roads system is of extremely great importance, as agriculture is the basis for the country's revitalization after civil war and the separation of the South. All aspects of the roads system need reform in Sudan – the roads linking the states, the roads within the states, the local and rural roads, but also the roads linking Sudan with its neighbours. But not only the physical infrastructure matters; also the planning and the maintenance of roads are key issues.

Infrastructure, especially transport, is pivotal for achieving not only SDG 9 but almost all SDGs. In Sudan, the importance of roads is multidimensional and cuts across the economic, social, cultural, and security fundamentals of the society. Security and peace depend on the roads system as connections between states and within states allow for economic opportunities and the provision of livelihoods. Health and education depend on mobility of people. The situation of roads in Darfur is utilized as an illustration which shows that a functioning roads system can help to overcome disasters, violent actions, food scarcity, insecurity, and political instability. The shortage in paved roads, the roughness of roads, and the seasonality of roads lead to fragmentation, to separation, and to isolation of markets and communities. The case of Darfur (with its five states which are only loosely connected) clearly demonstrates the acuteness of problems such as the geographic isolation, the difficulty to access markets for agricultural production and trade, and the time need for reaching health facilities. It is shown in the chapter that the roads subsector should be accorded top priority; the subsector is vital for peace, effective administration and control, security enhancement, conflict prevention, poverty reduction, inclusive growth, and sustainable development. Giving the roads system such a high priority means also that functions such as repairing, rehabilitating, organizing, planning, and constructing need the skills and resources to get them working properly. Still, the performance of the roads sector is low; all relevant indicators show that the sector is constraining growth and mobility in Sudan.

The three levels of government in Sudan, local/state/federal, are under great stress to provide the necessary goods and services for the population. And the private sector has not the incentives to invest in the roads sector, at least in a foreseeable period. That leaves international and regional organizations, such as the World Bank (WB) and the African Development Bank (AfDB), as potential financiers. But the links to these finance organizations need to be improved by following new economic policies as the Bashir regime has for thirty years mobilized funds mainly for security/military/public consumption projects. After the Sudanese Revolution which started in December 2019 the new government intends to correct the policies. Concerning the roads system, some positive signs are emerging. A consensus on the priority of an efficient and expanded roads network is forthcoming, a relatively capable institutional setup of roads sector authorities is installed, the endowment with the necessary raw materials for roads construction

is favourable, and the expected lifting of all kinds of sanctions may improve the financial situation of firms and of government authorities being active in the roads sector.

According to the Sustainable Development Goal (SDG) 9 it is necessary to build resilient infrastructure, to promote inclusive and sustainable industrialization, and to foster innovation. This broad goal can be divided into two distinctive goals, one for building a resilient infrastructure, which is quite comprehensive, and the other for industrialization and its major development driver, namely innovation. The main sectors of infrastructure are energy/electricity, water/sanitation, and the transport sectors. Considering developing countries, such as Sudan, infrastructure, and especially transport, is pivotal for achieving the majority of the other SDGs: to end poverty in all its forms and everywhere; to end hunger and malnutrition, and to achieve food security; to promote sustainable agriculture; to ensure healthy lives and to promote well-being for all ages; to ensure inclusive and equitable quality education and to promote lifelong learning opportunities for all; to ensure availability and sustainable management of water and sanitation for all; to ensure access to affordable, reliable, sustainable and modern energy for all; and to promote inclusive and sustainable economic growth, full and productive employment, and decent work for all. Other SDGs could be added to this impressive list highlighting the strong interlinkages between the SDGs.

In fact, for Sudan infrastructure is at present more related to the development of the agricultural sector and to agribusiness than to industrialization. The country has experienced forms of deindustrialization caused by the exclusive priority for the oil economy since the Bashir regime came to power in 1989. The new priority for developing agriculture value chains puts emphasis on infrastructure. But innovation is also key for agricultural development, for agro-industrialization and for agribusiness development. Looking at the targets of SDG 9, we see that there is a certain number of targets which are relevant for infrastructure development and for the revitalization of the agricultural value chains. It is obvious in the case of Sudan that the country needs a dynamic development of its road infrastructure to develop and to link markets, to industrialize also peripheral regions, to allow for the processing of agricultural commodities, to broaden the impact of R&D, and to develop the base for skills and technological capabilities. The case study on Darfur even shows that peace result from the mobility of the people as their economic, social, and security environment will improve. Indicators mentioned for measuring the performance of targets for SDG 9 also relate to infrastructure; specifically, they refer to the proportion of the rural population who live within two kilometres of an all-season road. This is central for the Sudanese case as most of the population lives in rural areas, and road transport is of key importance to their socio-economic development. Also, other indicators are important to measure the extent of market integration which is supported by the roads system. But also, innovation

and finance indicators matter in the context of sustainable transport and roads systems. In the chapter, such indicators are provided to give evidence of dynamic changes in the periphery, like the states of Darfur.

The structure of the chapter is as follows. After section 1 with the Introduction follows the section 2 with a focus on the characteristics of the transport sector of Sudan. Section 3 discusses the importance of the roads sector for conflict prevention, inclusive growth, and sustainable development in Darfur. Section 4 is on the performance and the achievement of the roads sector in Sudan. Section 5 gives the Conclusions and the Policy Recommendations. The author of this chapter did field work in Darfur, studying the role of the roads system for conflict prevention, inclusive growth, and sustainable development. The arguments about the developmental role of the roads sector in Sudan have benefitted from this field research of the author in Darfur.

The sixth chapter of Unit 2 has the title **Successful Local Initiatives for Infrastructure Development – Impacts on water, sanitation, and school infrastructure in platinum-mining communities in Zimbabwe and South Africa**; it is authored by **Albert Edgar Manyuchi, Killian Tendai Manyuchi, John Ouma Mugabe, and Fidelis Tungamirai Manyuchi**. The United Nations Global Agenda 2030 with the seventeen Sustainable Development Goals (SDGs) focusses in SDG 9 on Industry, Innovation, and Infrastructure, arguing that these three key aspects of development are central to African economies and need to be considered in context. This goal is about building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. SDG 9 is aligned to aspiration 4 (Transformed Economies) in African Union (AU)'s Agenda 2063 which focuses on sustainable and inclusive economic growth; science, technology and innovation (STI)-driven manufacturing, industrialization, and value addition; and economic diversification and resilience. An important target under SDG 9 aims to monitor the flows of development finances for infrastructure development to developing countries, including African countries. Apart from global and regional development finances, infrastructure development in African countries has resulted from local initiatives. In this study, ethnographic research methods are used to examine the contribution of local initiatives towards infrastructure development in Africa. As literature focusses so much on global finances of infrastructure development, this is a novel approach as local initiatives are at the centre of the discussion. The case study approach encompasses mining communities from South Africa and Zimbabwe, and it is argued that the local initiatives follow either a mandatory or a non-mandatory approach to infrastructure development. Both approaches play a role in the chapter. The main outcomes of the local initiatives have been the delivery of basic educational, health, water, and sanitation infrastructure to mining communities in South Africa and Zimbabwe. It is concluded that local initiatives are central to infrastructure provision in Africa, and they can

contribute greatly towards fulfilment of SDG 9, but also to related SDGs (on poverty, hunger, clean energy, climate protection, education, job creation, etc.). It is also found out that the promotion of local initiatives depends on explicitly formulated and legislated acts and on adequately monitored and evaluated policy frameworks. Local initiatives must be encapsulated within the SDG 9 and its eight targets, to measure the outcomes mentioned above.

Conceptual issues arise as the concept of ‘local’ initiatives is debatable in Africa. The basic question is: Is an initiative ‘local’ because of the origin of ‘ideas’ underlying the initiative or because of the ‘actors’ involved? Most initiatives in Africa are considered ‘local’ when they are implemented by actors which are living in a specific geographic locality; it does not matter that the ideas were borrowed and/or adopted from elsewhere. In this study, qualitative research methods are employed to collect data for a comparative analysis of successful local initiatives for water, sanitation, and education infrastructure development in Zimbabwe and South Africa. It was found that rural community members in Zimbabwe have acted on “local” initiatives through traditionally mobilised locally available resources to construct schools, latrines, and boreholes, while external actors bring non-locally available construction materials to the local communities. In South Africa, “local” initiatives are anchored on communities/local municipalities which are approaching private companies to plan with community infrastructure requests. The firms build the infrastructure and then transfer the infrastructure to communities upon completion of construction. The next important question is how sustainable these two approaches are. The Zimbabwean approach creates ownership but lacks intergenerational continuity. The South African approach creates dependence on private actors, and no sense of ownership is created. Given these two approaches, the authors of the chapter envisage a deep analysis of the comparative approaches and its advantages: successes and impacts of local initiatives for infrastructure development should not be judged only on the availability of physical buildings (schools, latrines, and boreholes); instead various yardsticks should be used to determine successes and to assess impacts. The methodology and the outcomes of the study are innovative and useful for policymakers. Mining projects can be favourable for local communities, but only under very specific preconditions and policy guidelines.

Looking more closely to SDG 9, we see that the target to “facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing states” is infrastructure-specific. Even though the indicator for this target is “total official international support (official development assistance plus other official flows) to infrastructure”, the authors argue that ‘local initiatives’ are indispensable to achieving the infrastructure aim and this target of SDG 9. The authors consider four research questions which are guiding the study. First, what are local initiatives

and how do they contribute to infrastructure development in communities? Second, what are the approaches used in local initiatives for infrastructure development? Third, what local initiatives for infrastructure development were successful and what were the indicators for measuring success? Finally, what impacts do successful local initiatives have on community infrastructure development? To work through these four questions, new data had to be generated. Data for this study were gathered as part of a baseline study for interfaith work in platinum-mining communities in South Africa and Zimbabwe. The authors used qualitative research methods including multi-method ethnographic assessment tools that incorporate community mapping, structured observations, focus group discussions (FGD), and individual in-depth key informant interviews (KII). Data were collected on successful local initiatives targeting water, sanitation, and education infrastructure development in communities around platinum-mining areas in Zimbabwe and South Africa.

The results show that the geography of the sites, the actors involved, the modes of consultation, and the ideas of the stakeholders define the “local” initiatives in South Africa and Zimbabwe. Local initiatives have led to various infrastructure branches – school (classrooms, teachers’ accommodation, and latrines), water (boreholes and water points, water purifying plants, and distribution systems), agriculture (dipping tanks), community infrastructure (latrines, community halls), and road infrastructure (construction, upgrades and maintenance). It was found that South Africa uses a mandatory approach as the government enforces explicit laws that compel platinum-mining firms to partake in local initiatives for community infrastructure development. Zimbabwe however has shifted between non-mandatory (no laws and regulations are enforced) to mandatory (based on laws and regulations) and back again to non-mandatory approaches in local initiatives for community infrastructure development.

The findings suggest that non-mandatory local initiatives may be cheaper to execute, may create a strong sense of community ownership, may promote sustainability, but may lack intergenerational continuity. On the other hand, mandatory local initiatives may promote corruption, may be unsustainable, may be expensive to execute, may create dependence, may destroy community-sense of ownership, and may create a sense of entitlement. The non-mandatory approach is found effective where state institutions for service delivery and enforcement of rules and regulations are weak, while the mandatory approach is found effective in cases of developmental states; the approach demands strong state institutions to be effective because it requires enforcement of the legal statutes.

Hence, the chapter has shown that local initiatives contribute significantly to local infrastructure development, and partially also to the realisation of SDG 9. The authors recommend an evidence-informed and multi-stakeholder-related review of existing policies to enhance community-centred and inclusive interven-

tions that strengthen community-wide soft skills and learning processes for sustainable and resilient community infrastructure which is envisioned under SDG 9. The SDG 9 indicators should also consider the contributions that communities can make towards infrastructure development through local initiatives.

This chapter six of Unit 2 is organised as follows. After Section 1 with the Introduction, Section 2 provides a conceptual framework that guides the analysis of the issues under this study and elaborates the study methodology. The study results are presented in Section 3, and the discussion of the results follows in Section 4 which also presents the study findings in relation to SDG 9. The conclusions and policy recommendations are presented in Section 5.

The Strategy

Financial Innovations matter for Financial Inclusion to strengthen the Productive Sectors and the Small Enterprises in Africa

African countries have a low financial inclusion rate, with Nigeria as an example, although in recent years the rate has increased because of financial innovations. But some countries, like South Africa, have a high financial inclusion rate. Financial inclusion/exclusion rates differ between regions of a country, depending on levels of income and dominance of economic sectors. Higher financial exclusion rates in regions have a negative effect on agricultural activities and on agribusiness, but also on formal and informal industrial and services sectors. In some countries, as in Nigeria, the financial exclusion rate is decreasing faster in the urban areas than in the rural areas. The financial exclusion analysis based on gender shows that financial exclusion is higher among the females than among the males in Nigeria. This suggests that the gender financial gap in Nigeria may continue to widen over time. A strategy to increase the financial inclusion rate in Africa has therefore to consider not only overall country policies, but also sub-regional policies and gender policies. Only a combination of economic and social policies will be effective. But financial sector policies in relation to agriculture and industry matter most.

Although the proportion of the people using formal bank contacts has increased, a further increase in the proportion of the people using formal banking institutions is necessary as this will reduce more the rate of financial exclusion in countries like Nigeria than other financial inclusion strategies. Most important factors that limit the use of formal banking operations in countries like Nigeria are irregular income, unemployment, and the distance to the bank. Action is therefore needed on income generation through job creation, programmes to combat unemployment and underemployment, and policies to facilitate access to banks by increasing mobility through infrastructure development. Distance as a barrier to

banking activities is increasing not only in Nigeria, so that infrastructure development (building roads, ICT expansion) and forms of mobile banking will help to raise the financial inclusion rate. Financial innovations and new technologies can be deployed to ease accessibility to the formal banking institutions.

The financial exclusion rate is higher among the farmers than for the average of the Nigerians, so that agricultural development policies have also to consider the level of financial exclusion. As the farmers rely to a large extent for their finance on informal financial institutions, a review of these systems is needed. After the review, it will be necessary to bridge the gap between informal and formal financial systems. The seasonality of farming activities may also be related to higher financial exclusion among the farmers. As income from the farming activities is seasonal, any diversification of farming activities may be of help to raise the financial inclusion rate. Beside of diversification of production, there is a need to introduce special financial facilities that are tailored to the specific needs of farmers because of the nature of their farming activities. Although some programmes exist, they are often temporary and conditioned. An extension of such programmes is recommended.

There is evidence that financial inclusion and crop yields are positively related. This means that if financial inclusion increases, this will raise agricultural productivity in farming areas. The relationship may also apply to other activities of small producers. But if most of the small and poor producers are financially excluded, such as the farmers in Nigeria, additional strategies are requested to start measures for financial inclusion. Such measures are based on mobile phones and mobile banking. Basic infrastructure and financial innovations will facilitate financial inclusion and then will lead to productivity increases. As financial inclusion has a negative but significant correlation with illiteracy, such as in Nigeria, a programme for financial inclusion will significantly reduce the level of illiteracy. Financial inclusion and education/training measures interact with other policy areas related to productive sectors. The reduction in the level of illiteracy will have indirect effects on the activities of the farmers and other small producers, as education/training is positively associated with the level of innovation adoption among the farmers and other small producers.

The relatively high level of financial inclusion in Kenya is attributed to the adoption of financial innovation, especially Mobile Money (MM). Since the introduction of MM, 79% of the adult Kenyans have subscribed to MM, while only 3.3% of the adult Nigerians are using MM platforms. As accessibility to rural electricity has a positive relationship with the use of mobile money (MM), infrastructure development will increase the probability of higher financial inclusion. The underdevelopment of MM in countries like Nigeria is caused by the lack of awareness, so that awareness campaigns such as in Kenya will be helpful. There is a need for increasing the awareness of financial innovations in countries like Nigeria, especially of MM technologies. It is necessary to learn from the modes of

advertisement as used for M-Pesa in Kenya; using existing retail stores and petrol stations as cash in/out outlets reduces deployment costs and provides greater convenience and lower cost of access to users. The awareness of MM services can be provided by using social media (radio, television, newspapers, Facebook, YouTube, billboards, etc.). But field agents of finance institutions and media instruments of other banking institutions can also be used to create awareness about MM.

As there is a positive correlation between such forms of financial innovation as MM and overall innovation indexes, such as the Global Innovation Index (GII), a higher rate of financial inclusion will also accelerate the provision of micro-finance bank credit to expand and to start businesses in rural and urban areas. Financial inclusion and overall innovation activity are highly related, so that financial policies and innovation policies also need coordination. Countries with a higher financial inclusion rate have a greater share of microfinance bank loans as a proportion of GDP, so that small enterprises will benefit from such credit facilities. In Kenya, the share of microfinance bank loans as a proportion of GDP stood in 2018 at 5% compared to 0.1% in Nigeria in the same year. Lack of credit facilities because of low financial inclusion limits also the role of retail stores and of other shops that can be used by MM service providers as cash in/out outlets, which can increase the proximity of MM customers to the services of MM infrastructure. There are many possibilities for policymakers to work on the financial inclusion of small enterprises target of SDG 9.

Many African countries can learn from the financial inclusion policies of Kenya. M-PESA has many competitive advantages, such as free and quick registration to the service, free deposits, and the ability to send money to any mobile phone subscriber whether they were subscribed to the service or not. And, for remote payments M-PESA is cheaper than other available mechanisms, such as money transfers by the bus companies, by the Kenya Post's PostaPay, or by Western Union. Sending money through M-PESA is far cheaper than sending money through the Kenya Post's PostaPay or through a bus company. Lower transaction costs facilitate economic transactions throughout the economy and support the operations of micro and small enterprises. But there is a need to translate such opportunities to become an economic reality by creating realistic frameworks through laws and regulations; there is need for an innovative approach that meets and surpasses market's expectation. Important are also all those organizations which are actively participating in designing and developing advisory programmes and digital platforms that improve the livelihoods of smallholder farmers and producers by linking them to modern supply chains; financial inclusion is only one element of improving such chains, but an important one.

Improving the quality of infrastructure and the capacity for innovation to upgrade the performance of agro-industries in Africa

The SDG 9 illuminates the critical importance of capital accumulation, infrastructure development, stimulating innovation capacity, and building institutions to promote industrialization and manufacturing with the aim to create job opportunities and to sustain economic growth. It is necessary to identify in a concrete manner the status of SDG 9 and its interconnected pillars – innovation, industrialization, and infrastructure. For agribusiness development and agro-industrialization the focus on SDG 9 is of key importance. To allow for a significant and continuing role of SDG 9 in implementing and achieving the SDGs, the messages from the sustainable development literature related to economic growth and structural change, to infrastructure and innovation, and to agro-industries and agribusiness have to be reviewed. Many African countries, also Sudan and South Sudan, can benefit from the availability and abundance of its human and natural resources. This can be achieved by promoting economic policy to raise the labour efficiency and to facilitate the private sector to lead the agricultural and manufacturing subsectors. The theories of growth and structural transformation give guidance to policies related to realizing SDG 9, and the policies towards the agricultural sector and the agro-industry subsectors can benefit from these insights accumulated over many decades.

It is necessary to look at the growth, structural change, and innovation strategies more from the side of the LDC situation, like countries as Sudan and South Sudan. These countries have other features for the technological build-up and the characteristics of the innovation process are different. Comparative analyses on innovation indices can give some guidance about innovation inputs and outputs, about specific country conditions of innovation capacity, and about feasible strategies to stimulate innovating companies, but this knowledge is not yet part of coherent economic policies and development strategies. It is necessary to study the reality of innovation in LDCs by deep investigations of enterprises, sectors, and the national economy. The global innovation indices can give some guidance and methodological basis but cannot be a substitute for own analyses with a country focus. Recent studies on the “deep state” in African countries emphasize the role of factors such as corruption, mismanagement, and bad governance for the business environment. The “deep state scenario” prevents that the markets are competitive enough to allow for innovations; under such conditions the theories and strategies of sustainable structural transformation and inclusive growth cannot be applied. They will not give guidance for policies to support firms, sectors, and regions in their innovation activity.

Investment into equipment is a vehicle to absorb new technologies and knowledge, and investment into human development lead to more learning by doing which is a major source of knowledge with the effect that the innovative mi-

lieus are strengthened. Openness of the economies towards trade and foreign investment can be regulated in such a way that domestic industries are given space to develop; but this requires that well-managed economic policies lead to innovations in enterprises and to the absorption of new technologies in factories and at farm level. Domestic firms should become enabled to regain market access for their products, but there is need for a quality increase of products and services, and for innovative and competitive supplies at global and regional markets. In many countries of Africa and in many sub-sectors of agriculture and agro-industry this is a feasible endeavour.

Policymakers need to work out strategies to protect domestic industries through innovation-friendly measures and through the build-up of technological capacity in firms. It is necessary to construct a clear line between protectionism and openness through industrial policies; such policies should be adopted after dialogues between government agencies and private business associations. The main impact of such dialogue forums will be the design and adoption of incentives policies to support national innovativeness and to gain economy-wide in absorptive capacity. Thereby, a culture of innovation can be instilled in firms, in-firm R&D effort will be expanded in businesses, the R&D outcomes of public institutions will be made relevant for firms through linkages with public research institutions, and the national innovation systems (NISs) can be made more relevant for key economic sectors and for firms irrespective of size.

As institutions to control the quality of products and to create open and competitive markets through antitrust and consumer protection agencies are lacking in LDCs, such as in Sudan and South Sudan, new instruments need to be developed to create competitive markets and to upgrade products so that they are based on human capital and on knowledge capital. For agriculture and agro-industry development such institutions are extremely important. Science, technology, and innovation (STI) institutions and regulatory, monitoring, and supervisory (RMS) institutions are core functions for development key sectors in LDCs. Although LDCs have some institutions to promote STI policies and strategies, many of them suffer from constraints which prevent an effective work of these institutions. These institutions are affected by poor governance and by weak linkages; there is a lack of connections between R&D organizations and the industrial sector; key economic sectors, such as agriculture, agribusiness and agro-industries, were neglected by the public R&D sector; and, even large and diversified companies in these countries are not strong in terms of in-firm R&D.

Some key policy recommendations can be mentioned for Africa:

- It is necessary to build a political consensus to develop agro-industries which are based on coherent policies and frameworks to support agribusiness in a long-term vision. Such a political consensus can be arranged for key offices and associations as some country cases in Africa show.

- It is proposed to promote innovation, science and technology policies aiming to support agro-processing and developing those commodities which have a probability to compete on the regional and international markets. There is a potential to support agricultural commodities and agricultural value chains which can capture larger market shares.
- It is advised to restructure industrial policy to support the agro-industry sector by developing agribusiness and by transforming small and medium enterprises (SMEs) and industrial incubators into technological and industrial clusters. This will improve the business prospects and the labour market position of young entrepreneurs and of graduates.
- It is necessary to reform education and training policies and trade and investment policies so that the LDCs can overcome its lack of an adequate absorption capacity, especially for new technologies and for direct investments towards key productive sectors, like manufacturing, agriculture, agribusiness, and agro-industries.
- It is advisable to improve public-private partnerships, private sector associations, professional societies, and farmers' cooperatives. This strategy would help in developing value chains of agro-industries to supply higher value-added products for domestic, regional, and global markets.
- It is possible to strengthen the science and technology (S&T) institutions of LDCs to improve the innovation capabilities in agro-industry sub-sectors toward realising the sustainable development goals (SDGs). Connecting R&D organizations better with industries is a necessary precondition for the development of targeted interventions that realize the full potential of innovation for sustainable development.
- It is observable that measures are necessary to facilitate the private sector's industrial upgrading and diversification strategies. Government could prioritize and facilitate the agricultural innovations and the extension of agricultural technology, but also the improvement of infrastructure for agricultural and industrial production.
- It is recommended to develop the patents system toward sustainable development and the methods of granting intellectual property (IP) rights protection in a way that considers all stages of the innovation and technological transfer process. It is a great task to create competitive and innovative conditions in the private sector. A focus in the patents system just on the quantity of patents to improve the innovation ranking is not enough; the quality and the outreach of the patents are important too.
- It can help a lot to adapt an unbalanced growth strategy by focussing on specific industries that already have linkages with other economic sectors and with the R&D system. Such a policy may be a first step towards re-industrialization. It is recommended that LDCs, like Sudan and South Sudan, follow a step-by-step strategy for developing agro-industries towards higher complexity and increasing value-added.

- It is observed that there are constraints on productivity growth in the agro-industry, including a lack of innovation capacity, an incoherent strategy and policy at all governance levels, and a gap in industrial infrastructure; but all these constraints can be overcome if there is a long-term focus.
- It is possible to remove all these constraints for agricultural development and processing so that a transition from the level of marketing only primary commodities to the level of higher productivity agricultural value chains may become successful. The removal of those constraints could induce a larger structural shift in the future.
- It is the case that institutional reforms are needed to ensure a better coordination between institutions and to create a greater complementarity among institutions. There is a need for collaboration among key agricultural sector/agricultural processing institutions and for strengthening management capabilities in the R&D sector; especially this relates to all institutions being of importance for a dynamic development of the agro-industries.

Urban Reconstruction and Development can be speeded up in Africa by coherent Renewable Energy Policies

Urbanization in Africa is a chance and a risk. It is a chance because of the many opportunities to apply renewable energy technologies in all spheres of urban life - housing, traffic, waste management, industrial production, education, schooling, training, and in health. Urban reconstruction means that all spheres of urban life are reorganized so that the well-being of the people is increased, and the social and economic activities are better organized. Urbanization, scarcity of land, changes of demand structure, and demographic changes lead to an increasing urgency to speed up the urban reconstruction. Urbanization is also a risk when spatial planning is not done in a rational way so that the application of renewable energy technologies is retarded or is failing. Renewable energy technologies give opportunities for formal and informal activities in urban areas, so that business opportunities are becoming a base for new ventures. Entrepreneurship opportunities arise in this context. All these changes apply to capital cities, to large and intermediate cities, and to small and rural cities. In all these cities business opportunities are growing in the field of renewable energy technologies.

Urban life will also be improved if the rural side is also considered as it has many repercussions on the urban areas. Promoting and investing in modern energy technologies would be necessary will eliminate the need for many people in rural locations to rely on fuelwood for cooking while lowering the rate of deforestation from wood-felling. There is evidence that trees act as sinks for carbon emissions helping to remove them from the atmosphere. And, aside the environmental risks of using primary energy sources such as fuelwood, there are also the health risks as the exposure to smoke and fumes from fuelwood burning, kerosene lamps and candles will cause health problems and will lower the labour productivity. Rural

development, when linking the rural households and enterprises/farms better to urban and peri-urban areas, can also become a dynamic base for business opportunities for renewable energy technologies.

All these changes in urban and rural areas increase the demand for energy resources. The increasing demand for energy resources, especially stable electricity supplies, increases not only the energy costs of households, but also the costs of engaging in business, making industries less competitive. Some smaller businesses could be priced out of the market by the dominant ones who are more able to sustain their business by using private power generators. An unfavourable business environment undermines economic growth and impacts negatively on employment. Regular electricity supply at competitive prices will not only create employment but will also sustain it. If renewable energy technologies add under competitive terms to the supplies, the prices will be adequate to allow for business development and growth. This is the more the case when electricity is generated from novel sources like solar power, wind energy, biogas and small hydropower as envisaged by SDG 7 and its targets that preview by the year 2030 that a significant share of the energy portfolio comes from renewable energy technologies.

The SDG 7 requests that by 2030 more LDCs and developing countries should have embraced clean, renewable, low-carbon, decentralised and reliable energy sources. In combination with SDG 9, the production of such technologies is feasible and will allow for the application in industries and for the development of infrastructure and of an adequate innovation capacity. Solar Photovoltaic (PV) is one of the new power technologies with a great potential for application in rural and urban areas. These technologies are important for tropical countries with high solar intensity. Promoting PV is now emphasized by various proposed strategies in Africa, directed to households and to enterprises, directed to formal and informal firms. Such strategies refer to households irrespective of their earning power and enterprises irrespective of their size and sectoral activity. A successful application of such technologies requires the introduction, implementation, and monitoring of supportive policies (regulatory and fiscal ones). It is advisable to encourage at the international levels a cooperation with leading PV countries like China, Japan, Germany, USA and Italy which have contributed greatly to lowering the costs of PV modules as well as to improve cell efficiencies over the course of few years. Countries like Egypt and Morocco, but also countries in the sub-Saharan Africa region, use such collaborations.

Sub-Saharan African countries are gaining ground in PV technologies through specific policies and measures. The Nigerian policymakers can learn from Kenya and Tanzania whose governments are supporting the expansion of their PV market, making them leaders in the industry. SDG 9 targets an increase in innovative small-scale enterprises by the year 2030, and an increasing number of such enterprises is active in the field of PV technologies, either as producer of modules and/or services or as a user of such technologies to supply products and services

based on the generated electricity. Lending institutions can play a key role in the increased uptake and the diffusion of decentralised PV, such as in Lagos, Nigeria or in other large cities of Africa. Liaising with competent partners as producers and financiers will enable a faster upgrade of the energy infrastructure and of related retrofit industries.

Incentives policies matter to increase the market for PV technologies. In addition to the subsidies that the governments in Africa are applying to PV products and installation materials, the availability of low-interest credit facilities will encourage households to install these electricity and energy systems (as they know that they will be able to repay the credits from the savings over the lifetime of the new technologies). All this refers also to micro and small enterprises when they need electricity from PV installations for their activities. Different ownership systems are possible, and some of them are of great relevance for remote households and enterprises in African countries. All types of ownership require strict regulations. Investors (local and international ones) can also benefit by following PV leasing schemes, which are generally referred to as part-worth utilities. Unlike the self-financing model, the leasing schemes are simply situations whereby the PV systems are owned by a third party or an independent investor who installs PV modules and supplies electricity to residents; they are charged for this electricity in the same way as the one getting it from the grid. The payments now go to the suppliers who are the lease scheme operators. The advantage of this model is that the capital cost of installation is borne by the investor, allowing payment by instalments from the energy consumers/end-users. This is also a suitable system for small enterprises because of the finance constraint. For donor agencies looking to support developing countries or LDCs on renewable energy supplies, results-based financing or aid can be considered. This system rewards nations or regions or municipalities when a set of predetermined results is achieved as part of the contractual agreement upon which the lending or aid is given. Adopting the above strategy would offer an enabling platform for clean energy resources to become more regular, reliable, and affordable for the many households and small enterprises who struggle with energy poverty and lack of energy for production.

The PV costs have been significantly reduced due to global developments and technological learning. Cities are crucial in the transition to low carbon futures, and therefore PV technologies are important. Promoting PV technologies in cities will save expenditure on governments' subsidies and will reduce energy infrastructure investments. Property developers and the house-building sector would be a key part of the transformation. This is how Japan grew its photovoltaic (PV) industry in the 2000s by allowing building designers and developers to liaise with

PV installation businesses. Also, small businesses of informal sectors will contribute to developing cities and managing the energy transition. Proper regulatory frameworks and enhanced administrative procedures would be needed to reduce bureaucratic hindrances. Likewise, improved tax administration systems are needed to encourage firms to invest and to pay their taxes. Political risks and uncertainty can be a hindrance to large scale investments, to innovative investment measures, and to long-term investment in the manufacturing sector, and so minimising this risk would be important to assure investors. The instruments of leasing schemes, as practiced in energy sector transformation towards renewable energy technologies, can be applied also in other areas of city development and rural transformation.

The African governments seek to improve electricity supply to households through supporting decentralised PV solutions, but still there is room for accelerating this trend. Energy policy regulations and climate action plans, that take into consideration the building construction sector, would help to alleviate the burdens placed on the undersized national grid infrastructure. A better coordination of grid-related and off-grid-based energy solutions is possible. Unsuccessful grid expansion initiatives of the past three decades should be a constant reminder that efforts to raise electricity output through a defective system will always fail. Regarding the widespread household generator use, the governments could those households who install PV and return the generators. Government agencies, the private sector, and energy end-users (households and enterprises) should be encouraged to invest in PV installations instead of continuing to purchase expensive, noisy, and heavily polluting generators. Case studies for Lagos, Nigeria, raise optimism, so that it is important to make responsible decisionmakers aware of such a potential in similar African cities, but also to search for solutions in remote rural areas.

Economic growth and industry development can be stimulated in Africa by intensifying the use of renewable energy technologies

The production of equipment, modules, and services for renewable energy (RE) technologies and their broad application in sectors of the economy has relevant growth effects. The main factors boosting renewable energy growth can be split into three groups: political factors, socio-economic factors, and country specific factors. It is obvious that the government and the private sector need to cooperate in all phases of the selection, production, purchasing and introduction of renewable energy technologies to create an energy sector dynamic. Industries and innovations to achieve inclusive growth in African countries depend on the building of energy sector infrastructure and on the production and use of renewable energy technologies.

Public-private partnerships can be a solution to build investment schemes for local power mini-grids in countries and regions with energy poverty. Investments in energy infrastructure are necessary to achieve SDG 9 and its targets and to boost

structural change and economic growth. The development of local power mini-grids is recommended for off-grid zones and should be organized through public-private partnerships; these ventures should be based on the principles of the circular and the solidarity economy to reach climate and environmental protection targets, but also the provision of sustainable, affordable and clean energy at local level. It is necessary to involve the State, the Diaspora, but also the technical and financial partners and the local population.

Mini grids usually use solar panels; these are combined with battery storage and with a local distribution system. The mini grids supply power to homes, to small businesses, and to industry, and to areas which are beyond the reach of the main grids. Processing of agricultural products is then becoming a feasible undertaking. The costs of mini-grid components, such as solar panels and battery storage technologies, are decreasing; solar mini-grid solutions are therefore becoming economically viable. Many African countries, including Ethiopia, Kenya, and Nigeria, are making mini-grid solutions a pillar of their national electrification plans, thereby complementing grid extensions and solar home systems.

The tasks for mini-grid solutions may be allocated as follows: Investment in the local power generation should be done by the private sector at 70% of the total costs and by the public sector at 30% of the total costs. Investment in the power transmission and distribution should exclusively be done (100%) by the government and its partners. As many localities in African countries, both in semi-urban and in rural areas, lack the access to energy because they are in off-grid zones, such mini-grids are a viable solution. In view of the abundant resources of renewable energy which are available in the African countries, especially hydro, solar, wind, and biomass, it is possible to develop local mini grids with these resources. Public-private partnerships are a solution to be favoured by government agencies to stimulate the private sector to invest in the renewable energy projects. Such partnerships also have learning effects for government offices to understand the working modalities of the private sector.

The main companies in charge of electricity generation and transmission on the national territory of African countries can play a role in these partnerships. In general, these companies neglect the semi-urban and the rural areas. It is therefore left for the government to create enabling conditions in such areas to attract private investors and to mobilize the rural and semi-urban communities to collaborate for the maintenance and the organization of the mini grids. When the electricity price of the main companies is a uniform one (not differentiated) on the national territory, the potential private investors might be reluctant to invest in off-grid zones because they cannot supply energy at the existing uniform price, even when they receive subsidies from the government. Thus, the government needs to partake by operating in the transmission and distribution of energy, while the private sector operates the generation of electricity in such a way that the national Interconnected

Power Network (IPN) is expanding. By such an operating style a simple decentralized solution for local communities is avoided, as there is some interconnection of mini grids in the system. Such a scheme will improve the national energy system, making it more resilient and comprehensive, and will boost economic activity in local communities and overall economic growth. Such a scheme will help to achieve SDG 7 (Ensuring access to affordable, reliable, sustainable, and modern energy for all) and SDG 9 (Boosting infrastructure, industry, and innovation through investments in the energy/RE sector).

Political motivations are the most relevant aspects for the promotion of renewable energy in African countries. Public policies play a role as renewable energy (RE) technologies are still perceived as expensive in African countries, in comparison with traditional energies (fossil fuel). Therefore, public policies are important, such as targeted subsidies, quota policies, direct investment, research & development funds, regulations for part-worth leasing schemes, and even feed-in tariffs (FITs); all these public policies can encourage renewable energy (RE) growth in African countries if applied in a coherent way. Many African countries try to reduce the carbon footprint of its development path by significant percentages up to 2035, compared with the year 2010. This target is a commitment taken by governments during the Paris conference on climate change in 2015. To achieve this goal, one of the measures taken could be a quota of 25% or even less of renewable energy in the total energy consumption by 2035. These initiatives are good ones but there is still more to be done for the growth of renewable energy (RE) in African countries and sub-regions, as creating awareness among policy-makers, building interconnections between African sub-regions on energy production, transmission and distribution, and establishing industry and infrastructure growth poles for the production of RE technologies and suppliers of related services.

Developed countries use carbon taxes as an instrument to commit enterprises to reduce GHG (greenhouse gas) emissions and to increase the share of electricity which is produced from renewables, but in developing countries it is more relevant to subsidize in a coherent framework renewable energies or to apply feed-in tariffs (FITs) at a certain rate for electricity supplied by private actors to the grid or the mini-grid. African countries have abundant natural resources being suitable for renewable energies; thus, the government can devise policies to subsidise the prices of renewable energy equipment and technology. Carbon taxes might have a negative impact on the economic activities of private actors, and this might make enterprises less competitive in terms of prices. Whatever the government is doing, a coherent approach is important, meaning that policy initiatives should not contradict each other. Also, the strategy should consider rural and urban areas, main economic sectors, and the size of enterprises, as small and medium enterprises should be promoted. The extent of the informal sector may hinder such a strategy, but the governments can include these enterprises in a subsidization programme.

Energy infrastructure is a critical issue. Governments need to present policy guaranties to induce RE development; financiers and venture capital investors exhibit a policy risk aversion as they avoid renewable energies' investment opportunities if regulatory exposure is perceived to be high. The construction of solar power stations in isolated villages based on mini-grid solutions and an Interconnected Power Network (IPN) is a feasible possibility. To achieve the SDGs 7 and 9 goal, building a resilient energy infrastructure is essential. Cameroon has the second largest watershed in Africa after the Democratic Republic of Congo. Hydropower is also an interesting source for RE. There is an abundance of rivers and streams throughout African countries. Apart from large hydroelectric dams which require a huge financial mobilization, a system of mini power grids can be established in remote area villages, by exploiting the potential of small rivers being available to generate energy of less than 5 MW in remote areas. These mini power off-grid projects will reduce not only energy poverty but also income poverty. African countries have a natural endowment with renewable energy (RE) resources such as solar radiation, waterfalls, biomass, and winds. It is therefore important for governments to invest in each region in the type of renewable energy which can rapidly be developed in that locality. Solar power stations could fit in the first region, wind power stations in the second, small hydropower stations in the third, and biomass power stations in the fourth region. It will be advisable to go for small-scale applications in isolated areas while waiting for the national grid to reach the areas in question. However, such a national grid can only be reached by interconnecting parts of the grid and many of the mini grids.

Key Areas are Research and Development and Technology Diffusion for RE. The African governments need to increase finance for research & development to achieve higher levels of the RE technologies. Because of the varied sources of RE power stations, the governments need to support local technology development and innovation. For instance, it is essential to finance research & development at the regional universities and at applied technology centres; it is also necessary to train staff and technicians in that domain, and to support the respective crafts. Patents need to be awarded to young researchers for their discoveries. Funding of R&D and of technology development are critical issues.

African countries need to elaborate Agendas for Energy Sector Transformation. Such an agenda is important to reach inclusive, green, and clean growth in Africa. The public utilities and the private energy sector enterprises need improvements of their company governance. The energy sector regulations need more coherence. The focus on informal sector enterprises and on rural areas should be strengthened. If renewable energy can be adequately developed and extended, this will help to encourage the activities of small and medium size enterprises. Small businesses, like metal and welding workshops, hair dressing and barbing salons, retail shops, and many more small businesses and workshops will go op-

erational in rural areas if adequate energy supplies are guaranteed. The small businesses will be able to employ workers and to make profits for further investment. If such small and medium size enterprises are flourishing, the level of poverty in the country will drastically drop in accordance with the targets of SDG 9. Energy is one of the main drivers of economic growth. Thus, energy policy becomes a tool to achieve beside of SDG 7 also SDG 9 and its targets. To build a resilient infrastructure and to promote inclusive and sustainable industrialisation, a resilient energy infrastructure is a precondition. Uninterrupted energy supplies make a country attractive for foreign direct investment (FDI). Action programmes on energy sector transformation will contribute to inclusive and sustainable growth, and the governments will be able to increase the share of renewable energy in the overall energy mix of the country. The growth and employment effects of such an Action Plan on Energy Sector Transformation depend on comprehensiveness and quality of design and implementation.

The roads system is a key infrastructure sector in Africa and needs a reconfiguration of functions and institutions

The roads system in Africa is composed of all roads which are part of the system, from major roads down to feeder roads, but the roads system also comprises all the public authorities which have functions to regulate and to maintain the system, as well as all the private and public corporations which have a role in construction and maintenance of the system. The roads system has many important functions as it allows for the mobility of people: for various purposes restoring and maintaining peace and security, providing for economic integration and market expansion, support of people for getting access to health and education institutions, allowing for the transport of goods and services, travelling for touristic interests and searching for better employment opportunities. All these functions require that the roads system will be continuously developed and expanded. All these functions are interconnected. If there is no connection between regions in a country, the markets are fragmented and security cannot be maintained all over the country. Economic fragmentation can also lead to civil wars and to violence, when groups of people feel underprivileged. When security cannot maintain order, lack of economic integration will lead to poverty increases. Without access to other regions or even within the region, access to health and education facilities is becoming difficult or impossible. As cost increases because of the lack of road transport facilities, the competitiveness of producers declines, and any start-up of new enterprises is becoming difficult.

The roads system is composed of many public and private actors, from public regulatory and supervision authorities to private construction and servicing companies. The roads construction value chain is complex as is the roads maintenance value chain. Various major bottlenecks can arise in the roads construction value chain: skills and qualifications are not always appropriate; procurement practices

and systems may be detrimental to the outcomes; supply chain integration may be weak; supply chain relationships may be politicized and not market-oriented; and the structure of the construction industry may be biased towards other fields of work, such as buildings. Although the construction industry is an important sector in most of the African countries, the value chain is not always optimized by economic logic. The sector is of interest for central and regional politicians and businesspeople, mostly organized by huge authorities and large companies. Investors and constructors often work in joint ventures, so that lack of transparency leads to overpricing, corruption, and mismanagement.

The roads system in African countries needs a reconfiguration because in many cases it is not linking all the regions of the country, but more so the capital city and some high-priority economic zones. If a country has a federal constitution, such as Sudan, Nigeria, and Ethiopia, it is necessary to link the main cities of the states among each other and the states with the federal capital city of the country. But also, the roads within the state (in rural and urban entities) and the roads between neighbouring states are of importance. To fulfil the functions of the roads system as mentioned above, such a comprehensive approach is needed. If a country has a geographically limited roads system (as the Sudan in the power triangle of Dongola, El Obeid, and Sennar and to the harbour area of Port Sudan/Suakin), the peripheral regions have no room for development (such as the great region of Darfur with five states which are not adequately connected by roads among each other and with the capital city of Khartoum).

The discussion about SDG 9 reminds us of the great importance of the construction sector and about all the services needed for a functioning roads system, comprising public and private services. Roads construction can be the base for industrial development with important backward and forward linkages, for innovation in the construction and maintenance value chain, and for a geographically more equal infrastructure development. There are many problem areas in regard of the value chain: productivity improvements in the value chain are often inhibited; project selection and prioritization are weak; the fragmentation across the value chain because of small-scale contractors and many sub-contracts; oligopolistic supplier industries affecting the performance; inefficient planning and design; lack of innovation and use of outdated technologies; ineffective procurement and contract management; lack of demand management, and many ethics and integrity problems. All this can be overcome and will speed up development along the SDG 9 targets.

If a private sector-led economic diversification policy is pursued in African countries, investment into infrastructure is a prerequisite for sustainable growth. However, in some countries there was bias towards the power sector, while the transport sector and especially the roads sector was neglected. But not only the roads sector was neglected, also the other transport sectors (river transport, air transport, urban transport, railways, and sea transport). However, to address the

severe problems of geographic isolation, to access to markets for agricultural produce and to access health and education facilities, the roads subsector should be accorded top priority. Roads are also considered as vital for effective administration, for the exchange of information, and for security purposes. Roads are a prerequisite for any serious development effort. The governments of many African countries have failed to achieve this priority because of the shortage of development funds, the mismanagement of transport sub-sectors, and the inability to undertake substantial investments in this vital sector. Some funds were also channelled towards other crucial services, such as water, sanitation, and electricity supply. It is time to work for the roads and other transport sub-sectors, giving support to the respective actors, especially the official transport authorities, the associations and corporations of the private sector, and the foreign entities, as for example, bilateral and multilateral donor agencies and NGOs.

However, maintaining peace (after civil war and violence), working for regional equity (addressing regional biases/disparities), and achieving progress on the socioeconomic development front (through poverty alleviation, market development, and regional integration) are dependent, among other things, on efforts to develop an all-season reliable roads network. Also, cross-border and international contexts matter for the roads network. Within the regional economic communities (RECs) and between them the roads networks need to be integrated and improved. Developing and adopting appropriate business models by the public transport sector (and in cooperation with the private sector) could also be envisaged; such partnerships are still rare. Appropriate business models for the contribution of the local private construction sector in cooperation with foreign construction companies through internationally utilized arrangements, such as BOT (Build-Operate-Transfer), could also be visualized.

The SDG 9 embraces the roads sector as a vital part of the infrastructure. Roads have an important role in linking production areas with consumers (markets); promoting agricultural, manufacturing, tourism and trade activities; reducing costs of living by lessening the cost of inputs as well as the cost of products in transport; assisting in avoiding shortages in goods and commodities at regional levels; contributing to saving time, efforts and resources in general, and saving petrol consumption and spare parts of vehicles in particular; advancing social and cultural interaction; and fostering political and economic stability as a precondition for peace. So, steps towards a better roads system have an impact not only on achieving the SDG 9, but affect all the SDGs. The construction industry and the transport industry are of interest and of great importance for realizing SDG 9 in Africa. Both industries are part of the infrastructure, both industries generate significant innovations, and both industries are determining the paths of industrialization.

Linking social infrastructure development with policies to regulate the mining industries in Africa can work

Mining sectors are of great importance for Africa's development, and its importance can be further increased if the SDGs are considered as guiding sticks. The mining sectors provide for foreign exchange revenues and public revenues, for direct investment and new industrial technologies from multinational corporations, and for some growth, employment, and linkage effects. But the environmental and the social consequences are hotly debated. The environmental damages and the social and political repercussions can be severe, so that the local population in areas where the mining industry operates is affected in terms of access to basic goods and services (water quality, impact on agricultural resources and livestock, effects on flora and fauna, and air pollution); by the siphoning-off of the public revenues from the places where mining industry operates to places where the central government is located; and by the political consequences of the "resource curse" with corruption and mismanagement.

But it is possible to mandate the mining sector introduce environmental and social adjustments and to protect the local population from negative effects. It is possible to mandate the corporations to elaborate strategic plans for the surrounding areas of mining complexes. The corporations can be mandated to develop local infrastructure, to employ and to train local people, and to improve the well-being of the nearby living population. The question is how to link infrastructure development with mining investments, and how to impact on investment decisions. The collaboration of governments, local civil society organizations, and mining corporations is of importance. The mining corporations can be mandated to develop schools, kindergartens, and health clinics, not only for the employees but also for the local population. They can be mandated to improve the water and sanitation systems and to prevent environmental damage. So, they can be mandated to reduce air pollution and to prevent detrimental effects on arable land for agriculture and on pastures for livestock. Some of these measures which are already done are effective, others are more symbolic. The discussion about SDGs and development of the mining sector has brought new attention to these important topics. All the 17 SDGs have some relevance for the future of the mining sector, and the mining industry affects the realization of all the SDGs. SDG 9 requests that industrial development, innovation, and infrastructure are upgraded by policy targets and concrete measures. Corporations can work on all the three components, on industrial development through beneficiation of the minerals and exploiting the backward and forward linkages, on innovation through the introduction of new technologies which save the environment and the energy resources, and on infrastructure development through local education and training, water and sanitation, and health sector initiatives.

Mining sectors in Africa and elsewhere can actively contribute to the realization of the 17 SDGs. International, regional, national, and local agencies discuss

how new partnerships with mining corporations can use the potential of the mining sectors for welfare increases. Opportunities for shared actions are discussed. Mining companies can focus on energy efficiency, but they can also use their own energy infrastructure to make available power to undersupplied areas. Through partnerships a shared use of the energy infrastructure becomes possible, thus helping to achieve SDG 7 (Energy Access and Sustainability). Solar plants can be built for mining complexes, and a part of the power which is generated will feed the national grid or a local grid. Similar opportunities exist for the mining sector to contribute to other SDGs. The mining industry can work towards economic growth and employment (SDG 8), towards creating a more resilient infrastructure (SDG 9), and towards combating climate change and its impacts (SDG 13). A mapping of Mining to the Sustainable Development Goals (SDGs) by UNDP, World Economic Forum and the Columbia Center on Sustainable Development (UNDP/WEF/CCSD, White Paper, July 2016) in the form of an Atlas shows that there are plenty of opportunities for the mining industry to support the implementation of the SDGs. Such an Atlas is only a first step toward building a dialogue around mining's contributions to the post-2015 development agenda. It illustrates the types of partnerships which will facilitate positive outcomes for the global mining industry and for the global implementation of the SDGs. Africa could benefit a lot from such actions. Success will however require an unprecedented level of cooperation and collaboration among governments, non-governmental organizations, development partners, the private sector and the local communities which are affected by mining operations.

Mining corporations can undertake successful local initiatives for infrastructure development, as in the cases of infrastructure projects on water, sanitation, health, environment, and the construction and maintenance of schools. Case studies of local initiatives for infrastructure development are revealing; the prerequisites for successes are identified. The definition of "local initiatives" is hotly debated, as it must be clear if it refers to actors involved, to a geographic delimitation, and/or to ideas undergirding them. The geographic area can be defined as restricted or as rather wide, and the actors which are active can be from outside but may be very interested in the development of the local area. Ideas can originate from elsewhere and are localised through adaptation, assimilation, and articulation by local communities. So, these definition elements of "local initiatives" for infrastructure development can inform the infrastructure-specific aims and the indicators of SDG 9 which matter. But, to realise the SDG 9 goal and its targets which are envisioning sustainable and resilient infrastructure, ideas from different contexts need to be fused, adapted, and adopted to local settings.

Study findings demonstrate that local initiatives can contribute greatly towards developing water, sanitation, school, and health infrastructure. Local initiatives can provide the essential basic infrastructure in resource-limited settings which are deprived of the infrastructure. Given this fact, further studies should

explore the contributions of local initiatives to infrastructure development in different settings and countries of Africa. The approaches used in local initiatives for infrastructure development differ between mandatory and non-mandatory approaches. Companies can be mandated to support infrastructure projects, and this may be successful; but there can also be successful infrastructure projects based on a non-mandatory approach. The efficacy of the two approaches depends on specific factors of countries, corporations, mining products, areas of local action, governance regimes in the country and the region, and various other factors. Both approaches can prove a practical utility when applied in a specific context. Further studies should give deeper insights on these two approaches, so that empirical evidence from the research studies can inform policy and practice. The success of the mandatory approach may be largely dependent on the enforcement of the relevant policies, while the non-mandatory approach may work in cases of a participatory environment with functioning partnerships in a country and region. The first approach relies more on formal agreements, while the second is more dependent on informal agreements. A review of such cases, of enabling policies and partnerships may help to gain insights on strengths and weaknesses of existing policies and partnerships. Capacitating the institutions that improve existing policies and partnerships for infrastructure development will be important.

The indicators for measuring success of locally initiated infrastructure development projects through cooperation with mining companies include participation or consultation, ownership, sustainability, technology and skills transfer, job creation, empowerment, and networking. Also, learning from experiences for further projects is an important indicator for measuring success of local initiatives. The process of learning is linked to knowledge, it is an interactive and a socially embedded process; it is a process to be understood by taking into consideration the institutional and cultural context. There are various forms of learning, namely learning-by-doing, learning-by-using, and learning-by-interacting; all these forms play a role in infrastructure development projects. Learning is related to the three main partners (local people, government, mining corporations) and their interaction. Learning in its various forms is important for innovation, is relevant for further industrial development, and is necessary for realising sustainable and resilient infrastructure, as envisioned in SDG 9.

Realising successful infrastructure projects demands innovation and interactive learning. Therefore, emphasis should be on community-centred programmes that strengthen interactive learning and innovation as being essential for sustainable and resilient infrastructure as envisioned in SDG 9. Policy frameworks therefore must promote interactive learning and the sharing of learned experiences across communities. The innovation for a sustainable and resilient infrastructure as aligned to SDG 9 can be incremental or radical, depending on contextual factors.

The impacts of successful local initiatives on community infrastructure development are ambiguous. Various social and economic impacts of local initiatives for infrastructure development can be identified. The physical infrastructure construction projects (such as for schools and health centres) seem to be still guided by archaic with little concern for sustainability and resilience. Therefore, it is recommended that infrastructure development-related policies and standards be reviewed to prioritise the construction of sustainable and resilient infrastructure, and primarily an implementation through local initiatives.

The impacts as seen by reviews and studies went beyond creating physical infrastructure. The local initiatives for infrastructure development may have ambiguous effects concerning gender norms and practices, forms of corruption, and emerging inequalities. The processes of infrastructure development should be inclusive, should prevent corruption, and should reduce inequalities. Therefore, creating explicit policies to guide the implementation of local initiatives for infrastructure development is recommended. These policies should promote transparency, prevent corruption, and promote equality and inclusivity. On this basis, these policies will further the realisation of the infrastructure-specific aims of SDG 9. This approach to locally initiated infrastructure development projects may improve the quality of lives of members of the community where they are constructed. An innovative policy mix that considers the indispensability of local initiatives will enable communities to adapt and to be resilient to social, economic, political and ecological impacts, and ultimately will facilitate the realisation of the infrastructure aims under SDG 9.

References

- AUC/OECD, 2019, “Africa's Development Dynamics 2019: Achieving Productive Transformation”, AUC/African Union Commission, Addis Ababa/OECD Publishing, Paris; Access: <https://www.oecd.org/publications/africa-s-development-dynamics-2019-c1cd7de0-en.htm>
- BBC News, 2020, “Coronavirus in South Africa: Outbreak closes Mponeng gold mine”, Available at: <https://www.bbc.com/news/world-africa-52791780>
- Deloitte, 2018, Africa Construction Trends Report: If You Want To Prosper, First Build Roads; access: <https://www2.deloitte.com/ke/en/pages/energy-and-resources/articles/africa-construction-trends-report.html>
- Deloitte, 2015, “State of mining in Africa: In the spotlight”; Available at: https://www2.deloitte.com/content/dam/Deloitte/na/Documents/energy-re-sources/na_zs_state_of_mining_africa_09022015.pdf
- FAO/Food and Agriculture Organization of the United Nations, 2018, Transforming Food And Agriculture To Achieve The SDGs, 20 interconnected actions to guide decision-makers, FAO, Rome; access: <http://www.fao.org/3/I9900EN/i9900en.pdf>

- IASS/Institute for Advanced Sustainability Studies, 2016, *The Future of Africa's Energy Supply, Potentials and Development options for Renewable Energy*, by Rainer Quitzow et al, March 2016, Potsdam: IASS; Access: https://www.iass-potsdam.de/sites/default/files/files/study_march_2016_the_future_of_africas_energy_supply.pdf
- ICA/Infrastructure Consortium for Africa, 2020, "Spending by African governments on infrastructure"; Available at: <https://www.icafrica.org/en/topics-programmes/spending-by-african-governments-on-infrastructure/>
- ICA/Infrastructure Consortium for Africa, 2020, "Catalysing Africa's Infrastructure Development"; Available at: <https://www.icafrica.org/en/>
- IP/FERDI, 2016, *Investing in Development in Africa, How Impact Investment Can Contribute To Meeting The Sustainable Development Goals (SDGs) in Africa*, October 2016; access: <https://ferdi.fr/dl/df-HF85ftaqPtr7fs2g8wRJq3kA/study-investing-in-development-in-africa-how-impact-investment-can.pdf>
- IRENA, 2020, "Renewable capacity statistics 2020", International Renewable Energy Agency (IRENA), Abu Dhabi; Access: IRENA (2020), "Renewable capacity statistics 2020", International Renewable Energy Agency (IRENA), Abu Dhabi; Access: <https://www.irena.org/publications/2020/Mar/Renewable-Capacity-Statistics-2020>
- KPMG, 2016, "What influences foreign direct investment into Africa? Insights into African Capital Markets", Available at: <https://assets.kpmg/content/dam/kpmg/pdf/2016/07/What-influences-FDI-into-Africa.pdf> Accessed 04/10/2020
- KPMG and UNGC, 2015, *SDG Industry Matrix*, September 2015; access: <https://assets.kpmg/content/dam/kpmg/xx/pdf/2017/05/sdg-financial-services.pdf>
- McKinsey, 2020, "Solving Africa's infrastructure paradox", Available at: <https://www.mckinsey.com/business-functions/operations/our-insights/solving-africas-infrastructure-paradox>
- Ndung'u, N., and Signé, L., 2020, "Capturing the 4th industrial revolution: A regional and national agenda"; Available at: <https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/>, and the full chapter by the authors at: https://www.brookings.edu/wp-content/uploads/2020/01/ForesightAfrica2020_Chapter5_20200110.pdf
- Nicol, F; Humphreys, M. and Roaf, S., 2012, "Adaptive thermal comfort: Principles and practice", Routledge Publishers, Abingdon, Oxon, UK.
- OECD, 2020a, "Global Value Chains (GVCs)"; Available at: <https://www.oecd.org/industry/ind/global-value-chains.htm>
- OECD, 2020b, "Results-based funding: Key take-aways from a technical workshop"; Available at: <https://www.oecd.org/dac/peer-reviews/Results-based-financing-key-take-aways-Final.pdf>
- PIDA/Programme for Infrastructure Development in Africa, 2020, "Programme for infrastructure development in Africa"; Available at: <https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/programme-for-infrastructure-development-in-africa-pida>

- Sovacool, B., 2009, 'Rejecting renewables: The socio-technical impediments to renewable electricity in the United States', in: *Energy Policy*, 37(11), pages 4500-4513.
- SDG Center for Africa/SDGC/A, 2017, *SDG Financing for Africa: Key Propositions and Areas of Engagement*, The Sustainable Development Goals Center for Africa Conference, Kigali, Rwanda: 27 January 2017; Access: <https://sdgcafrica.org/wp-content/uploads/2018/07/SDG-Center-for-Africa-Conference-Report-Kigali-Rwanda-27-January-2017.pdf>
- SDG Center for Africa/SDGC/A and Sustainable Development Solutions Network/SDSN, 2018, "Africa SDG Index and Dashboard Report 2018", Kigali, Rwanda and New York, USA: The SDG Center for Africa (SDGC/A) and The Sustainable Development Solutions Network (SDSN); Access: <https://www.sdgindex.org/reports/africa-sdg-index-and-dashboards-2018/>
- UNDP, World Economic Forum, and the Columbia Center on Sustainable Development (UNDP/WEF/CCSD), 2016, *Mapping Mining to the Sustainable Development Goals: An Atlas*, White Paper, July 2016; Access: https://www.commdev.org/pdf/publications/P_Mapping_Mining_SDG.pdf
- UN Global Compact/UNGC, 2020, *Action Platform, Financial Innovation for the SDGs*; access: <https://www.unglobalcompact.org/take-action/action-platforms/financial-innovation>
- United Nations Sustainable Development Goals/UNSDGs, 2020, "Progress of Sustainable Development Goal 9"; Available at: <https://sdgs.un.org/goals/goal9>
- United Nations, 2020a, "Why development infrastructure in Africa matters"; Available at: <https://www.un.org/africarenewal/web-features/why-infrastructure-development-africa-matters>
- United Nations, 2020b, "Sustainable Transport"; Available at: <https://sustainabledevelopment.un.org/topics/sustainabletransport>
- World Bank, 2020a, "Results-based financing (RBF) and Results in Education for All Children (REACH)"; Available at: <https://www.worldbank.org/en/programs/reach>
- World Bank, 2020b, "Banking on impact: what you need to know about results-based financing"; Available at: <https://www.worldbank.org/en/news/feature/2019/06/28/banking-on-impact-what-you-need-to-know-about-results-based-financing>

Financial Inclusion, Innovation and Agricultural Development in Nigeria

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1 Introduction

The agriculture sector was the mainstay of the Nigerian economy before independence and immediately after it, until the oil boom of the 1970s has emerged. In the period before the 1970s, agriculture provided the needed food for the population as well as serving as a major foreign exchange earner for the country. It provided the means of livelihood for over 70% of the population and was a major source of raw materials for the agro-allied industries and a potent source of the much-needed foreign exchange (Alabi et al., 2014). The agriculture sector in periods immediately after independence performed creditably the roles highlighted above to such an extent that the regional developments witnessed during the period were linked directly to agricultural development (Imahe and Alabi, 2005). Development economists have in fact attributed the present economic problem in Nigeria to the poor performance of the agricultural sector (Olomola et al., 2014).

There are many problems that are inherent in agricultural and food production in Nigeria. There is lack of storage facilities for farm produce, with a high volume of annual loss of agricultural produce attributed to inadequate storage facilities (Oguntade, 2014; Asoegwu and Asoegwu, 2007). The extension service delivery system in Nigeria has suffered many setbacks from inefficiency and inadequate numbers of extension personnel (Akande, 2006). Technology-based agriculture has not yet been developed on a significant scale in Nigeria, as previous growth in the agricultural sector has always come from expansion of land under cultivation rather than from increased productivity (World Bank, 2011). Alabi and Adams (2020) revealed the proportion of the farmers that owned modern equipment, such as tractors, ridgers, harvesters, and planters, were about 5%. While

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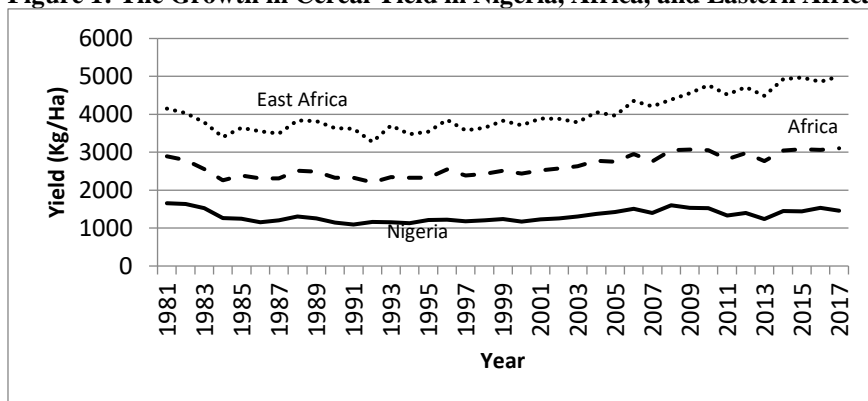
other developing countries have 130 tractors/100km², Nigeria has seven (7) tractors/100km² compared with Sub Saharan Africa (SSA) and World averages of 13 tractors/100km² and 200 tractors/100km² of arable land respectively (WDI, 2019). This implies that Nigerian farmers have low accessibility to means of agricultural mechanization that can increase their productivity. Uguru (2012) indicates that 7% of African agricultural practices⁴ are using irrigation systems; in Nigeria, only 0.8% of arable land is under irrigation compared to 28.0% in Thailand. The use of improved crop varieties and agrochemicals, such as fertilizer, is not yet adequate in Nigeria (Ozor and Urama, 2013). FAOSTAT (2019) shows that the fertilizer application per hectare in Nigeria stood at 6 kg, while the recommended standard level is 150 kg per hectare⁵; such low levels of mechanization are compromising productivity. This is evident in figure 1 as it shows that the cereal yield⁶ in 2017, which stood at 1462 kg per hectare, is 12% lower than its yield in 1981, which stood at 1655 kg/hectare. The figure also shows that the yield in Nigeria is lower than that of Africa's and Eastern Africa's average cereal yields, and that the cereal yield in Nigeria is about 30% lower than that of the Eastern Africa's cereal average yield of 1892 kg/hectare in 2017. The figure 1 reveals further that while the average cereal yield is increasing in Africa and Eastern Africa (from 1831 kg/ha in 2016 to 1892 kg/ha in 2017 in Eastern Africa), it is declining in Nigeria (from 1535 kg/ha in 2016 to 1462 kg/ha in 2017).

The lower agricultural productivity limits the ability of the Nigerian food production sector to feed the growing population. For example, there is a 6.5% growth in the annual demand for food in Nigeria, which a 3.7% growth rate of food production cannot meet (PFA/Public Financing of Agriculture, 2015). Available recent evidence shows that the proportion of the Nigerians who are undernourished has increased from 9 million in 2008 to 23 million in 2018 (FAOSTAT, 2019).

⁴ See on the definition of agricultural practices: <https://www.vedantu.com/question-answer/what-are-agricultural-practices-define-5b7fdd6be4b084fdbbfc8d1d>

⁵ Most growth-inducing and poverty-reducing agricultural growth in Nigeria is expected to come largely from expanded use of inputs that embody improved technologies, particularly improved seed, fertilizers and other agro-chemicals, machinery, and irrigation (Sheahan and Barrett, 2014). However, Liverpool-Tasie et al. (2010) indicated that fertilizer use in Nigeria is lower than that observed in other parts of the developing world, despite of the fact that the country is experiencing annual nutrient depletion.

⁶ Cereal yield, measured as kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only (FAOSTAT, 2019).

Figure 1: The Growth in Cereal Yield in Nigeria, Africa, and Eastern Africa

Source: Computed from FAOSTAT (2019)

Lower productivity, underutilized agricultural land, and lost opportunities for value addition have perpetuated poverty and food insecurity in Nigeria. Most farmers lack access to financial services to allow them to develop their businesses, to buy equipment, to purchase agro-chemicals, and to improve their standards of living. Farmers are often cash-constrained, limiting their ability to make improvements or upgrades. Firms in the value chain, such as input dealers, buyers, traders, and processors typically need considerable working capital for inputs, for buying crops for onward sale or processing, for arranging transport, and for procuring other services. Box 1 below illustrates the importance of financial inclusion and the impact on value chain development in Nigeria.

Box 1: Financial inclusion and value chain development in Nigeria

An examination of the Nigerian financial sector landscape shows that there is a significant financial intermediation deficiency and the excluded households are more likely to be in rural areas, despite of the vigorous growth of the institutional infrastructure and outreach. Small-scale farmers who do have access to bank loans frequently find the terms to be too rigid, the amounts too small, or the fees too high to permit the kinds of investments that can significantly increase production. As a result, they often borrow from informal sources that typically charge high interest rates and have limited potential to expand. Besides, most credits flowing to Nigerian agriculture, whether from formal or informal sector sources, have been short-term and to some extent medium-term. Generally, short-term finance does not have significant impact on farm cultiva-

tion and, therefore, does not improve overall output and incomes. Low productivity, combined with very limited on-farm processing, forces farmers to sell their produce in unfavourable market conditions at low prices. At the same time, the smallest of the farms do not have the resources to improve productivity and to benefit from the different support schemes of government. However, availability of bank credit has been shown to be the gateway to avail several benefits, such as interest subsidies on credit, investment subsidies linked to credit, crop insurances, and participation in value chains. Thus, inclusive growth is closely linked to financial inclusion for the farming community.

Source: AfDB (2013).

Evidence suggests that the financing gap for smallholders is huge (AfDB, 2016). Traditional financial services providers have not been able to effectively serve this part of the small-scale farmers which faces multiple challenges from buying inputs and technologies at a fair price, harvesting, and transporting their produce from remote places, to getting their payments in the more efficient and secure ways. Furthermore, given the seasonality of their businesses, farmers do have difficulties to make their income, received during harvest seasons, last throughout the year which compounds their capital constraint.

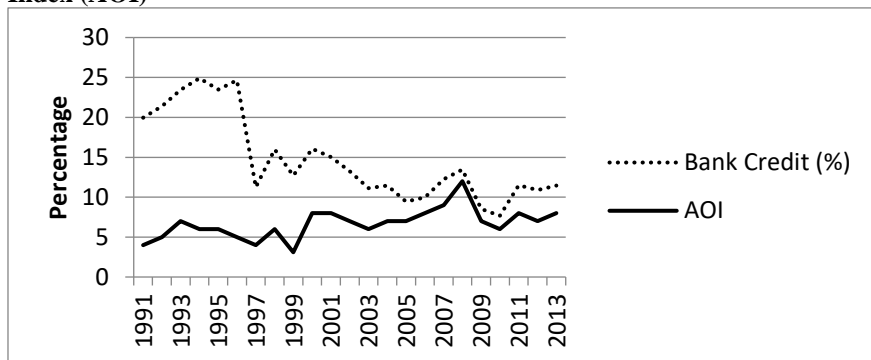
Figure 2 paints the picture of lack of financial supports for agriculture in Nigeria. It shows that the shares of bank credit that goes to agriculture declines over the years and continues to decline up to the present time. The Agriculture Orientation Index (AOI), which measures the ratio of the share of government expenditure to agriculture to the share of agriculture in total GDP, when multiplied by 100, averaged 7% during the period.⁷ Figure 2 indicates that the Agriculture Orientation Index (AOI) fluctuates below 10% between 1991 and 2013.⁸ This may explain the reason for the huge financial gap in Nigerian agriculture, because the private and public financial contributions to Nigeria's agriculture sector are low as portrayed in figure 2. Compared with other developing regions, the AOI of Nigeria is spectacularly low.⁹ So, the support of Nigeria's agriculture rests on inadequate public and private financial flows, although the low productivity of agriculture in Nigeria in terms of yields has various reasons which need to be studied carefully.

⁷ This indicates that if agriculture contributes 25% to national GDP between 1991 and 2014, It means that only 1.75% of the national public expenditure went to the agricultural sector. It also suggests that agricultural sector was given only a 7% consideration of public expenditures relative to its contribution to GDP.

⁸ This implies that less than 10% of public expenditures were contributed to the agriculture sector relative to the contribution of agriculture to national GDP during the period under consideration. The higher the AOI, the higher the priority the government accords to agriculture in its spending outlay.

⁹ See FAO's data on the issue of AOI: <http://www.fao.org/sustainable-development-goals/indicators/2a1/en/>

Figure 2: Share of Bank Credit to Agriculture and Agriculture Orientation Index (AOI)



Source: Computed from FAOSTAT (2019) and CBN (2018)

The benefits of an inclusive financial system are the decline in the cost of capital, a more efficient allocation of productive resources, and the facilitation in the day-to-day management of finances. Likewise, providing financial access directly to farmers can free up much needed capital for buyers to make the investments needed to expand operations or to enter into new markets (USAID, 2011). Notwithstanding the benefits of financial inclusion, it has been discovered that there are large numbers of potential entrepreneurs, farmers, small enterprises and others, who are excluded from the financial sector, which leads to their marginalisation and to a denial of opportunity for them to grow and to prosper (Rakesh, 2006). In Nigeria, many people lack access to formal financial services. For example, in Nigeria about 40% of the adult population were financially excluded (EFInA, 2014). The general level of financial inclusion is low and the rural financial system in Nigeria cannot enhance a far-reaching development of the rural and agricultural economy, as a developed financial system is needed for agricultural investment, for reaching an enlarged productivity, and for generating higher incomes across the whole economy.

The reason for Sustainable Development Goals (SDG) 9 is to build a resilient infrastructure, to promote inclusive and sustainable industrialization, and to foster innovation. Specifically, one of the targets of SDG 9 is to increase the access of small-scale industrial and other enterprises (including farming) to financial services, including affordable credit, and to promote their integration into value

chains and markets¹⁰. The financial inclusion as stated in the SDG 9 targets is important for the agriculture sector because it will significantly enhance the incomes of the rural poor, and it will enhance accessibility to a wider range of financial services and to products that are necessary to diversify their means of sustenance¹¹. All this will lead to lesser hunger and will eliminate poverty traps (Adeola and Evans, 2017). The other targets of SDG 9 are stated in box 2.

Box 2: Other SDG 9 Targets Apart from Financial Inclusion (Target 3)

1. Develop quality, reliable, sustainable, and resilient infrastructure. 2. Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product. 3. Upgrade, by 2030, infrastructure and retrofit industries to make them sustainable. 4. Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries. 5. Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological, and technical support. 6. Support domestic technology development, research, and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities. 7. Increase significantly access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

Source: UN/SDGs (2019)

For more inclusive social and economic development in rural areas, improving the smallholder farmers' access to and usage of financing means is critical. Access to financial services at the household level enables rural households to meet consumption and social demands without having to divert financing from investment opportunities (Chaddad et al., 2005/Date Written). Going by the above discussion, financial inclusion is needed throughout the agricultural value chain to achieve broad-based economic growth which can raise incomes for low-income households. The effect of financial inclusion on agriculture, however, remains open to question as some important related issues have not yet been fully examined in the literature. None of the past studies, for example, have addressed the issue whether

¹⁰ This agreement envisages a world free from poverty and deprivation, and a situation where the fundamental conditions for human prosperity—healthy ecosystems, a stable climate, and a clean environment - are safely maintained.

¹¹ Agriculture is a good option for the required diversification; it exhibits also lower price volatility. Nigeria has substantial undeveloped amounts of the necessary endowments for this course of development.

the usage of financial services has significant impacts on agricultural productivity in Nigeria (Evans, 2017).

It has been proved that there is huge financial exclusion among the adult population in Nigeria, but empirical information about the proportion of farmers in the financial exclusion in Nigeria is scanty (Evans, 2017). Moreover, as noble as the SDG 9 goal is (which has 8 targets and 12 indicators), it does not offer a plan for how to achieve such laudable targets and objectives. As we move towards the implementation of the 2030 Agenda for Sustainable Development, a study of this matter is relevant to provide the hands-on experience of identifiable ways and methods that will be instrumental to achieving the goals set by the international community, especially the ones that have to do with financial inclusion, infrastructure development, innovation, and technological progress in Nigeria. Additionally, since Nigeria has one of the highest infrastructure gaps in the world, examination of the role of infrastructure on financial innovation and inclusion, within the specific context of agriculture, will be able to provide solid and insightful evidence for policymakers for promoting inclusive agriculture growth in Nigeria. Therefore, this study intends to achieve the following objectives:

1. Examining the growth, the nature and the structure of financial inclusion in Nigeria.
2. Analysing the determinants of the growth of financial inclusion in Nigeria.
3. Comparing the financial inclusion in Nigeria with other African countries which are endowed with high financial inclusivity.
4. Investigating the roles of innovation, infrastructure, and industry on financial inclusion in Nigeria.
5. Determining the effect of financial inclusion on agricultural productivity in Nigeria.

The study has six sections. After the Introduction (section 1) there is a section 2 on the growth, the nature, and the structure of financial inclusion in Nigeria. Section 3 covers issues relating Financial Inclusion and Agricultural Activities in Nigeria, while section 4 is on Financial Innovation, Rural Infrastructure and Financial Inclusion as a basis for the development of viable Agricultural Value Chains in Nigeria. Section 5 discusses the relevance of Sustainable Development Goal 9, and of Financial Innovation and of Financial Inclusion for Nigeria's Agricultural Development, followed in section 6 by Conclusions and Policy Recommendations.

2 The Growth, Nature and Structure of Financial Inclusion in Nigeria

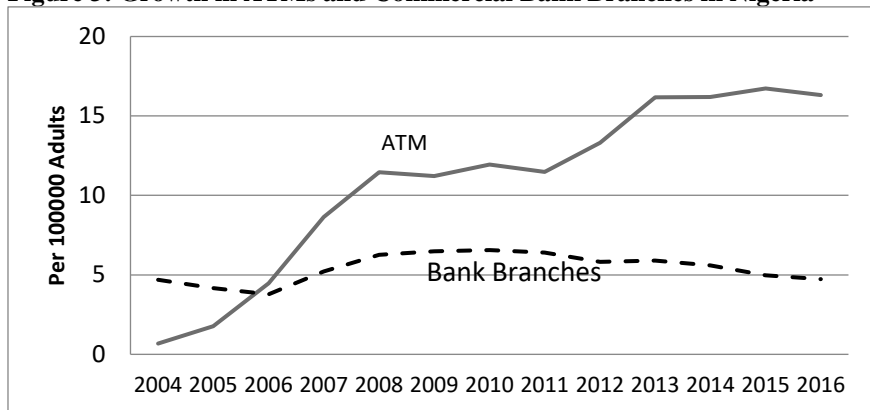
Table 1 elucidates the progress in financial inclusion in Nigeria. The table 1 reveals that the proportion of people using formal bank services has increased from 21% in 2008 to about 40% in 2018. This translates to a growth rate of 88% among the people who are conducting their financial transactions by using formal banking facilities, what is a considerable change towards financial inclusion. This can be attributed to an increase in the number of Automatic Teller Machines (ATMs) in Nigeria. There is some increase in regard of Other Formal Financial Institutions, but a decline in using non-formal financial institutions between 2008 and 2018. The share of financial exclusions has been reduced considerably.

Table 1: The Growth and Structure of Financial Exclusion in Nigeria

	With Banking Institutions		With Other Formal Financial Institutions		With Non-Formal Financial Institutions		Financial Exclusion	
Year	Population (Million)	%	Population (Million)	%	Population (Million)	%	Population (Million)	%
2008	18.3	21.1	2.2	2.5	20.7	23.9	45.4	52.5
2010	25.4	30.0	5.3	6.3	14.8	17.4	39.2	46.3
2012	28.6	32.5	9.2	10.5	15.2	17.3	34.9	39.7
2014	33.9	36.3	11.5	12.3	11.3	11.9	36.9	39.5
2016	36.9	38.3	10.0	10.3	9.4	9.8	40.1	41.6
2018	39.5	39.6	8.9	9.0	14.6	14.6	36.6	36.8
Growth Rate (%)	116	88	305	260	-30	-39	-19	-30

Source: Computed from EFINA (2018)

Figure 3 shows that, while the number of commercial bank branches has stagnated at 4.70 per 100,000 people in Nigeria, the share of ATMs per population grew in Nigeria from 0.68 per 100,000 people in 2004 to 16.32 per 100,000 adults in 2016. This increase correlates positively with the increase in the banking activities in Nigeria. The fact that the growth of the ATMs steps up the growth of the formal banking activities in promoting financial inclusion emphasises the relevance of financial innovations for enhancing financial inclusion in Nigeria. The spread of ATMs also reflects the urbanization trends in Nigeria.

Figure 3: Growth in ATMs and Commercial Bank Branches in Nigeria

Source: Computed from WDI (2019)

The increase in formal banking activities can also be implicated for the decrease in informal non-banking financial activities; these transactions went down from about 24% in 2008 to about 15% in 2018 (table 1). This implies that an increase in formal banking activities can lead to a decrease of informal non-banking financial activities in Nigeria. The reduction in the proportion of people using non-formal institutions for their financial operations may also be a result of the fact that the volume of finances getting from these sources may be relatively small compared with the volumes given by formal financial institutions (Badiru, 2013). The informal financial institutions also attract higher interest rates (Oke et al., 2007), thereby affecting the viability of projects undertaken by the people. The share of people who are using other formal non-bank institutions to conduct their financial transaction also increased from 2.5% in 2008 to about 9% in 2018.

Table 1 also demonstrates that the financial inclusion rate which stood at 47% (100% - 53%) in 2008 has increased to 63% in 2018 (100% - 37%). The 63% financial inclusion rate estimated for Nigeria in 2018 is an improvement on financial inclusion compared with what was obtained in 2008. However, the 63% financial inclusion rate estimated for Nigeria is among the least financial inclusion rates in Africa. It is far lower than the 93% financial inclusion rate in South Africa. It is also lower than the financial inclusion rates estimated for Eastern African countries of Rwanda, Kenya, Uganda, and Tanzania with financial inclusion rates of 89%, 83%, 78% and 72% respectively, as revealed in table 2. This implies that there is much room for Nigeria to improve its financial inclusion rate despite the progress that has been made in the past one decade.

Table 2: Financial Inclusion and Exclusion Rates in Some Selected African Countries

Country	Financial Exclusion (in %)	Financial Inclusion (in %)
South Africa	7	93
Rwanda	11	89
Kenya	17	83
Namibia	22	78
Uganda	22	78
Tanzania	28	72
Cameroon	36	64
Burkina Faso	39	61

Source: Computed from EFINA (2018)

To justify the importance of the banking sector for reducing the extent of financial exclusion in Nigeria we estimated the elasticities of banking, formal and informal financial institutions on financial exclusion in Nigeria on table 3. The table indicates that the increase in the proportion of the people conducting their financial activities through formal banking institution will significantly reduce the rate of financial exclusion in Nigeria, and more than through other financial inclusion strategies (via formal non-banking, and/or informal non-banking strategies). For example, the table indicates that if the number of people using formal bank institutions increased by 100%, the financial exclusion rate will decrease significantly by 106% in Nigeria.

Table 3: Elasticity of Banking, Formal and Informal Financial Institutions in Nigeria

Institution	Coefficient	t-ratio	Remark
Banking	-1.061493	-2.07	Significant
Formal non-Banking	-0.3564719	-0.80	Non-Significant
Informal non-Banking	-0.5480417	-1.64	Non-Significant
Constant	2.849487	5.90	Significant

Source: Computed by the Authors. * Level of Significance is 5%

We then went further to examine the factors that may not allow people to use banking institutions in Nigeria (see the results in table 4). The three most important factors that limit the use of formal banking facilities in Nigeria in 2016 are irregular income (41%), unemployment (20%), and distance to the bank (33%). While irregular income and unemployment as constraints to accessibility to banking services are declining in Nigeria, the factor “distance” as a barrier to banking activities is increasing. For instance, while irregular income as a constraint declined from 45% in 2014 to 41% in 2016, distance as a barrier has increased from 7% in

2014 to 33% in 2016. This suggests that while efforts are being made to increase income generation activities and to support the creation of jobs, great stride will be made in reducing financial exclusion in Nigeria if the banking facilities are located closer to the people. This is where financial innovation and technologies can be deployed to increase the proximity of the people to banking facilities (also via mobile phones and modern payment systems through ICT).

Table 4: Factors Limiting Formal Banking Activities in Nigeria

Reasons	2010	2012	2014	2016 ⁺
Irregular Income	45.3%	45.2%	45.0%	41.2%
Unemployment	27.1%	21.6%	21.4%	20.1%
Distance to the Banks	7.2%	12.4%	19.5%	33.0%
Documentation	3.8%	10.9%	3.2%	6.9%
Prefer Cash	4.8%	9.4%	6.9%	10.4%
Illiteracy	4.3%	7.5%	8.5%	11.7%
It is Expensive	3.4%	6.5%	7.5%	15.9%
No identity document	2.6%	5.4%	2.2%	4.2%
Don't know	2.4%	0.2%	4.9%	0.4%
Others	12.7%	1.8%	9.5%	0.4%

Source: Computed from EFInA (2016). Note: ⁺Multiple responses are allowed, and hence the total may be more than 100%.

State-related analysis of financial inclusion is presented in table 5. The table indicates that Gombe state has the highest financial exclusion rate of 76%, with a meagre financial inclusion rate of 24%. Gombe state is a state located in the North Eastern part of Nigeria. The available evidence reveals that the average level of poverty in Gombe state is higher than the national average poverty rate in Nigeria. The lowest financial inclusion rate of this state in Nigeria may be caused by the fact that Gombe state has 66%, 27%, 24% and 45% as illiteracy, unemployment, underemployment, and food insecurity rates respectively, which are higher than the national average of illiteracy, unemployment, underemployment, and food insecurity rates of 44%, 24%, 21% and 31% respectively (NBS/National Bureau of Statistics, 2018). Illiteracy can reduce the level of awareness regarding the presence of financial institutions in the state. Unemployment and underemployment will limit the income generation ability of the people in the state and hence hinder their possibility of association with financial institutions. Food insecurity may have a negative effect on the health of the people, and this may also affect their labour productivity and their financial capability.

Lagos state has the highest financial inclusion rate of 85%, and the exclusion rate of 15% is very low as demonstrated in table 5. The table 5 also shows that the

Lagos residents use different combination of financial windows, as about 69% of them are using formal banking institutions¹², about 4% are using other formal non-banking institutions¹³, and about 12% are using informal financial institutions¹⁴. The high financial inclusion rate in Lagos state correlates with lower illiteracy, unemployment, underemployment, and food insecurity rates in the state, as the state records lower illiteracy, unemployment, underemployment, and food insecurity rates (of 19%, 15%, 12% and 13%) respectively, compared with the national average of illiteracy, unemployment, underemployment, and food insecurity rates of 44%, 24%, 21% and 31% respectively (NBS/National Bureau of Statistics, 2018). The state-by-state distribution of financial institutions which are used in Nigeria is presented in table 6. This table 6 reveals the great discrepancies which exist state by state, in terms of financial windows used and the overall financial exclusion rate.

Table 5: The Pattern of Financial Exclusion and Inclusion by States in Nigeria in 2018

State	Banking Institutions (%)	Other Formal (Non-Bank) Institutions (%)	Informal Finance Institutions (%)	Financial Exclusion (%)	Financial Inclusion (%)
Gombe	16.4	4.4	3.2	76.1	23.9
Lagos	69.4	3.8	12.1	14.7	85.3
National	39.5	9.0	14.6	36.8	63.2

Source: Computed from EFINA (2018)

¹² Those who are using the bank institutions for their financial transactions are those that currently have access to or use a deposit money bank, in addition to having/using any of these products: ATM card, credit card, savings account, current account, fixed deposit account, mortgage, overdraft, loan, or Islamic banking product.

¹³ These are all adults who have access to or use other formal institutions and financial products not supplied by deposit money banks, including insurance companies, micro-finance banks, pension schemes or shares. It also includes remittances (through formal channels).

¹⁴ These are all adults who do not have any banked or formal other products but have access to or use only informal services and products. This includes savings clubs/pools, esusu, ajo, or moneylenders; as well as remittances (through informal channels, such as via a transport service or a recharge card). Esusu is a digital platform to save and to build credit: <https://www.esusu.org/>, and ajo is a contributory thrift saving scheme: <https://www.pulse.ng/lifestyle/money/saving-scheme-ajo-benefits-of-contributory-thrift-saving-scheme/2sfblne>.

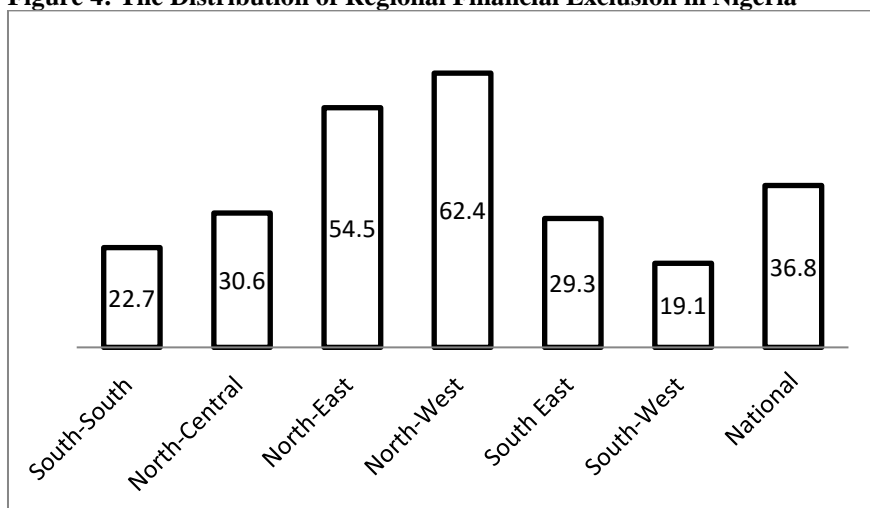
Table 6: The Distribution of Financial Institutions Used in Nigeria in 2018 by State

State	Banking Institutions (%)	Other Formal (Non-Bank) Institutions (%)	Informal Financial Institutions (%)	Financial Exclusion Ratio (%)
Bayelsa	46.3	3.7	14.6	35.3
Akwa Ibom	25.9	20.1	24.9	29.1
Edo	47.2	8.2	19.2	25.4
Delta	60.8	7.5	11.6	20.1
Rivers	62.5	2.8	16.9	17.8
Cross Rivers	54.5	12.7	16.5	16.3
Nasarawa	35.5	5.9	21	39.5
Niger	35.8	12.4	13.7	38.1
Plateau	34.2	11.3	16.7	37.8
FCT	55.4	6.7	6.0	31.9
Benue	30.6	9.6	31.4	28.4
Kwara	53.3	8.7	16.1	22.0
Kogi	43.5	10.2	28.5	17.8
Gombe	16.4	4.4	3.2	76.1
Bauchi	19.5	11.8	7.8	60.8
Yobe	19.3	8.4	12.3	60.0
Adamawa	28.7	8.5	12.4	50.4
Borno	23.4	16.4	11.7	48.6
Taraba	23.5	19.6	26.0	30.9
Kano	8.4	7.8	8.5	75.2
Jigawa	13.3	12.8	9.0	64.9
Katsina	14.6	7.3	14.0	64.0
Zamfara	12.6	14.7	13.9	58.7
Kaduna	30.2	6.1	8.8	54.9
Sokoto	17.2	16.5	11.5	54.8
Kebbi	32.6	11.5	11.5	44.4
Ebonyi	25.7	10.7	19.9	43.6
Imo	40.4	20.0	10.8	28.7
Anambra	60.4	5.5	6.6	27.5
Enugu	56.9	7.0	9.2	27.0
Abia	56.1	4.5	14.0	25.4
Ondo	47.5	5.8	17.9	28.8
Oyo	47.3	5.9	24.0	22.8
Ogun	55.8	8.9	13.5	21.8
Ekiti	61.1	4.5	16.7	17.6
Lagos	69.4	3.8	12.1	14.7
Osun	56.0	5.2	24.2	14.6
National	39.5	9.0	14.6	36.8

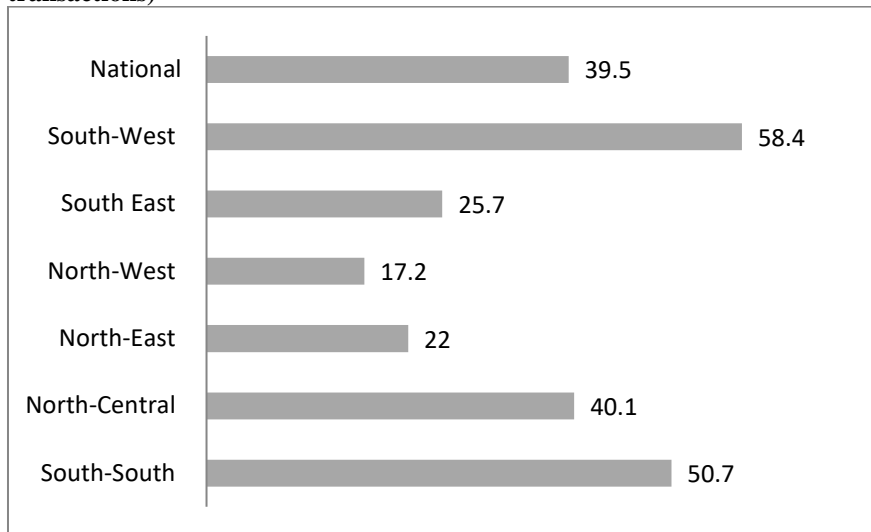
Source: Computed from EFINA (2018)

Figure 4 reveals that the financial exclusion rates in the North-West and the North-East regions were higher than the national average of around 37% in Nigeria. The financial exclusion rates in North-West and the North-East regions were 62% and 55% respectively. It had been stated before that Gombe state has the highest financial exclusion rate, and that this state is placed in the North-East region of Nigeria. The people in the North-East and North-West regions in Nigeria are predominantly farmers (Olomola et al., 2014). The high rates of financial exclusion in these regions may have quite negative effects on their agricultural activities. The figure 4 also demonstrates that the South-West region has the lowest financial exclusion rate of about 19%. It has been said earlier that Lagos state, which has the highest financial inclusion rate, is placed in the South-West region of Nigeria. Lagos state is the headquarters of all the commercial banks in Nigeria; it is the financial and economic hub of Nigeria. The high presence of the banking sector may explain the higher financial inclusion rate in Lagos state as 69% of those who are financially included in Lagos state have bank accounts (see table 5), while 58% of those who are financially included in the South-West region have bank accounts, compared to the national average of about 40% (figure 5). This brought to fore the importance of the banking sector in improving financial inclusion in Nigeria.

Figure 4: The Distribution of Regional Financial Exclusion in Nigeria



Source: Computed from EFInA (2018)

Figure 5: Regional Pattern of Banking in Nigeria (people with bank accounts/transactions)

Source: Computed from EFInA 2018

Table 7 demonstrates that financial exclusion in Nigeria is a major problem in the rural areas as it shows that the financial exclusion rate in rural areas (46%) is more than twice that of urban areas (22%) in 2018. The financial exclusion is also decreasing faster in the urban area than in the rural area. Table 7 shows that while the financial exclusion rate declined by 13% in urban areas, it declined only by 5% in rural areas between 2014 and 2018. The financial exclusion may be a major issue in the rural areas of Nigeria because of limited economic opportunities in the rural areas compared with those in urban areas of Nigeria. The higher illiteracy rate of 54% in rural areas compared with a rate of 32% in urban areas may also limit the uptake of the financial operations in rural areas compared with urban areas (CWI/Core Welfare Indicator, 2010). The higher financial exclusion may explain the higher poverty level in the rural areas (54%) compared to the rate of 36% in the urban areas of Nigeria (NBS/National Bureau of Statistics, 2018).

The financial exclusion rate is higher among the females than among the males in Nigeria. It stood at 33% and 41% for males and females respectively, as presented in table 7. The other concern is that the rate of decrease of financial exclusion is lower among the females (6%) than among the males (10%). This reinforces the fact that the gender financial gap in Nigeria may continue to widen in Nigeria over time. For example, the financial exclusion gap between males and

females in Nigeria, which was 7.8% in 2012, has increased to 8.4% in 2018. Therefore, deliberate attention should be taken to bridge the gender financial exclusion gap by pro-active policies.

Table 7: The Growing Gap in Financial Exclusion Based on Gender and Locations

Year	Male	Female	Gap	Urban	Rural	Gap
2012	36.1	43.5	7.4	-	-	-
2014	35.8	42.7	6.9	24.8	47.8	23
2016	36.8	46.6	9.8	24.4	52.2	27.8
2018	32.5	40.9	8.4	21.6	45.6	24
Decrease (%)	10.0	6.0	4.0	13.0	5.0	8.0

Source: Computed from EFINA (2008; 2010; 2012; 2014; 2016 and 2018)

Out of the people who are financially excluded in Nigeria, 26% of them are youth (in the 18 to 25 years age group) and 39% of them are people without formal education, as it is presented in table 8. The Global Findex Database/GFD (2019) has stated that the share of financial inclusion among the youth in Nigeria is very low. The high proportion of energetic youth without financial capacity may be due to the high unemployment rate among the youth in Nigeria. The unemployment limits their ability to generate income. This may also explain the high youthful restiveness in Nigeria. The Global Findex Database/GFD (2019) reported that those people with secondary school or more education have a 3 times higher financial inclusion rate than the people with primary education or less in Nigeria. The low financial inclusion rate among the illiterates in Nigeria can be explained on the basis of the fact that education is important to secure gainful employment and to adopt the right technologies among the farmers so that they can increase their productivity and enhance their income.

All these data show that policies to increase financial inclusion in Nigeria need to be adapted to the locality, to the education level, to the age group, to gender, and to other socioeconomic characteristics.

Table 8: The Proportion of Financial Exclusion and Non-Banking based on Age and Education

Age Group (Years)	Financial Exclusion (%)	Education Level	Financial Exclusion (%)
18 to 25	25.70	No Formal Education	39.1
26 to 35	17.22	More than Primary Education	17.5
36 to 45	16.73	Tertiary Education	2.0
46 to 55	17.71		
More than 56	22.64		

Source: Computed from EFInA (2018)

3 Financial Inclusion and Agricultural Activities in Nigeria

The further development of agriculture as a business can be used to create opportunities for those in rural areas, as well as for women and youth in Nigeria. It can drive inclusive growth, helping to reduce poverty and to build wealth (FAO, 2011). However, figure 5 reveals that the financial exclusion rate in Nigeria is higher among the farmers than the average for Nigerians. The figure shows that the financial exclusion rate among farmers is 52%, which is higher than the estimated 37% average financial exclusion rate for Nigeria. Table 9 reveals further that the financial exclusion among the farmers is also higher than those who are in other occupations in Nigeria, such as salaries earners, traders, and business owners. The financial exclusion rate among the salaries earners, and traders and business owners were 10% and 29% respectively. The major channel for financial inclusion among the farmers is based on informal financial institutions. While 23% of the farmers that were financially included used informal financial institutions, only 15% used banking facilities for their operations. The financial capacity of informal financial institutions has however been proved to be limited (Badiru, 2013).

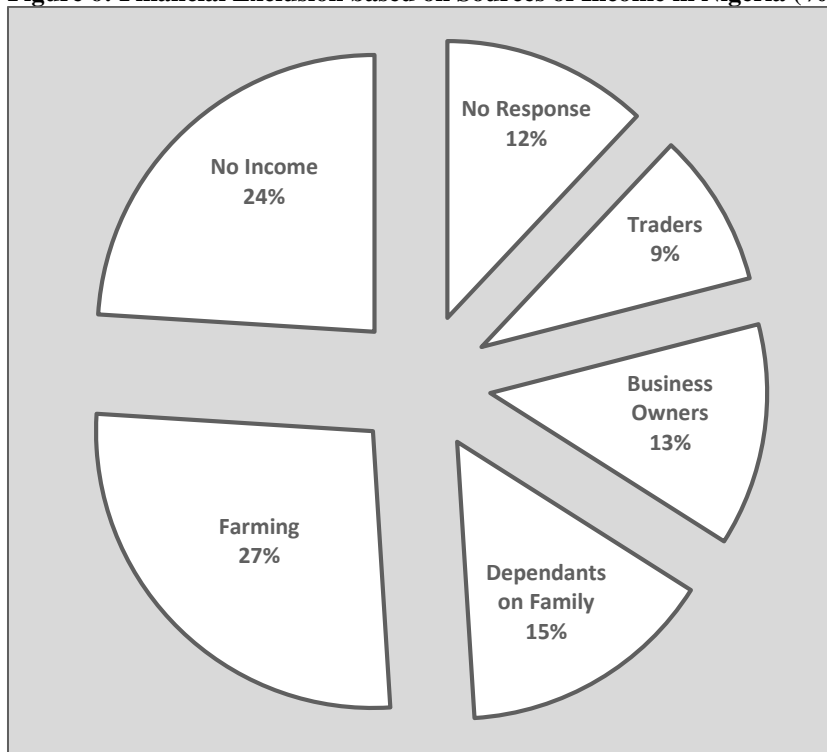
Table 9: The Structure of Financial Inclusion and Exclusion in Nigeria based on Occupation

Occupation	Banking Institutions (%)	Other Formal (Non-Bank) Institutions (%)	Informal Financial Institutions (%)	Financial Exclusion (%)
Regular Salaries and Wages	76.8	5.6	7.5	10.1
Traders and Owners of Businesses	35.7	13.6	21.4	29.3
Farming	14.9	10.2	23.3	51.6
Dependants	29.6	9.4	12.6	48.4
Others	56.3	9.5	11.2	23.1
Total	32.5	10.5	17.3	39.7

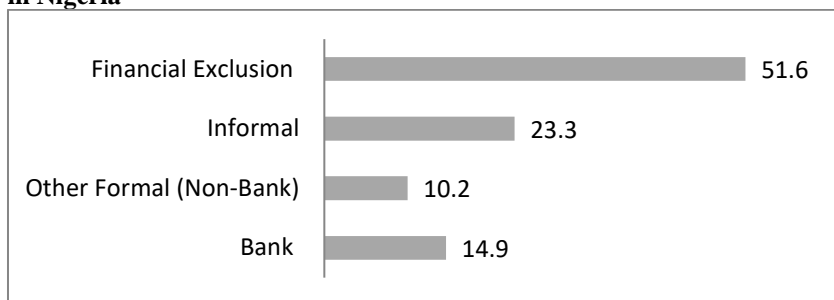
Source: Computed from EFinA (2016)

Figure 6 shows that many of the people who are financially excluded in Nigeria are those that are engaged in farming. This is a major argument to link financial inclusion policies and agricultural development policies.

Figure 7 indicates further that only 15% of the farmers used formal banking institutions for the farming activities, while 10% used other formal financial institutions, and 23% relied on informal financial institutions. This implies that more than half of the farmers (52%) are excluded from financial institutions in Nigeria. The reason is that farming is done in rural areas where the distance to financial institutions may be a barrier (if not transactions can be done via mobile phones). Another reason for higher financial exclusion among the farmers may be the fact that income from the farming activities is seasonal, so if the farming activities are not diversified the farmers will only expend in the planting season what they have earned during the harvesting season. This also implies that farmers need special financial facilities that may be tailored to their specific needs because of the nature of their farming activities.

Figure 6: Financial Exclusion based on Sources of Income in Nigeria (%)

Source: Computed from EFInA (2018)

Figure 7: The Nature and Structure of Financial Exclusion among Farmers in Nigeria

Source: Computed from EFInA (2016)

Box 3 (see below) reveals the efforts which the Nigerian Government has undertaken to improve financial inclusion in the agricultural sector of Nigeria.

Box 3: Efforts to Improve Financial Inclusion in the Agricultural Sector of Nigeria

For suppliers of financial services in Nigeria, the cost of rural operations is often too much which, when combined with the low returns and the high risks, results in a low supply of financial services. Consequently, the Nigerian Government, in a bid to increase financial inclusion in the country, has set an ambitious target of universal financial access by 2020. This ambition has brought many financial inclusion-driven initiatives into the agricultural sector, such as the Agricultural Credit Guarantee Scheme (ACGS), the Commercial Agricultural Credit (CAC) Scheme, and the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL). In 2009, the Central Bank of Nigeria (CBN) partnered with the Federal Ministry of Agriculture and Water Resources (FMAWR) and launched the Commercial Agricultural Credit (CAC) Scheme in order to provide access to finance for Nigeria's agricultural value chains (i. e. production, processing, storage and marketing). In 2016, the CBN and the Federal Ministry of Agriculture and Rural Development (FMARD) raised a sum of N75 billion as a loan to Nigerian farmers, under the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL). This scheme guarantees 75% of the loans provided by commercial banks to farmers as part of efforts to marshal financing for Nigerian agribusinesses by integrating end-to-end agriculture value chains with agricultural financing value chains (i. e. managing and pricing for risk, loan product development, loan origination, loan disbursement, and credit distribution).

Source: Evans (2017)

Using data from 36 states and the Federal Capital Territory (FCT), we examined the relationship between financial inclusion and agricultural productivity in Nigeria by using maize yield as the proxy for agricultural productivity in Nigeria (maize is widely grown in all the states in Nigeria). We also considered the relationship between financial inclusion in Nigeria and some development indicators for Nigeria, as reported in table 10. The development indicators considered are head-count poverty (%), illiteracy (%), unemployment (%), under-employment (%), and food insecurity (%). We considered these development factors jointly with yield, as the values of the development indicators have been proved to be lower in the rural areas where farmers reside (Core Welfare Indicator, 2010). Table 10 below shows that financial inclusion is positively correlated with maize productivity in Nigeria. This means that if financial inclusion in Nigeria increases, the agricultural productivity in Nigeria will increase in the same direction. The relationship is however not significant because a great number of the farmers is financially

excluded in Nigeria as we have indicated previously. Financial inclusion has a negative but significant correlation with illiteracy in Nigeria. This means that if financial inclusion increases it will significantly reduce the level of illiteracy in Nigeria. The reduction in the level of illiteracy will have indirect effects on the activities of the farmers as education is positively associated with the level of innovation adoption among the farmers. Financial inclusion also has a negative but significant relationship with under-employment. This suggests that the level of under-employment is reduced with an increase in financial inclusion. This corroborates the fact that the lack of access to finance limits the ability of the workers to explore the economic opportunities around them maximally. Financial inclusion is significantly but negatively related to food insecurity (as measured by the proportion of children stunted in the population in each state). The financial inclusion will enhance the ability of the people to secure gainful employment, and hence the family will have enough money to purchase food to feed the family. Even for the farm family, an increase in financial inclusion will increase the farm yield and that will increase the food availability at home and consequently will lead to the reduction in food insecurity at home.

Table 10: Correlation Coefficient between Financial Inclusion, Yield, and Development Indicators in Nigeria

Development Indicators	Financial Inclusion	Remark*
Maize Yield (Kg per Hectare)	0.07	Non-Significant
Income Poverty (%)	-0.02	Non-Significant
Illiteracy (%)	-0.81	Significant
Unemployment (%)	-0.20	Non-Significant
Underemployment (%)	-0.68	Significant
Food Insecurity (%)	-0.83	Significant

Source: Computed from FAOSTAT (2019) and EFInA (2018). * Level of Significance is 5%

It is evident from table 10 that financial inclusion will not only increase agricultural productivity in Nigeria, but it will also reduce income poverty, illiteracy, and unemployment, under-employment, and food insecurity in Nigeria. Therefore, efforts should be made to improve financial inclusion in Nigeria. In that direction, Nigeria can adopt the steps that some countries that are global leaders in financial inclusion are already taking. In this regard a good example is Kenya. Table 11 shows that financial inclusion in rural Kenya is twice that of rural Nigeria. While 32% of the people in rural Nigeria are financially included, 64% of the people in rural Kenya are financially included. The high level of financial inclusion in Kenya

has been attributed to the adoption of financial innovation instruments, especially Mobile Money (MM)¹⁵ (Mukong and Lwanga, 2019). The limitations of providing conventional banking and financial services in many developing countries – limited availability and affordability - have paved the way to the mobile money technology (MMT) which facilitated transactions by using a cellular telephone.

Kenya has experienced a wave of innovations in the financial sector. Some of the innovations which were experienced include process innovations, institutional innovations as well as product innovations. One of the leading financial innovations in Kenya is mobile banking as powered by Mobile Network Operators (MNOs), as illustrated in box 4 (below).

Table 11: Comparison of Financial Inclusion in Nigeria and Kenya (2010-2016)

Category	Nigeria (%)	Kenya (%)
All (15 Years and Above)	37	60
Poorest 40%	23	51
Richest 60%	48	76
Less than Primary School	19	50
More than Secondary School	53	80
Rural	32	64

Source: Computed from WDI (2019)

Box 4: Financial Innovation and Mobile Banking in Kenya

Mobile banking in Kenya is offered by several Mobile Network Operators, including Safaricom Limited which offers M-Pesa; Airtel Kenya, which offers Airtel Money; Essar Telecom Kenya Limited, which offers Yu Cash; and Telkom Kenya Limited, which offers Orange Money. There is also Mobikash mobile money which is offered by Mobikash Kenya Limited. M-PESA was developed by Vodafone and was launched commercially by its Kenyan affiliate Safaricom in March 2007. M-PESA, as a success story of a Mobile Network Operator (MNO), operates a system of low-value electronic accounts held by the mobile operator and accessible from their subscribers' mobile phones through a SIM card-resident application. The conversion of cash and electronic value is performed at a network of retail stores (often referred to as agents),

¹⁵ This new - branchless - banking technology is a key route out of informal banking for many in the developing world. It reaches farther and deeper into historically marginalised and unbanked communities, thus addressing some of the challenges (traveling and queuing at distant branches or saving cash) being associated with using the conventional banking system. The MM technology has the potential to serve financially excluded individuals in remote areas of developing countries (Mukong and Lwanga, 2019).

which are paid for by exchanging these two forms of liquidity on behalf of customers.

Source: Mas et al, (2009)

Since the introduction of mobile money (MM), quite a large percentage of the population has subscribed, and the figure stood at 77 percent of the total population in 2014 (CBK/Central Bank of Kenya, 2017). The number of total subscriptions to mobile money has increased from about one million in 2007 to about 47.6 million in 2018. The volume of mobile money transactions grew from Kenya shillings 732.2 billion in 2010 to 1.9 trillion in 2013 and to 3.9 trillion in 2018. In terms of percentage contribution to GDP, in 2013 it was 40 percent, and increasing to 45.2 percent in 2015 (CBK/Central Bank of Kenya, 2015). M-Pesa mobile money has been one of the most successful and leading mobile money systems in the World (Buku and Meredith, 2013; Nyamongo and Ndirangu, 2013). Many Kenyans are regular users of a mobile phone-based electronic payments system; M-PESA processes more transactions domestically than Western Union globally (Mas et al., 2009). FSD/Financial Sector Deepening et al. (2016, 2019) show that while bank use has increased from 13.5% in 2006 to 40.8% in 2019, the use of mobile money financial services increased in Kenya from 0% in 2006 to 79% in 2019. The use of banks (formal financial services) has grown with the growth of mobile money financial services, known as mobile banking. This growth in the use of mobile money has greatly contributed to financial inclusion which now stands at 82.9% in 2019 (FSD/Financial Sector Deepening et al., 2019).

4 Financial Innovation, Rural Infrastructure and Financial Inclusion in Nigeria – Relevance for the Development of Agricultural Value Chains

Financial innovations matter for Nigeria, and the country can learn from the experiences of Kenya with its financial innovations aimed at increasing the rate of financial inclusion. Table 12 indicates that the number of commercial bank branches per 100,000 adults in Nigeria has declined by 24% between 2008 and 2016. Moreover, distance as a barrier to banking activities has increased from 7% in 2010 to 33% in 2016. This may compound the problem of proximity to the use of banking institutions if financial innovation is not adopted to draw banking activities closer to the people (see on the factors limiting formal banking activities in Nigeria the table 4). Generally, table 12 also indicates that the level of financial innovation adoption in Nigeria is very low and grows slowly too. One of the most important financial innovations being adopted in Nigeria is ATM. Table 12 shows that while

bank branches are declining, the adoption of ATM per 100,000 adults has increased by 42% during the same period. Although about 69% of the adults have mobile phones, only 3.3% used Mobile Money (MM) which has been proved to be an effective financial innovation that can bring a paradigm shift to financial inclusion in Nigeria, as it has been done in other countries (GSMA/Global System for Mobile Communications Association/Groupe Speciale Mobile Association, 2018). The fact that so many Nigerians have mobile phones which can be used in adopting mobile money suggests that Nigeria has a great room for the improvement in mobile money technology adoption in Nigeria.

Table 12: The Growth in Financial Innovations and in Financial Inclusion

Year	Mobile Money (%)	Mo- bile Phone (%)	Credit Card (%)	ATM*	Bank Branches*	Financial Inclusion (%)
2008	2.0	49.0		11.46	6.26	47.5
2010	2.0	66.6	2.4	11.94	6.56	53.7
2012	2.2	64.1	4.8	13.31	5.81	60.3
2014	1.6	62.8	3.4	16.20	5.61	60.5
2016	1.6	60.4	-	16.32	4.74	58.4
2018	3.3	68.9	-	-	-	63.2
% Change	65	41	42	42	-24	33

Sources: Computed from EFINA (2016; 2018) * Per 100,000 adults

Table 13 confirms that more than 97% of the adult Nigerians never used Mobile Money (MM) before and that 1% out of the 3.3% of the Nigerians that used MM have discontinued in 2018. This is evidence that the use of MM as a financial innovation is underdeveloped in Nigeria when it is recognized that about 79% of the adult population in Kenya use MM (FSD/Financial Sector Deepening et al., 2019). For example, bank use has grown from 13.5% in 2006 to 40.8% in 2019, while mobile money which started in 2007 has grown to a 79% usage rate in 2019 in Kenya. This growth in use of mobile money has greatly contributed to financial inclusion which now stands at 83% in 2019 (FSD/Financial Sector Deepening et al., 2019) in Kenya. Table 13 reveals the reasons for the underdevelopment of MM in Nigeria. The major reason is lack of awareness. As in 2018, more than 83% of adult Nigerians were not aware of MM despite of the fact that about 70% of Nigerians have access to mobile phone. Nigerians have not fully harnessed the use of mobile phone technology; EFINA/ Enhancing Financial Innovation and Access (2010) has shown that 43 % of the Nigerians with mobile phones are unbanked. EFINA/ Enhancing Financial Innovation and Access (2018) indicates that 75% of the Nigerians desire knowledge about how to use financial technology, especially,

mobile money. Nigerians can learn how awareness on MM has increased so rapidly in Kenya.

Table 13: Experience with Mobile Money (MM) in Nigeria

Experience	2016 (%)	2018 (%)	Reasons for not Using MM	%
Never Used MM	98.7	96.7	Not Aware of the MM technology	83.3
Registered MM	0.8	1.7	Do not know much about MM technology	5.7
Using MM, but Not Registered	0.2	1.1	No Reason Given	4.2
Using MM, but Discontinued	0.3	0.7	Use of other means	3.6
			Lack of Trust	2.5
			Do not know how to get MM	1.6

Sources: Computed from EFINA/ Enhancing Financial Innovation and Access (2016; 2018)

Box 5 elucidates the relevance of Mobile Money for the development of agricultural value chains.

Box 5: The relevance of Mobile Money for the development of agricultural value chains

For the Agricultural Value Chains (AVCs), mobile money integration will bring with it lots of benefits to the producers. The players within the Value Chains (VCs) can transact information and money seamlessly and can derive much more benefit because of low cost of transactions. As the transactions are digital, real-time and cashless in nature, the cost incurred is lesser when compared to cash transactions. Digital mobile money ecosystems provide high security of the transaction and that of the money in high theft-risk countries. Mobile money allows seamless integration of buyers and sellers for exchange of cash and information. In contrast to cash transactions, mobile money ensures a more direct approach to payment and hence, it reduces the opportunities for leakages along the VC. Quick, low-cost and high security features of mobile money may trigger immediate payment from the buyer to the producers. Overall, due to the reduced cost of the transaction, and because of frequent and immediate payments, the cost economics favours all the players of the VC. Mobile money transactions have a digital trail and hence, they offer higher accountability than

the cash transactions. The positive externalities of mobile money usage by the producers would result in the development of rural economies. Local options for accessing liquidity ensure increased commercial activity as mobile money agents spread to smaller, more distant villages. The likelihood of money being used locally increases if the payment recipients (for sale of crop through farmers or from remittances through relatives from urban areas) can access their money locally. Thus, mobile money will spur the fuller financial inclusion at the village level. The mobile money accounts can be used as a medium for financial service providers to offer higher-level financial services to otherwise unserved and under-served rural population predominantly engaged in agriculture. Mobile money operators themselves might in future provide these services, or banks linked to mobile money schemes may offer them.

Source: Anup Singh (2012)

What are the uses of MM in Nigeria? The table 14 reveals that 57%, 26% and 9% of the people that used MM in Nigeria used it for remittances, airtime purchases for mobile phones, and for the payment of bills, respectively. The remittances can be domestic or international remittances. The use of MM for remittances is important in Nigeria because many Nigerians reside abroad. However, the table implies that the few Nigerians (3.3%) who are using an MM platform are not using it for business activities between individuals, organisations, and governments. According to Adesanya (2017), the Nigerian economy has not transitioned from her traditional cash-based characteristics of doing business. The result is the increasing number of informal financial operators whose activities are not regulated, although they control high volumes of liquidity which could have been used to create economic opportunities if it were in the hands of the formal financial institutions. With the current macroeconomic challenges and an uncertain economic outlook, the important and still growing retail space in Nigeria has great potential for deposit mobilization, engaging the un(der)banked, converting the unbanked, creating liquidity, driving cashless policy, and promoting economic growth (Adesanya, 2017).

Table 14: The Uses and Drivers for MM Uptakes in Nigeria

Uses	%	Drivers of MM	%
Remittances	57	For Sake of Ease	55.0
Airtime Purchases	26	Conduct Fast Transactions	49.1
Paying Bills	9	Family and Friends are Using MM	20.7
Others	8	Conduct Safe Transactions	13.8
		Save and Store Money	12.5
		Test and Try Mobile Money	4.6
		Ease to Pay Bills	4.1

Source: Computed from EFINA (2018)

There is no doubt that there is a need for increasing awareness of financial innovations in Nigeria, especially for MM. The table 14 above has presented the drivers that can be used to create awareness about the MM in Nigeria. Based on the survey conducted by Enhancing Financial Innovation and Access (EFInA), the fact that MM makes financial activities easy should be a selling point to Nigeria. MM makes business activities easy between individuals, organisations and governments. Using an MM platform to conduct business and financial activities is faster than using any other financial platforms, as 49% of Nigerians agreed (see the survey results in table 14). The use of MM is easier for people who have their family and friends already using the MM platform. According to Mukong and Lwanga (2019), in Uganda relatives, friends and neighbours make up the second largest source of information about MM while very few people learned about MM through field agents/other banking institutions. Many adopters of MM in Uganda were convinced by their family members, friends, and neighbours to use the technology. This indicates that close contact (strong social ties) is highly correlated with mobile money adoption (Mukong and Lwanga, 2019).

The low adoption of financial innovations may be implicated for huge infrastructural gaps in Nigeria which impede agricultural development and stable economic growth. In order to establish the role of infrastructure on financial innovation adoption in Nigeria, we investigated in table 15 the correlation between financial innovation, rural infrastructure and financial inclusion in Nigeria. We used rural accessibility to electricity and mobile phone as indicators of infrastructure and use adoption of MM and ATM as financial innovations. We used rural electricity as a measure of infrastructure in Nigeria because many of the rural areas lack electricity needed for processing and storage of perishable agricultural produce, as well as for other needs of the farmers. Nigerians' access to electricity stood at 54% of the population, with rural areas having only a 23% rate of access to electricity (WDI, 2019)¹⁶. We also considered mobile phone adoption as a measure of infrastructure because the rapid uptake of mobile telephony can be accompanied by many wireless applications that are of relevance in addressing the needs of individuals and the emergence of small business enterprises. One notable application is the use of mobile phones for financial transactions. Individuals can use their mobile phones for mobile banking or for mobile money transactions¹⁷.

¹⁶Accessibility rates to electricity in rural areas in Brazil, Malaysia and Thailand were at 79%, 93% and 88%, respectively (World Bank, 2014).

¹⁷ The characteristics of mobile money — convenience, privacy, and reach — make it a particularly attractive remittance channel for women and rural households. WorldRemit (an online money transfer service) data show that mobile money is the preferred way for their customers to send money to rural areas (Scharwatt, 2017). Mobile money can play a

In the former, users are required to have a bank account. They can then download a banking application on their cellular phones, which allows them to transact without necessarily going to the bank, allowing for a shorter transaction time. Mobile banking can also take the form of bank officials using movable units to service clients in remote areas where banks do not have a physical infrastructure (GSMA, 2018). Mobile money on the other hand does not require the user to open a bank account. This technology not only saves time, it also allows individuals at the lower end of the income spectrum to transact at minimal costs. Funds can change hands instantaneously and agents are often in the same location as users (GSMA, 2017).

Table 15 reveals that rural electricity has positive and significant correlation with banking. It means that if the proportion of the people that have access to electricity in rural Nigeria increases, the percentage of people using formal banking institutions to conduct their businesses will increase significantly. Since the use of formal banking institutions has a positive and significant relationship with financial inclusion as shown in table 15, the increase in accessibility to rural electricity in Nigeria will indirectly increase financial inclusion in Nigeria. Accessibility to rural electricity has a positive relationship with the use of mobile money, of mobile phones and of ATMs as reported in table 15. The relationship may not be significant because of the low level of accessibility to rural electricity in Nigeria. It may be that there are other intervening factors that must be considered before the relationship can be significant. It may also mean that the relationship between accessibility to rural electricity and the use of mobile money, of mobile phones and of ATMs is not linear, and correlations can only measure linear relationships.

critical role in formalising international remittances. While formal remittances' flows to developing countries have reached \$450 billion in 2017 (KNOMAD, 2017), the true size of remittances is believed to be significantly higher, with large flows going through unregulated informal channels.

Table 15: The Correlation Matrix of Financial Innovation, Rural Infrastructure and Financial Inclusion in Nigeria

	Bank- ing	MM	Mobile Phone	Rural Electricity	ATM	Financial Inclusion
Banking	1.00	0.24	0.75* ¹⁸	0.94*	0.89*	0.92*
Mobile Money	0.24	1.00	0.44	0.47	-0.82*	0.37
Mobile Phone	0.75*	0.44	1.00	0.73	0.30	0.79*
Rural Electricity	0.94*	0.47	0.73	1.00	0.73	0.78
ATM	0.89*	-0.82*	0.30	0.73	1.00	0.76
Financial Inclusion	0.92*	0.37	0.79*	0.78	0.76	1.00

Source: Computed from EFInA (2018) *Significant at 5%

Mobile phone usage has a positive and significant correlation with the use of formal banking institutions and financial inclusion in Nigeria as portrayed in Table 15. This is because about 70% of Nigerians have access to mobile phones. Although there is a positive correlation of mobile phones with MM, the relationship is not significant. Enhancing Financial Innovation and Access/EFInA (2018) has also revealed that many of the Nigerians that have a mobile phone do not use it for MM, but only to make calls. GSMA (2017) reported that many of the financially excluded individuals that have access to mobile phones can be financially included through mobile money technology adoption¹⁹. Mobile money can serve as a gateway to financial inclusion, enhancing the impact of international remittances on

¹⁸ According to Mas et al (2009), a survey of 3,000 households in Kenya showed that the average M-PESA user is, in comparison to non-users, twice as likely to have a bank account (72% versus 36%). M-PESA users had annual expenditures being about 65% larger than those of non-users, and they have 20% more assets. Users are also likely to be slightly more male, slightly older, more literate, and better educated (FSDT/Financial Sector Deepening Trust, 2009b). In terms of services utilized, one quarter of the M-PESA users reported using their phones for storing money. However, the survey of M-PESA users in late 2008 revealed that less than 1% of the accounts had balances of over KSh 1,000 (\$13). A government audit of M-PESA in August 2009 revealed that the average balance on M-PESA accounts was only KSh 203 (\$2.70) (FSDT/Financial Sector Deepening Trust, 2009a).

¹⁹ Originating from Kenya in East Africa, mobile money has become one of the cheapest, fastest, most reliable, flexible, and easily accessible method of financial transacting relative to other systems which it substituted in nearly 90 countries worldwide (GSMA, 2017). The greatest share of mobile money transactions presumably takes place between household members, relatives and friends. Thus, the utility from (and ultimately the benefits of) having a mobile money account is expected to increase when other household members, friends and relatives own a mobile money account or if they subscribe to the same mobile money platform. Therefore, social ties and information spillovers (networks)

development. For example, in Kenya people receiving remittances on their mobile money account can buy government bonds through M-Akiba, enabling the investment of remittances in the local economy (GSMA, 2018). The financial sector in Kenya has experienced significant strides in terms of growth. Compared to the other African countries, the Kenyan financial sector is performing far much better (Alter and Yontcheva, 2015). The financial sector assets to GDP stood at 85.52 percent in 2017, up from 77.81 percent in 2016 (CBK/Central Bank of Kenya, 2017). The banking industry has greatly contributed to this growth. Its contribution to GDP has grown and stood at 56.9 percent and 56.1 percent in the years 2013 and 2015, respectively (CBK/ Central Bank of Kenya, 2015). This growth in the banking sector has been boosted by the financial innovations in Kenya in which adoption of MM is the primary goal.

The use of ATM has a positive and significant relationship with banking which may in turn affect financial inclusion positively. However, the use of ATM has a significant, but a negative relationship with the use of MM. This implies the more people adopt the use of MM, the less they use ATM. This also implies that not all financial innovation adoptions are mutually inclusive (EFInA, 2018). This is also a pointer to the fact that the banks can divert more of their resources intended to be used for the construction of more ATMs to MM technology.

Table 16 (see below) paints the vivid picture of the growth of financial innovation adoption in Nigeria and Kenya, especially in the area of MM. The number of MM agent outlets in Kenya grew from 7 per 100,000 adults in 2012 to 307 per 100,000 adults in 2017, as demonstrated in table 16. However, in Nigeria the number of MM agent outlets has declined from 30 per 100,000 adults in 2012 to 11 per 100,000 adults in 2017. The table also indicates that the number of MM transactions grew from 0.255 in 2012 to 22.981 in 2017 in Kenya. The number of MM transactions grew only from 0.025 in 2012 to 0.447 in 2017 in Nigeria. The importance of MM to the economy of Kenya is evident in the fact that, while the MM contribution to GDP in Kenya stood at 36%, the MM contribution to GDP in Nigeria is less than 1% in 2017.

MM can facilitate many transactions in Nigeria's agriculture sector, and in developing agricultural value chains. It is a device to support the links and transactions within agricultural value chains, with the local, regional and global economy, and throughout the rural community. All markets can benefit from this instrument of financial inclusion.

between household members, relatives and friends are expected to significantly increase the probability of mobile money technology adoption.

Table 16: Comparison of the Growth of MM in Nigeria with Kenya

Year	Kenya			Nigeria		
	Agent Outlets/100,000 Adults	Number of Transactions	Value of Transactions (% of GDP)	Agent Outlets/100,000 Adults	Number of Transactions	Value of Transactions (% of GDP)
2012	7	0.255	1	30	0.025	0.04
2013	28	2.839	7	35	0.166	0.18
2014	101	8.502	17	20	0.282	0.38
2015	168	13.253	23	21	0.434	0.46
2016	208	17.878	31	13	0.452	0.74
2017	307	22.981	36	11	0.447	0.96

Source: Computed from WDI (2019), **Note:** Number of Transactions in millions

5 Sustainable Development Goal 9, Financial Innovation and Financial Inclusion – Relevance for Nigeria’s Agricultural Development Strategy

The SDG 9 does not only target financial inclusion and services but also to upgrade infrastructure and to retrofit industries to make them sustainable, with increased resource-use efficiency. The SDG 9 intends also to facilitate sustainable and resilient infrastructure development through enhanced financial, technological, and technical support to African countries and other developing areas. The SDG 9 aims to achieve all these targets by supporting domestic technology development, research, and innovation in developing countries, and by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities. Moreover, SDG 9 aims to increase access to information and communication technology (ICT) and to provide universal and affordable access to the internet in least developed countries, which will enhance financial inclusion in the developing and least developed countries of the world. The targets in SDG 9 are laudable because increases in investment in infrastructure and innovation are crucial drivers of financial inclusion and consequently for economic growth and development (UNDP, 2019). Investing in scientific research and innovation are important ways to facilitate financial inclusion and sustainable development. Accessibility to the internet, to computers, and access to information and knowledge will foster innovation and entrepreneurship, which can increase income generation opportunities as being positively related to financial inclusion. Some of these innovation factors account for high financial innovation and financial inclusion in Kenya. The high level of adoption of MM and financial innovation in Kenya

prompt us to examine some of the innovation factors that might have been of help in financial innovation and financial inclusion in Kenya vis-a-vis Nigeria (see in table 17 below).

Table 17: Comparison of Innovation Indicators between Nigeria and Kenya

Indicators	Nigeria		Kenya	
	Score	Rank	Score	Rank
Global Innovation Index 2017		119		80
Global Innovation Index 2018		118		78
Ease of Starting Business	80.8	98	83.2	90
Domestic Credit to Private Sector (% of GDP)	15.7	115	32.9	95
Microfinance Gross Loans (% of GDP)	0.1	57	4.7	9
Research and Development	13	103	6	72
University/Industry Research Collaboration	25.3	118	54.9	31
Firms Offering Formal Training (% of firms)	30.7	49	40.6	33
ICT Access (in % of the people)	31.6	109	36.2	103
ICT Use (in % of the people)	15.8	111	17.6	107
Computer Software Spending (% of GDP)	0.1	82	0.2	78
Electricity Output (KWh/capita)	172.5	114	209.6	112

Source: Computed from the Global Innovation Index/GII (2018); see: <https://www.wipo.int/publications/en/details.jsp?id=4330>

Table 17 shows that Kenya as a country is more innovative than Nigeria. Kenya was ranked at position 78 in 2018, based on the Global Innovation Index (GII, 2018²⁰), while Nigeria was ranked at distant position 118. The Global Innovation Index (GII) improved by 2 points in Kenya between 2017 and 2018, but the improvement in Nigeria is by 1 point only. This suggests that the innovation level in Kenya is not only higher than that of Nigeria; it is also improving faster than that of Nigeria. The ease of doing business indicator, which is relevant for the starting of mobile money outlets and agencies, is much better in Kenya than in Nigeria (score of around 81 in Nigeria compared with Kenya's score of around 83). This may explain the reason for an increase in the establishment of mobile money agent outlets in Kenya from 7 per 100,000 people in 2012 to 307 per 100,000 people in 2017. Difficulty in establishing a business in Nigeria may also account for the decline in the number of mobile money agent outlets in Nigeria from 30 per 100,000 people in 2012 to only 11 per 100,000 people in 2017.

²⁰ See on the Global Innovation Index (GII) 2018: <https://www.wipo.int/publications/en/details.jsp?id=4330>

Another set of important innovation and industry factors that may affect financial innovation adoption and financial inclusion are the accessibility to commercial and microfinance bank credit to expand and to start business. Table 17 indicates that credit to private sectors as a percentage of GDP in Kenya (33%) is more than twice that of Nigeria (16%). Microfinance bank loans as a proportion of GDP in Kenya stood at 5% in 2018 compared with 0.1% in Nigeria. Lack of credit facilities will limit the creation of business opportunities and may reduce employment opportunities which are important determinants of financial inclusion.

The disparity in human capital development indicators may also explain the reason for the low financial innovation adoption in Nigeria compared with Kenya. In terms of research and development, while Nigeria was ranked at position 103, Kenya was ranked at position 72. This implies that Kenya spent more on research and development than Nigeria. This can be implicated for the higher innovation index of Kenya compared with the one of Nigeria. In terms of university & industry research collaboration and of formal training of industry staff Nigeria is again ranked lower than Kenya as reported on Table 17.

According to UNDP (2019), bridging the digital divide is crucial to ensure equal access to information and knowledge, as well as to foster innovation and entrepreneurship. Therefore, access to the internet and to a computer are very crucial to financial innovation adoption in the developing world. Table 17 reveals the digital divide between Kenya and Nigeria in terms of access and use, but also in terms of spending on software development. The table shows that Kenya spent twice the proportion of the GDP (0.2%) than Nigeria did (0.1%) on computer software development in 2018. On the same note, internet access and use in Kenya are higher than internet access and use in Nigeria. The internet access and use in Kenya are 36% and 18% respectively, compared with the internet access and use in Nigeria that are 32% and 16% respectively.

We have established in table 15 that accessibility to rural electricity has a positive and significant relationship with the use of banking institutions which indirectly impacts on financial inclusion. However, the electricity output also can be an important determinant of financial innovation adoption and inclusion. The electricity generation output in Nigeria is only 82% of the electricity generation output in Kenya²¹.

²¹ Owing to various national electrification projects that have been undertaken by Kenya Power, such as the Last Mile Connectivity Project (LMCP) and the Global Partnership on Output-Based Aid (GPOBA) that targets informal settlements in urban areas and low-income households in the rural areas. The report comes at a time when Kenya Power is working towards achieving universal access to electricity by 2020. To achieve this target,

According to the Energy Progress Report (World Bank et al., 2019)²², the national accessibility to electricity has increased from 16% in 2003 to 64% in 2017; the access to electricity among the rural population in Kenya has increased from 7% in 2003 to 58% in 2017, while the access of the urban population grew from 58% to 81% in the same period²³. Kenya has been listed among the countries where large gains were made in ensuring that more citizens access electricity for lighting, cooking, and for driving businesses²⁴. However, the Energy Progress Report (2019) shows for Nigeria that the national accessibility to electricity has increased only marginally from 52% in 2003 to 54% in 2017; the access to electricity among the rural population in Nigeria has even decreased from 33% in 2003 to 23% in 2017, while that of the urban population grew from 85% in 2003 to 87% in 2017. It is evident that rural electrification is the priority of the government of Kenya, and that policy priority has increased the rural electrification from an access rate of 7% in 2003 to an access rate of 58% in 2017. This may be the reason while mobile money (MM) is also used widely in the rural and urban areas of Kenya. The information above also points to the fact that rural electrification in Nigeria is being neglected and that this can affect quite negatively the adoption of financial innovations in the country. According to Mukong and Lwanga (2019), in Uganda, on the average, 82% of those who are aware of MM service providers have learned about them through social media (radio, television (TV), newspapers, and billboards). The radio, the television (TV), and the mobile phone are to be powered by electricity. Therefore, the lack of electricity may limit the awareness about MM and its adoption in Nigeria.

6 Agricultural Value Chains, Financial Innovation, and Inclusion

For Nigeria, to move closer to unlocking its full agricultural potential, the value chains need to be identified, mapped, prioritized, and digitalized (Ekanikpong, 2019). For Nigeria, to feed her teeming population, farmers must increase yield, decrease the threat of crop failure, decrease operational costs, and sell the crops for the maximum volume and value possible. This necessitates, among other

the Company intends to ride on the on-going electrification projects as well as to increase investment in the distribution network by building additional substations and associated lines to accommodate new customers and to enhance the quality of power supply.

²² Tracking SDG 7: The Energy Progress Report (2019), by International Bank for Reconstruction and Development/The World Bank and other institutions.

²³ See from ESMAP, Kenya, Tracking SDG 7: <https://trackingsdg7.esmap.org/country/kenya>.

²⁴ See from Kenya Power: <https://www.kplc.co.ke/content/item/2485/kenya-leads-east-africa-peers-in-access-to-electricity>. See on the Kenya Power and Lighting Company: <https://www.kplc.co.ke/>

things, digitally managing the input resources, like fertilizer, water, and seed of high quality, and reducing the impact of environmental variables (such as the climate and the pests). The full economic impact of the application of technology and innovation across the whole agriculture and food supply chains could add major value to Nigerian agriculture. The entire agriculture and food supply chain, from agriculture to final retailing and catering, is estimated to contribute to the GDP growth, and to be a major source of employment for the country (NBS, 2018). By creating comprehensive insights into agriculture operations and the agricultural situation, digital platforms, such as FarmX mobile applications, could support farmers in making data-based operational decisions to optimize yield and to boost revenue, while minimizing the expenses, the chances of crop failure, and the environmental impact.

Some smallholder farmers are now using mobile and web applications to connect with value chain players, to access industry information, to purchase livestock feeds and fertilizer from online stores, to hire farm equipment, to diagnose crops, and to gain access to markets through e-commerce platforms (Ekanikpong, 2019). FarmX Mobile Solutions should be mentioned, which comprises FarmX Mobile Application (farmX) and farmTRUST²⁵. The local dialect Interactive Voice Response (IVR) switchboard provides innovative matching opportunities for agricultural supply chain players to connect for an increase of productivity, for market access, and for efficiency which will help farmers to retain a bigger share of their crop value. Agricultural technology mobile solutions, such as the farmX mobile app, offer services such as profiling of farmers, logistics services, and agro-allied services, which enable a digital identity of farmers. This aids in improving access to inputs and extension services from government to farmers. Data from such a platform also enable development agencies to access the farmers for plant fertilizer distribution and for inputs based on gender, location, and size of farms. These mobile platforms also provide required information and data to banks and insurance companies who provide credit and insurance services to women farmers to access agriculture insurance, loans, legal services, and equipment hire at subsidized and reduced rates, whereby addressing gender inclusivity.

Exploring the opportunities with digital platforms could help farmers to make better operational and market-based decisions which are centred on modern economic measures versus instead of continuing with traditional farming practices. Also, such services allow farmers to review data from historical information on similar issues that may have been encountered so that they could learn from the actions taken at that time and to make better operational decisions today. An ex-

²⁵ See: <http://www.farm-trust.com/>

ample of farmTRUST, using an agricultural sensor drone service, is helping farmers to decide when to harvest. For instance, the service could alert a farmer that a specific plot might be ready for harvest earlier than expected. It could also be instrumental at the start of the crop cycle as it produces precise 3-D maps for early soil analysis, being useful in planning seed planting patterns. Farmers could assess crop health and could spot bacterial, fungal or any other infections on crops. By scanning a crop using both visible and near-infrared (NIR) light, drone-carried devices identify which plants reflect different amounts of green light and Near-Infrared (NIR) light. This information produces multispectral images that track changes in plants and indicate their health status.

Although innovators in Nigeria continue to face serious challenges in terms of scaling, reducing cheap imports, and growing exports, the agriculture sector continues to show a high potential for future digital and ICT expansion. A large and growing domestic population, an ample supply of arable but unfarmed land, high ICT penetration and adoption, and a diverse food production base can help the country to make strong progress towards its mid-term growth targets, leveraging digital technologies for agricultural productivity. The future of agriculture will also require new and pioneering partnerships between different stakeholders in the food system and the ability to meet this challenge (Kamande and Nafula, 2016). The good working example of these partnerships is what Farmcrowdy is doing in Nigeria. Farmcrowdy has introduced a new category of funding small scale farming in Nigeria by allowing Nigerians to venture and to sponsor agriculture (Onwuaso, 2017). Farmcrowdy is reshaping the way in which people participate in farming and food production, through using their online connectivity to source funds from sponsors, whose money is used to procure land, to plant crops, and to meet the funding needs of boosting agricultural production with small scale farmers. Farm sponsors can expect to see returns after harvest of 6-25% for a period of 3-9 months, depending on what farm type they choose. Since the launch of its website in 2016, Farmcrowdy has impacted 25,837 small scale farmers on 16,000 acres of land where the farmers raised 5.7 million of chicken (Farmcrowdy, 2019). The vast majority of 178,215 Farmcrowdy sponsors are based in Nigeria, whilst 10% are placed in the US and in UK. Farmcrowdy has 50,311 followers on its website every week (these are the people that want to know about small scale farming in Nigeria).

The launch of the Farmcrowdy mobile app provides a more accessible platform for agriculture enthusiasts to experience, to learn, and to appreciate agriculture practice first-hand. Farmcrowdy currently provides regular updates, images and videos from the farmers as they work on the sponsored farms, providing an opportunity for their sponsors and farm followers to digitally track the journey of their sponsored farm through regular updates. In the past years, Farmcrowdy has witnessed many farm units of poultry which are sold out to engage farmers who

would have found it difficult accessing loans from the banks; so it promotes financial inclusion. People are equally excited about creating impact in the lives of Nigerian farmers while earning a decent return. This is a way of creating impact; it is a model to generate a return for everyone who is sponsoring small scale farmers with Farmcrowdy. Currently Farmcrowdy is operating in more than eight states across Nigeria, while farm sponsors can choose to sponsor a variety of farm types, including cassava, maize, rice, soya beans and poultry (broiler chickens for meat), with cycles lasting between 3 to 9 months depending on the farm. Farm sponsorships start from N96,000 [\$270], and Farmcrowdy coordinates with pre-arranged buyers to sell the farm harvest when the cycle is complete. The farm profit from the harvest is then split between the sponsors who receive 40% of the harvest profits plus their original sponsorship, while the farmers receive returns of 40%, and Farmcrowdy gains the rest of 20% of the profits. More than 80% of the farmers in Nigeria operate on a small-scale level, and it is currently estimated that 38 million of them are with an unbankable status. Farmcrowdy, through pairing farmers with sponsors to effectively manage the farming cycle with training in smart farming techniques, with supply of equipment and technical support, has ushered 25,837 small scale farmers into the financial ecosystem, making them financially inclusive. The Farmcrowdy app., which is now available for download in the Google Playstore, will through an accessible information feed and a push of notifications, allow users to view available farms, to follow existing farms, to provide ease of communication with farm account officers, and will allow the facilitation of easy feedback and comments. The case of the ADVANCE II Project (Agricultural Development and Value Chain Enhancement) in Ghana also illustrated how the use of ICT will not only improve agricultural production and its value chain, but that it also illustrates how it can encourage financial inclusion technology. This is presented in box 6 below.

Box 6: Mobile Money and Agricultural Investment in Ghana

The USAID's ADVANCE II Project (Agricultural Development and Value Chain Enhancement) supports the scaling up of agricultural activities and investments to improve the competitiveness of important value chains in Ghana, while it is supported by Feed the Future. In Ghana, buyers drive from the south to buy food from the rural, agricultural north. But due to a lack of bank affiliates in the north, buyers must carry huge sums of money as they travel across the country. Dealing with this amount of cash is risky, dangerous, and cumbersome for buyers and farmers alike. Mobile money eliminated the risk and provided a perfect solution: it diminishes the threat of theft and ensures that buyers are paying farmers efficiently and smoothly. In addition, mobile money is simple

to use and offers the ability to access additional financial services, such as savings, insurance, and credit. To implement the mobile money solution, ADVANCE II partnered with MTN, one of the largest mobile network providers in Ghana. MTN piloted the mobile banking service with a farm in northern Ghana. They first trained a group of nucleus farmers, farmers who contracted and provided support to smallholder farmers, in the mobile money service. After being trained by ADVANCE II, the nucleus farmers subsequently trained 1,072 smallholder farmers. The success of the project made ADVANCE II to train input dealers and out-grower businesses. After success with the farmers, the out-growers, and the input dealers, ADVANCE II saw more benefits which mobile money could offer. The farming communities have savings and loan associations, where each farmer contributes weekly towards production for the next season. The ADVANCE II team also went ahead to partner with MTN and Fidelity, a banking firm, to digitize the savings and loan associations. ADVANCE II and the farmers they work with are excited about the results of mobile money, and they plan to scale up the program to 10,000 smallholder farmers. It is stated: "I would recommend it to any project that would want to implement mobile money or digital finance as part of their project approach,". This says Francis Ussuman, Regional Coordinator on the ADVANCE II team.

Source: USAID (2017)

7 Conclusions and Policy Recommendations

The study demonstrates that the financial inclusion rate which stood at 47% in 2008 had increased to 63% in 2018 in Nigeria. The estimated 63% financial inclusion rate is an improvement on financial inclusion activities in Nigeria compared with what was obtained in 2008. However, the 63% financial inclusion rate estimated for Nigeria is among the least financial inclusion rates in Africa. It is far lower than the 93% financial inclusion rate in South Africa. It is also lower than the financial inclusion rates which were estimated for Eastern African countries of Rwanda, Kenya, Uganda, and Tanzania, with financial inclusion rates of 89%, 83%, 78% and 72% respectively. This implies there is much room for Nigeria to improve its financial inclusion rate despite the progress that has been made in the past one decade. The analysis state-by-state reveals that Gombe state has the lowest financial inclusion rate of only 24%. Lagos state has the highest financial inclusion rate of 85%. Gombe state is placed in the North-Eastern part of Nigeria, while Lagos is placed in the South-Western part of Nigeria. On a regional basis, financial exclusion rates are higher than the national average of 37% in the North-West and the North-East regions in Nigeria. The financial exclusion rates in North-West and the North-East regions are 62% and 55% respectively. The people living in the North-East and North-West regions in Nigeria are predominantly farmers.

These higher financial exclusion rates in the regions may have a negative effect on their agricultural activities.

The financial exclusion analysis based on location indicates that financial exclusion in Nigeria is a major problem in the rural areas, as it shows that the financial exclusion in rural areas (46%) is more than twice that of the urban areas (22%) in 2018. The financial exclusion is also decreasing faster in the urban areas than in the rural areas. While the financial exclusion rate declined by 13% in urban areas, it declined by only 5% in rural areas between 2014 and 2018. The financial exclusion may be a major issue in the rural areas in Nigeria because of the limited economic opportunities in the rural areas compared with urban areas in Nigeria. The financial exclusion analysis based on gender shows that financial exclusion is higher among the females than among the males in Nigeria. It stood at 33% and 41% for males and females respectively in 2018. The other concern is that the rate of decrease of financial exclusion is lower among the females (6%) than among the males (10%). This suggests that the gender financial gap in Nigeria may continue to widen over time. For example, the financial exclusion gap between males and females in Nigeria was 7.8% in 2012 but has increased to 8.4% in 2018. Therefore, deliberate attention should be taken to bridge the gender financial exclusion gap in Nigeria.

The study shows further that the proportion of people using formal bank contacts has increased from 21% in 2008 to about 40% in 2018. This translates to about a 88% growth rate among the people conducting their financial transactions by using formal banking facilities. The elasticity estimation indicates that an increase in the proportion of the people using formal banking institutions will significantly more reduce the rate of financial exclusion in Nigeria than other financial inclusion strategies. For example, the estimation reveals that if the number of people conducting their business transactions via formal banking institutions can be increased by 100%, the financial exclusion rate will decrease by 106% in Nigeria. The three most important factors that limit the use of formal banking operations in Nigeria are irregular income, unemployment, and the distance to the bank. While irregular income and unemployment as constraints to the use of formal banking institutions are declining in Nigeria, distance as a barrier to banking activities is increasing. For instance, while irregular income as a constraint declined from 45% in 2014 to 41% in 2016, distance as a barrier increased from 7% in 2014 to 33% in 2016. This suggests that while efforts are being made to increase regular income generation activities, via the creation of more and better jobs, great stride will be made in reducing financial exclusion in Nigeria if the formal banking facilities are located closer to the people. This is an important area where financial innovations and new technologies can be deployed to ease accessibility to the formal banking institutions.

When the financial exclusion was analysed as based on occupation, the findings show that the financial exclusion rate in Nigeria is higher among the farmers than the average for Nigerians. The financial exclusion rate among farmers is 52%, which is higher than the 37% average financial exclusion rate which was estimated for Nigeria. The major channel for financial inclusion among the farmers is informal financial institutions. While 23% of the farmers that were financially included used informal financial institutions, only 15% used formal banking facilities for their operations. The informal financial institutions which are patronised by farmers have limited financial capacities. The high financial exclusion rate among farmers may be caused by the fact that farming is done in rural areas where distance to formal financial institutions is a barrier. The seasonality of farming activities may also be implicated for higher financial exclusion among the farmers. Since income from the farming activities is seasonal, if the farming activities are not diversified, farmers will only expend what they have earned during the harvesting season when starting in the planting season. This also implies that farmers need special financial facilities that may be tailored to their specific needs because of the nature of farming activities. Although some programmes exist, they are often temporary and conditioned.

The examination of the relationship between financial inclusion and maize yield shows that financial inclusion is positively correlated with maize productivity in Nigeria. This means that if financial inclusion in Nigeria increases, it will increase the agricultural productivity in Nigeria. The relationship is however not significant because so many farmers (a majority) are financially excluded in Nigeria as we have indicated previously. Financial inclusion has a negative but significant correlation with illiteracy in Nigeria. This means that if financial inclusion increases it will significantly reduce the level of illiteracy in Nigeria. The reduction in the level of illiteracy will have indirect effects on the activities of the farmers, as education is positively associated with the level of innovation adoption among the farmers.

Comparing the financial inclusion in rural Kenya with that of rural Nigeria shows that financial inclusion in rural Kenya is twice that of rural Nigeria. While 32% of the people in rural Nigeria are financially included, 64% of the people in rural Kenya are financially included. The high level of financial inclusion in Kenya has been attributed to the adoption of financial innovation, especially Mobile Money (MM). Since the introduction of MM, 79% of the adult Kenyans have subscribed to MM, while only 3.3% of the adult Nigerians are using MM platforms. The socioeconomic factors responsible for this weak performance regarding financial innovations in Nigeria need further investigation.

Based on the investigation of the role of the infrastructure on financial innovation adoption we find that rural electricity has a positive and significant correlation with (formal) banking. It means that if the proportion of the people that have

access to electricity in rural Nigeria increases, the percentage of people using formal banking institutions will increase significantly. Since the use of formal banking institutions has a positive and significant relationship with financial inclusion, the increase in accessibility to rural electricity in Nigeria will indirectly increase financial inclusion in Nigeria. Accessibility to rural electricity has a positive relationship with the use of mobile money, mobile phones, and ATM. Mobile phone usage has a positive and significant correlation with the use of formal banking institutions and financial inclusion in Nigeria. The use of ATM has a positive and significant relationship with banking which may in turn affect financial inclusion positively. However, the use of ATMs has a significant but negative relationship with the use of MM. This implies that the more people adopt the use of MM, the less they use ATM. This is a pointer to the fact that the banks can divert more of the resources intended to be used for the construction of ATMs to MM technology.

From the study we know that the major reason for the underdevelopment of MM in Nigeria is the lack of awareness. As in 2018, more than 83% of the adult Nigerians are not aware of MM. There is no doubt that there is a need for increasing the awareness of financial innovations in Nigeria, especially of MM. Nigerians can adopt the mode of advertisement used for M-Pesa in Kenya. Using existing retail stores as cash in/out outlets reduces deployment costs and provides greater convenience and lower cost of access to users²⁶. We know that M-Pesa has been very instrumental in Kenya; it can also be useful in Nigeria. This MM instrument used in Kenya shows that the country fully embraced the use of mobile money. In Nigeria, the awareness of MM services can be provided by using social media (radio, television, newspapers, Facebook, YouTube, billboards, etc.). Relatives, friends and neighbours, field agents of finance institutions, and other banking institutions can also be used to create awareness about MM in Nigeria.

The high level of adoption of MM and of other financial innovations in Kenya has been implicated for high financial innovation and financial inclusion in Kenya vis-a-vis Nigeria. Kenya was ranked at the position 78 in 2018 based on the Global Innovation Index (GII), while Nigeria was ranked at the distant position 118. The important innovation and industry factors that may affect financial innovation adoption and financial inclusion are the accessibility to commercial and micro-finance bank credit to expand and to start business. This study indicates that credit to private sectors - as a percentage of GDP - in Kenya (33%) is more than twice that of Nigeria (16%). Microfinance bank loans - as proportion of GDP - in Kenya stood at 5% in 2018 compared to 0.1% in Nigeria in 2018. Lack of credit facilities

²⁶ Available record highlights the success of M-PESA as it shows that the number of M-PESA stores is higher than the total number of bank branches, automated teller machines (ATMs) and post offices combined in Kenya.

will limit the creation of retail stores that can be used by MM service providers as cash in/out outlets, which can increase the proximity of MM customers to the services of MM infrastructure.

We found out in this study that Kenya spent twice the proportion of the GDP (0.2%) of Nigeria (0.1%) on computer software development in 2018. On the same note, internet access and use in Kenya are higher than internet access and use in Nigeria. The internet access and use in Kenya are 36% and 18% of the people respectively, compared with the internet access and use figures in Nigeria that are 32% and 16% respectively. Access to the internet and to the computer are very crucial to financial innovation adoption in the developing world. The electricity generation per capita in Nigeria is only 82% of electricity generation per capita in Kenya. While the accessibility to electricity among the rural population in Kenya has increased from 7% in 2003 to 58% in 2017; the accessibility to electricity among the rural population in Nigeria has decreased from 33% in 2003 to 23% in the same period. The much lower accessibility to electricity in Nigeria may explain the lower financial innovation adoption rate in Nigeria when compared to Kenya. Nigeria's access to electricity can be improved through solar home systems or mini grids as it is done successfully in Kenya. Nigeria can increase investment in the distribution network by building additional sub-stations and associated lines to accommodate new customers and to enhance the quality of power supply. The Nigeria Power Authority should ride on technological advancements to upgrade its systems to enhance service delivery to its customers, with special emphasis to be given on rural electrification.

The financial institutions can learn from the factors that have been attributed to the success of MM in Kenya, especially the M-Pesa. In Kenya, Safaricom built a strong service brand for M-PESA, which rode on a strong customer sense of affinity with and trust in the operator. The management recognized the potential impact of M-PESA and committed the company to heavy investments in marketing before the proposition could be proven. Safaricom managed to develop a strong service brand, which is even stronger than Safaricom's corporate brand — itself already a powerful brand in Kenya with a dominant share of the mobile phone market. M-PESA amply surpassed first-year forecasts, quickly turning the network effects in their favour as new customers informed more customers and turned M-PESA into a lucrative business for more stores. Safaricom was able to leverage public goodwill that existed with the corporate brand and treated M-PESA stores as valuable brand outposts. All this was supported by a service that was designed to be simple and easy-to-use. While M-PESA's launch was associated with a significant advertising campaign in traditional media such as TV and radio, there was also massive outreach through road shows and tents that travelled around the country signing people up, explaining the product and demonstrating how to use it. This is a common marketing approach in Kenya for products that

reach lower-end markets because the traditional media are not viewed by the poor as relevant or trustworthy, and Safaricom made best use of this channel.

Safaricom effectively leveraged its extensive network of airtime resellers to build a reliable, consistent store network that served customers' needs. For M-PESA to be broadly available to the bulk of the population, Safaricom had to design a channel structure that could support thousands of M-PESA stores spread across a broad geography to offer cash in/cash out services. Safaricom built a channel that was based on the key requirements of profitability (providing incentives for third-party retail players to get involved), scalability (achieving rapid growth), and control (over the brand, customer experience, and geographic distribution of stores). Safaricom did not wish to directly manage thousands of retail stores. Hence, it sought to engage partners to help manage the individual stores, thereby reducing the number of direct contacts which Safaricom had to deal with. While Safaricom wanted a scalable structure, it also wanted to maintain control over the customer experience.

Safaricom designed a pricing scheme for both customers and stores that provided incentives for both to join M-PESA early on. Customer pricing was designed to encourage customers to experiment with the service: free and quick registration to the service, free deposits, and ability to send money to any mobile phone subscriber whether they were subscribed to the service or not. For remote payments, M-PESA is cheaper than other available mechanisms, such as money transfers by the bus companies, the Kenya Post's PostaPay, or Western Union. For example, sending KSh 1,000 through M-PESA was 27% cheaper than the Kenya Post's PostaPay, and 68% cheaper than sending it via a bus company.

Nigeria should make efforts to link the mobile phone users to MM by sending SMS messages to the mobile phone users, emphasising the advantages of mobile money and of other financial innovations in messages directly to their phones. Most of the un(der)banked population are hostile to the wave of electronic financial transaction platforms and still believe in the "do-it-for-me" service. That is why the informal financial providers are strongly trusted and established. Based on the ideology of "do-it-for-me" service, the most appropriate channel for the un(der)banked in Nigeria maybe the combination of their trusted traditional method with the new MM technology. Many of the financial institutions must develop a market intelligence that can create access to the un(der)banked population. For instance, in Lagos many of them do not know that they can mobilize a lot of money from 442 registered retail markets in Lagos alone. Finally, to translate opportunities that are available for financial innovation in Nigeria to become an economic reality, there is need to create a realistic framework through regulations;

there is need for an innovative approach that meets and surpasses market's expectation; and there is need for a remuneration that encourages all stakeholders to become and remain partners.

Although financial innovators in Nigeria continue to face serious challenges in terms of scaling, in reducing cheap imports, and in growing exports, the agriculture sector continues to show high potential for future digital-supported expansion. A large and growing domestic population, an ample supply of arable but unfarmed land, a high ICT penetration and adoption, and a diverse food production base should encourage the country to make strong progress towards its mid-term growth targets by leveraging digital technologies for agricultural productivity. The future of agriculture will also require new and pioneering partnerships between different stakeholders in the food and agricultural system, and the ability to meet this challenge; many organizations/institutions are involved, such as Federal and Sub-National Governments, USAID, FAO, CTA, GSMA, GAFSP, CGIAR, DFID, Farmcrowdy, El-kanis & Partners, HarvestPlus, Bill and Melinda Gates Foundation, and International Finance Corporation (IFC). These organizations/institutions are actively participating in designing and developing advisory programmes and digital platforms that improve the livelihoods of smallholder farmers by linking them to modern supply chains; they are also creating opportunities to increase agriculture productivity through improved farming practices, access to financing, technology, and high-quality inputs.

References

- Adeola O. and O, Evans (2017). The impact of microfinance on financial inclusion in Nigeria. *The Journal of Developing Areas*, 51(4): pages 193-206.
- Adesanya, O. O. (2017). Financial inclusion in Nigeria: The challenges of banks and mobile money operators. Available on the internet at: <https://www.bis.org/ifc/publ/ifcb47k.pdf>.
- AfDB/African Development Bank (2016). 2015-2019, Draft agriculture and agribusiness strategy. African Development Bank, Tunis, Tunisia.
- AfDB/African Development Bank (2013). Agricultural value chain financing and development for enhanced export competitiveness. African Development Bank, Tunis, Tunisia.
- Akande, S. O. (2006). Food policy in Nigeria: An analytical chronicle. Ibadan: Nigerian Institute for Social and Economic Research (NISER).
- Alabi, Reuben Adeolu (2014). Impact of agricultural foreign aid on agricultural growth in Sub Saharan Africa: A dynamic specification. AGRODEP (African Growth and Development Policy Modelling Consortium) Working Paper 0006. Washington, D.C., U.S.A. International Food Policy Research Institute/IFPRI. Access: <http://www.agrodep.org/sites/default/files/AGRODEPWP0006.pdf>

- Alabi, Reuben Adeolu and Adams, Oshobugie Ojor (2020). The impact of the e-wallet fertilizer subsidy scheme and its implication on food security in Nigeria, Research Paper 390. African Economic Research Consortium (AERC), Nairobi, Kenya. Access: <https://aercafrica.org/wp-content/uploads/2020/01/Research-Paper-390.pdf>
- Alabi Reuben Adeolu, Omojola Tolulope, and Olumide Oseni (2014). An analysis of the impact of Official Development Assistance in Nigeria, 132pp. Lambert Academic Publishing GmbH and Co. KG Heinrich-Bocking-str. 6-8, 66121. Saarbrucken, Germany.
- Alabi, R. A., Aigbokhan, B. and M. I. Ailemen (2004). Improving technical efficiency of Nigerian cocoa farmers through institutionalized farm credits. In: M. N. Omare, M. O. Makokha and W. Oluoch-Kosura (eds.). Shaping the future of African agriculture for development: The role of social scientists. Proceedings of the Inaugural Symposium of the Association of African Agricultural Economists/AAAE, Nairobi, Kenya.
- Alter, A. and B. Yontcheva (2015). Financial inclusion and development in the Central African Economic and Monetary Community (CEMAC). IMF Working Paper Number WP/15/235. IMF, Washington D.C.
- Asoegwu, S. N. and A. O. Asoegwu (2007). An overview of agricultural mechanization and its environmental management in Nigeria. *Agricultural Engineering International*, 9 (6): pages 1–22.
- Badiru I. O. (2013). Review of farmers' access to agricultural credit in Nigeria. Nigeria Strategy Support Program Policy Note 25. The International Food Policy Research Institute (IFPRI), Abuja, Nigeria.
- Buku, M. and M. Meredith (2013). Safaricom and M-Pesa in Kenya: Financial inclusion and financial integrity. *Washington Journal of Law, Technology & Arts*, 8(3): pages 376-400.
- CBK/ Central Bank of Kenya (2017). The Kenya financial sector stability report. Financial sector regulators forum. Central Bank of Kenya, Nairobi, Kenya.
- CBK/ Central Bank of Kenya (2015). The Kenya financial sector stability report. Capital markets authority, insurance regulatory authority, retirement benefits authority, and Sacco societies regulatory authority. Central Bank of Kenya, Nairobi, Kenya.
- CBN (2018). Central Bank of Nigeria Annual Report and Statement of Account, Abuja, Nigeria, CBN Publication.
- Chaddad, F. R., Cook, M. L., and T. Heckeleei (2005). Testing for the presence of financial constraints in US agricultural cooperatives: An investment behaviour approach. *Journal of Agricultural Economics*, 56(3), pages 385-397.
- CWI/Core Welfare Indicators (2010). Harmonised living standard survey. National Bureau of Statistics (NBS), Abuja, Nigeria.
- EFInA/Enhancing Financial Innovation and Access (2018). Access to financial services in Nigeria 2018 Survey. Enhancing Financial Innovation and Access, Lagos, Nigeria.
- EFInA/Enhancing Financial Innovation and Access (2016). Access to financial services in Nigeria 2016 Survey. Enhancing Financial Innovation and Access, Lagos, Nigeria.

- EFinA/Enhancing Financial Innovation and Access (2014). Access to financial services in Nigeria 2014 Survey. Enhancing Financial Innovation and Access, Lagos, Nigeria. Access: <http://www.efina.org.ng/assets/ResearchDocuments/A2F-2014-Docs/Updated/EFinA-Access-to-Financial-Services-in-Nigeria-2014-Survey-Key-FindingswebsiteFINAL.pdf>
- EFinA/Enhancing Financial Innovation and Access (2012). Access to financial services in Nigeria 2012 Survey. Enhancing Financial Innovation and Access, Lagos, Nigeria.
- EFinA/Enhancing Financial Innovation and Access (2010). Access to financial services in Nigeria 2010 Survey. Enhancing Financial Innovation and Access, Lagos, Nigeria.
- EFinA/ Enhancing Financial Innovations and Access (2008). Access to financial services in Nigeria: Key findings. Available at: http://www.efina.org.ng/Key_Findings.pdf
- Ekanikpong, B., (2019). Prioritizing Nigeria agriculture value chain digital intervention. Available at: <https://www.agrilinks.org/post/prioritizing-nigerias-agriculture-value-chain-digital-intervention>
- Evans, O. (2017). Back to land: The Impact of financial inclusion on agriculture in Nigeria, Iran Economic Review, Volume 21(4): pages 885-903.
- Evans, O. and O. Lawanson, (2017). A Multi-sectoral study of financial inclusion and economic output in Nigeria. Ovidius, University Annals, Economic Sciences Series, XVII (1/2017), pages 195-204.
- FAOSTAT (2019). Food and Agriculture Organization (FAO) of the United Nations, Rome, Italy; access: <http://faostat.fao.org/default.aspx>.
- Farmcrowdy, (2019). Earn profit and empower farmers. Available at: <https://www.farmcrowdy.com/>
- FAO (2011). State of food and agriculture, 2011. Food and Agriculture Organisation, Rome, Italy.
- FSD/Financial Sector Deepening (2016). The 2016 FinAccess household survey infographics sheet. Nairobi, Kenya. Financial Sector Deepening (FSD), Kenya.
- FSD/Financial Sector Deepening (2019). The 2019 FinAccess Household Survey Nairobi, Kenya. Financial Sector Deepening (FSD), Kenya.
- FSDT/Financial Sector Deepening Trust (2009a). FinAccess National Survey 2009: The dynamics of Kenya's changing financial landscape. Available at: <https://fsdkenya.org/publication/finaccess-national-survey-2009-dynamics-of-kenyas-changing-financial-landscape/>
- FSDT/Financial Sector Deepening Trust (2009b). Research on Mobile Payments Experience: M-PESA in Kenya. Available at: http://s3-eu-central-1.amazonaws.com/fsd-circle/wp-content/uploads/2015/08/30095839/11-02-14_Mobile_payments_in_Kenya.pdf
- GFD/Global Findex Database (2019). Global Findex Database. Available at: <https://globalfindex.worldbank.org/>
- GSMA/Global System for Mobile Communications Association (2019). The mobile economy. Available at: <https://www.gsma.com/t/mobileeconomy/>

- GSMA/Global System for Mobile Communications Association (2017). State of the industry: Mobile financial services for the unbanked. Access: https://www.gsma.com/mobilefordevelopment/wpcontent/uploads/2018/05/GSMA_2017_State_of_the_Industry_Report_on_Mobile_Money_Full_Report.pdf.
- Global System for Mobile Communications Association/GSMA (2018). State of the industry: Mobile financial services for the unbanked. Access: https://www.gsma.com/mobilefordevelopment/wpcontent/uploads/2018/05/GSMA_2017_State_of_the_Industry_Report_on_Mobile_Money_Full_Report.pdf.
- Kamande, M. and N. Nafula (2016). The welfare effect of ICTs in agricultural markets. AGRODEP Working Paper 035. African Growth and Development Policy Modeling Consortium (AGRODEP). Dakar, Senegal.
- Imahe, O. J. and R. A. Alabi (2005). "Determinants of agricultural productivity in Nigeria". *Journal of Food, Agriculture and Environment*, 3(2): pages 269-274.
- KNOMAD/ Global Knowledge Partnership on Migration and Development (2017). Migration and remittances: Recent developments and outlook. Available at: <http://documents.worldbank.org/curated/en/719531507124177735/Special-topic-return-migration>.
- Liverpool-Tasie, S., Babatunde Olaniyan, Sheu Salau, and James Sackey (2010). A review of fertilizer policy issues in Nigeria. Nigeria Strategy Support Program (NSSP) Working Paper No. 0019. IFPRI, Washington D.C. USA.
- Mas, Ignacio and Olga Morawczynski (2009). "Designing mobile money services: Lessons from M-PESA". *Innovations*, Vol. 4, Issue 2
- Mukong, A. K. and E. N. Lwanga (2019). Social Networks and technology adoption: Evidence from mobile money in Uganda. Final Research Report Submitted to African Economic Research Consortium (AERC), Nairobi, Kenya.
- Morawczynski, Olga and Mark Pickens (2009). Poor people using mobile financial services: Observations on customer usage and impact from M-PESA. Consultative Group to Assist the Poor (CGAP) Brief, August. Washington, D.C.
- Morawczynski, Olga and Gianluca Miscione (2008). "Examining trust in mobile banking transactions: The case of M-PESA in Kenya". In: "Social Dimensions of Information and Communication Technology Policy: Proceedings of the 8th International Conference on Human Choice and Computers/HCC8", edited by C. Avgerou, M. Smith and P. van den Besselaar, International Federation for Information Processing/IFIP, Technical Committee/TC 9, Pretoria. Access to IFIPTC9: <http://ifiptc9.org/>
- NBS/National Bureau of Statistics (2018). Review of the Nigerian Economy. National Bureau of Statistics, Abuja, Nigeria.
- Nyamongo, E. and L. Ndirangu (2013). Financial innovations and monetary policy in Kenya. Munich Personal RePEc Archive (MPRA), Paper No. 52387

- Olomola, A., Mogues, T., Olofinbiyi, T., Nwoko, C., Udoh, E., Alabi, R. and J. Onu (2014). Analysis of agricultural public expenditures in Nigeria. Examination at the Federal, State and Local Government levels. International Food Policy Research Institute (IFPRI) Discussion Paper 01395. Access: <http://www.ifpri.org/sites/default/files/publications/ifpridp01395.pdf>.
- Oguntade, E. A. (2014). Food losses in cassava and maize value chain in Nigeria. Analysis and recommendations for reduction strategies. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Bonn, Germany.
- Oke, J. T. U., R. Adeyemo, and M. U. Agbonlahor (2007). An empirical analysis of microcredit repayment in Southwestern Nigeria. *Humanity and Social Sciences Journal* 2 (1): pages 63–74.
- Onwuaso, U. (2017). Farmcrowdy launches mobile app agritech in Nigeria. Available at: <https://guardian.ng/technology/farmcrowdy-launches-mobile-app-for-agritech-in-nigeria/>
- Ozor, N. and K. Urama (2013). “The role of technology in ensuring adequate food security in Africa”. *Development*, 56(2): pages 266-273.
- Public Financing of Agriculture/PFA (2015). The need to cultivate our farmers futures. Action Aid, Abuja, Nigeria. Available at: <https://nigeria.actionaid.org/publications/2015/need-cultivate-our-farmers-futures>
- Rakesh, M. (2006). Economic growth, financial deepening, and financial inclusion. *Dynamics of Indian Banking* (pages 92-120). New Delhi.
- Scharwatt, C. (2017). Key takeaways from our Information Management Technology (IMT) workshop at Mobile 360 Africa. Available at: <https://www.gsma.com/mobilefordevelopment/blog/key-takeaways-imt-workshop-mobile-360-africa/>
- Singh, Anup (2012): Sources of Funding and Support System for Value Chain Finance: Lessons from Asia. Available at: http://www.ruralfinanceandinvestment.org/sites/default/files/Paper_6_Sources_of_funding_and_support_for_VCF_1.pdf
- Sustainable Development Goals/SDGs (2019). Sustainable Development Goal 9. Sustainable Development Goals Knowledge Platform. Available at: <https://sustainabledevelopment.un.org/sdg9>
- The EPR/Energy Progress Report by World Bank Group, ESMAP, IEA, UNSD, WHO, and IRENA (2019). Tracking SDG 7 – The Energy Progress Report (2019). International Bank for Reconstruction and Development. The World Bank, Washington, D.C., in association with ESMAP, IEA, UNSD, WHO and IRENA
- Sheahan, M. and C. B. Barrett (2014). Understanding the agricultural input landscape in Sub-Sahara Africa. Recent plot, household, and community level evidence. Policy Research Working Paper 7014. The World Bank, Africa Region.
- Uguru, M. I. (2012). Genetics for farming and food security in Africa: Lessons from Nigeria. Paper presented at the 2012 ATPS/African Technology Policy Studies Annual Conference and Workshops held from 19-22 November, Addis Ababa, Ethiopia.

- USAID (2017). Mobile Money Solves Risky Cash and Lack of Loans for Farmers in Ghana. Access: <https://www.agrilinks.org/blog/mobile-money-solves-risky-cash-and-lack-loans-farmers-ghana-new-video>
- USAID/United States Agency for International Development (2011). Rural and agricultural finance taking stock of five years of innovations. Available at: http://www.ruralfinanceandinvestment.org/sites/default/files/1USAID_Rural_Finance_Initiatives.pdf
- WDI/World Development Indicators (2019), World Bank World Development Indicators Database. Available at: <http://data.worldbank.org/data-catalog/world-development-indicators>.
- World Bank (2011). Growing Africa: Unlocking the potential of agribusiness. The World Bank, Washington, D.C., USA.
- World Bank (2014). Databank, agriculture and rural development. Available at: <http://data.worldbank.org/topic/agriculture-and-rural-development>. The World Bank, Washington, D.C., USA.
- World Bank (2019), Tracking SDG 7: The Energy Progress Report (2019), International Bank for Reconstruction and Development/The World Bank, Washington D.C. 2019; Access: <https://www.irena.org/publications/2019/May/Tracking-SDG7-The-Energy-Progress-Report-2019>
- UNDP/United Nations Development Programme (2019). Sustainable Development Goals. Available at: <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-9-industry-innovation-and-infrastructure.html>

Making Capital and Institutions work for Developing Agro-industries in Sudan

Yagoub Elryah¹ and Nadia Hassan^{2 3}

1 Introduction

The global sustainable development agenda aims to end poverty and to promote prosperity and people's well-being by 2030. Out of the 17 Sustainable Development Goals (SDGs), two are responsible to make the rest of the goals a reality; these are SDG 8 (on Growth and Decent Work) and SDG 9 (on Infrastructure, Innovation, and Industrialization). This study is discussing the alignment of SDG 9 in the national development agenda of Sub-Saharan countries with a special focus on Sudan. One of the major issues in African economies, including Sudan, is how to diversify and to develop its production base and exports, a task that is extremely difficult without transforming the production capacity from agriculture-based to manufacturing processes. The agro-industry is an integral segment of the transformation to an industrial status; this sector is sensitive to structural and technological changes. To remain competitive and sustainable, African countries should improve infrastructure and build good institutions, upgrade the existent technology, and promote industrialization (Lin, J. Y. & V. Treichel, 2014). However, manufacturing and industrialization remain the main engines of structural transformation and economic growth. Our approach for discussing the alignment of SDG 9 in the national development agenda is first, to review the goal from the perspective of economic growth theories, namely: the endogenous growth theory (EGT) and the new structural economics (NSE) approach, and to see whether its global targets and indicators can be internalized.

We find that the SDG 9 is pertaining to industry but is compartmented into three pillars (build resilient infrastructure, promote inclusive and sustainable in-

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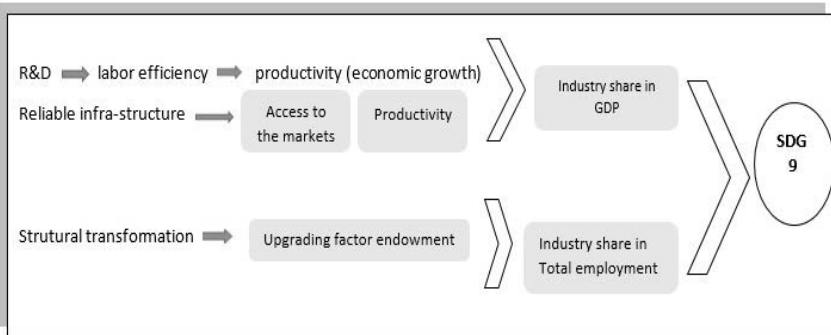
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dustrialization, and foster innovation). These three pillars are supposed to be attained via eight targets⁴. Four of these eight targets (SDG 9.1, 9.3, 9.4 & 9.A) are concerned with optimizing the building and the allocation of physical and financial capital, and three other targets (SDG 9.5, 9.B & 9.C) stress the upgrading of human capital. Those seven targets are the drivers and the means to realize the central target SDG 9.2 of inclusive and sustainable industrialization. Target SDG 9.2 is the direct articulation of the core pillar of SDG 9, read as: promoting inclusive and sustainable industrialization, so that by 2030 it is possible to significantly raise industry's share of employment and gross domestic product.

This description of the above seven plus one targets allows to group them in one theme, and that is capital; hence the title of our contribution defines capital in this sense. We also note that these targets are interconnected and complementing each other, i. e. solutions posed by one target remedy shortcomings evolved from another. On the other hand, SDG 9 indicators provide interpretations for the goal and the targets and how they are to be implemented. This gives the implementing country ample chances to redirect development plans, to apply conducive policies, and to improve conditions and environment for realizing an enhanced business and society partnership so that the sharing and responsibility of all will be applied effectively. These themes are depicted in figure 1 below.

Figure 1: Factors for realizing SDG 9



Source: A figure created by the authors

Included in the title of the chapter is the focus on institutions; these are those systems and frameworks which constitute the conducive environment for industry to uphold sustained growth. Why emphasis on agro-industry? It is the advice of the United Nations Development Programme (UNDP) - the guardian of the SDGs for

⁴ The eight targets of SDG 9 are of great importance for this study as specific policies are related in subsequent sections mainly to the first five of these targets (see the link: <https://sustainabledevelopment.un.org/sdg9>).

Least Developing Countries (LDCs) - to emphasize developing the agro-industrial sectors.⁵ This advice is based on the notion that the LDCs have their comparative advantages in their endowments for producing some major agricultural products. But also, the formerly oil-rich Sudan (up to the separation of South Sudan in 2011) has such endowments (land, agricultural skills, water, agricultural R&D, extension services, agriculture finance windows, etc.) and can diversify its production and exports towards agricultural products for export and for import substitution.⁶ Hence, UNDP is inviting for streamlining development upon the new structural economics (NSE) approach based on endowment concepts.⁷

Agro-industry refers broadly to the establishment of enterprises and supply chains for developing, transforming and distributing specific inputs and products in the agricultural sector. A narrower definition portrays agro-industry as “the sum of post-harvest activities involved in the transformation, preservation and preparation of agricultural products for intermediate or final consumption” (UNIDO, 2009, p. 58). Agro-industries enable the value chain to add more value and to be more productive, as it creates employment opportunities and improves households’ income in rural and urban areas (Kormawa, Wohlmuth and Devlin, Eds., 2012). Moreover, the agro-industry has several linkages with the SDGs, notably to SDG 1 (no poverty), SDG 2 (zero hunger), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation and infrastructure). and SDG 12 (responsible consumption and production).

As upon SDG 9.2, industrialization that underlies an increased share of industry in GDP and of industry in employment, entails two implications: the first one is the appropriate path of economic growth that provides further value adding and expands the base of industry products, and thus is raising the per-capita GDP. The second implication is the boosting of industrial investments to be capable of generating employment and fostering structural change. Employment by industry does not go for low ranks of labour that are described as disguised or redundant work force. On the contrary, a great responsibility is laid on the shoulders of industry as to lead to economic growth and development by delivering the requirements for structural transformation through both, highly skilled white-collar and blue-collar labour.⁸ Different economic growth theories meet in one notion that growth is only attained by raising labour efficiency. Sustainability of economic growth is attained

⁵ This is brought out as well in projects financed by the Sustainable Development Goals Fund: <https://www.undp.org/content/undp/en/home/blog/2018/Transforming-agriculture-in-Africa-is-key-to-a-more-peaceful-world.html>

⁶ As an example, UNDP is investing in solar-powered irrigation systems for sustainable agriculture in Sudan: <http://www.sd.undp.org/>

⁷ See on the application of the new structural economics (NSE) approach to African countries: <https://www.un.org/development/desa/dpad/tag/new-structural-economics/>

⁸ See on the history of these terms and on the relevance for developing countries: <https://smallbusiness.chron.com/bluecollar-worker-whitecollar-worker-11074.html>

when labour efficiency is targeted deliberately by conscious and versioned national efforts for upgrading national technical capacity and by conducive policies for enhancing national technological absorptive capacity. Development of human capital to raise labour efficiency is attained through learning by doing; priority is on policies to create an education system which leads to output which matches the vision of labour efficiency and the growing demand for technologists, scientists, and skilled workers in industry. Furthermore, industry is the ground for innovation on which economic growth boosts up.

This study sets out to increase our understanding of the role of human and physical capital and of institutions in sustaining the economic growth. The study is structured into six sections. The study aims to give a comprehensive and complete picture of the status of SDG 9 in Sudan as a country representing a LDC in Sub-Saharan Africa.⁹ *Section one* is the Introduction; *Section two* focuses on the relevance of economic theories of growth and structural transformation that underlie the targets and indicators of the SDG 9, pertaining to infrastructure development, innovation, and industrialization for the case of Sudan. Focus is on endogenous growth theory (EGT). The discussion revealed questions on the applicability of economic concepts derived from growth and structural change theories. *Section three* is investigating the new structural economics (NSE) approach with respect to the SDG 9 focus. It is argued that a new structural economics approach is needed to investigate the impediments to growth in an economy based on primary goods exports. *Section four* presents the case of Sudan's industry as a representation of an LDC case. This section presents an overview of Sudan's efforts for developing and reforming the economy towards industrial development, with a focus on agro-industries. It is discussed how a new agro-industrial development process can use more fully the huge agricultural potential of the country. *Section five* is based on discussions and analyses of the last economic reform programme of Sudan for the period 2015-2019 in regard of the issues of convergence with and divergence from the SDG 9. It is a check of real developments against plans and proposals. *Section six* gives the conclusion of the study, followed by the main findings and policy implications.

2 Reviewing SDG 9 from the Perspective of Economic Growth and Structural Transformation Theories

This section discusses the economic theories that underlie the formulation of targets and indicators of the sustainable goal pertaining to industrialization. The New Growth theories explain economic growth as increases in the efficiency of labour

⁹ See on the LDC inclusion criteria for Sudan: <https://www.un.org/development/desa/dpad/least-developed-country-category-sudan.html>

that builds as a process of knowledge acquirement which is maintained and sustained by manufacturing enterprises. The New Growth Theory emphasizes that economic growth results from increasing returns. Generally, the increasing returns are associated with knowledge, which have many implications for economic development policy. The theory underscores the importance of investing in new knowledge creation to sustain growth. As formulated in Romer's (1987) endogenous growth model, as industry introduces more complicated machines and workers learn to operate the new machines, they acquire knowledge. Accumulation of this knowledge, denoted as human capital, is translated into higher labour efficiency which positively contributes to the growth process. While the neoclassical model assumes that the efficiency of labour is exogenous, Romer's (1987) new growth theory endogenizes human capital, as originated in R&D, to explain why and how such knowledge accumulates.

Our discussion on SDG 9 in Sudan from the perspective of economic growth concepts relates to key issues. The SDG 9 places great emphasis on the role to be played by scientific research in technological upgrading and innovation in the process of industrialization and by increasing the share on industry in GDP. Targets 9.B and 9.C are calling for international cooperation in research and ICT to facilitate the process of knowledge acquisition for low-income countries. Target 9.5 stresses the need for encouraging innovation and, substantially, increasing the number of research and development (R&D) workers per 1 million people and the volume of public and private research and development (R&D) spending. It seems that this emphasis on increasing the number of research and development (R&D) workers has its foundation in endogenous economic growth theory. Romer (1987) in his prized model explained how advanced industrialized countries realized and maintained sustained growth. The breakthrough that he made is introducing R&D as the sector being responsible for ideas creation. Many analysts consider the prime equation of his model as the one describing the R&D process:

$$\Delta A = \delta A + \eta L_A$$

When A_t is the number of ideas, i. e. the stock of knowledge accumulated up until time t , it is equal to the number of people devoting their time to discovering new ideas, $L_t A$, multiplied by the rate at which they discover new ideas, i. e. δ . Romer (1987) gave prominence to the R&D sector in initiating technological progress through its close linkage with the capital goods manufacturing sector. That has the meaning that in a constructive exchange pattern, the R&D sector transfers the right to use the stock of knowledge accumulated out of new ideas to the sector producing capital goods, described as the intermediate goods-producing sector. This in turn provides the capital goods to the final goods-producing sector (see the schematic presentation with the exchange sequence below).



As aforementioned, the focus of this chapter is to see to what extent this new growth concept is meeting the requirements for growth in LDCs like Sudan. The theoretical distinction between the R&D sector and the final goods-producing sector also physically and institutionally exists in LDCs where R&D activities are carried out only by public institutions. The private sector cannot afford the relatively high cost of doing research and development. So, the task is taken by government-financed research centres. In Romer's (1987) industrialized world R&D and its accumulated ideas are closely connected to the business sector being producer of final or intermediate goods. Key to Romer's (1987) theory is the partnership between the R&D sector, being private, public or independent, and the intermediate sector, having a sophisticated structure. The latter sector is a basic part of the advanced economies, constituted by the large technically advanced manufacturing establishments. Such establishments denote the sharp disparity in technological development between the developed world and the least developed world, where too often a complete absence of this sector is experienced. The intermediate capital goods-producing sector is also responsible for introducing and inducing the bulk of innovations in their society. A push-type characterizes such innovations.

To discuss the application of the endogenous growth theory to Sub-Saharan country cases, we first institute the stylized facts about the national innovation system (NIS) in most of the African countries that exhibit the ailing linkages among the system nodes. The insufficient Research–Industry links are one of the crucial and chronic problems that hinder effective innovations to be made. It is characteristic for R&D in Sub-Saharan countries, including Sudan, to be done in public institutions which are mostly suffering weak linkages to business. Mostly, research results are either having poor connection to industry's demand or they are not targeted to specific customers, so that the research activities are not adding value in industry; so, then there will be only a modest impact of R&D on industry and society. Increasing the number of researchers alone, as SDG 9 advocates, cannot satisfy the requirement for capital accumulation as in the theory additional factors matter. Romer (1987) in his equation for the stock of accumulated ideas lays importance on the time devoted by researchers for creating ideas, presuming that a conducive environment is maintained, so that the researchers are best motivated to devote much of their time to demonstrate creativity that eventually is transformed into commercial innovations by the capital goods-producers. This type of a strong and effective relationship between R&D institutions and its manufacturing partners is lacking in LDCs where the national innovation system (NIS)

is weakened by the poor linkages among the system nodes, an obstacle that leads to a poor impact of R&D results.

Thus, the main challenge exists in initiating viable constructive linkages between R&D and industry rather than increasing only the number of researchers as suggested by SDG 9.5. Otherwise, only increasing the number of labourers working in the R&D sector, this strategy remains a redundant call in the absence of incentive systems and effective institutions that motivate both researchers and industrialists to make innovative industrial achievements which are based on the R&D results. Time devoted to research is measured in the Frascati Manual¹⁰ by Full Time Equivalents (FTE) per researcher. It is necessary to optimize the research-industry linkage based on the time devoted to R&D, resulting in viable knowledge or, what Romer (1987) denoted, ideas which are transferred and used in industry. Parallely, an index of FTE for research workers can also be applied in LDCs, but such an index can misleadingly indicate a higher score than justified when it measures time as input or in efficiency terms. In the absence of a strategy and of institutions that link R&D to industry, research output or ideas will continue to be of low effectiveness in terms of value addition in industry. Much of the research activities in Sudan, as well as in other LDCs, end with outputs that do not reach the customers, because of poor links of R&D to industry and a weak market orientation, and hence a poor outcome of the research and development (R&D) undertaken.

Our argument is empirically evidenced by the actual size of the research workers in Sudan's public R&D system that exceeds slightly the number 6,000 persons who are distributed over 12 specialized R&D institutions and 65 universities with affiliated research institutes.¹¹ Recently, a Gum Arabic Research Chair was initiated in the Faculty of Agricultural Sciences of the University of Khartoum. This is seen as an attempt to adjust the research priorities to the agro-industrial export potentials of the country. Table 1 is presenting the number of research fellows in some of the better-known R&D institutions. It is not clear to what extent research is done in the many other research institutions, such as there are many public and private universities in the regions; and the knowledge about FTE of researchers is also poor.

¹⁰ See on the Frascati Manual: <https://www.oecd.org/sti/inno/frascati-manual.htm>

¹¹ See on the lists of universities for Sudan: <https://free-apply.com/en/articles/country/366755>, and: https://en.wikipedia.org/wiki/List_of_universities_in_Sudan

Table 1: Number of researchers in some important Sudanese R&D Institutions

Institution	Classification of Researchers		
	Re-searchers	Senior Researchers (Professors/Associate Professors)	Total
Industrial Research & Consultancy Centre (IRCC)	90	57	147
Agricultural Research Corporation (ARC)	275	172	447
Animal Resources Research Corporation (ARRC)	389	96	485
Atomic Energy Commission (AEC)	55	30	85
National Centre for Research (NCR)	110	21	131
National Research Institute for Food Science (NRIFS)	55	15	70

Source: MOHE (Ministry of Higher Education and Scientific Research)/The Scientific Research and Innovation Commission (SRIC), April 2019

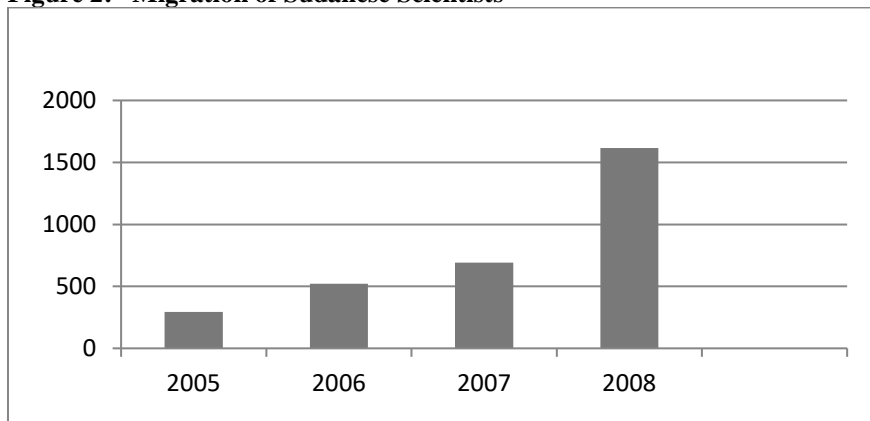
It is not only the lack of resources and the un-enabling environment that demotivate even skilled and well-trained researchers in their fragmented research community, but the problems are further aggravated by the quick labour turnover resulting from the global migration of scientists and researchers, also from Sudan, which is described as “brain drain”. This brain drain also limits the connection between the research sector and the intermediate goods sector. The migration of scientists recorded by public service agencies in Sudan has reached a total of 1,617 in 2008 as shown below in figure 2; this number is expected to have increased as the daily life in Sudan was deteriorating.¹² However, the weakness of such data prevents more detailed analyses.

So, the research institutes in Sudan continue to be in a cyclical process of building and then losing skills. More effective policies are needed to respond to the high rate of migration of Sudanese experts and of skilled labour. Though some “brain gain” initiatives had been implemented in partnership with the UNDP in

¹² A survey was conducted by the Industrial Research and Consultancy Centre (IRCC) in a consultancy study in 2011, reporting that many professionals in agriculture, medicine, economics, and management are working abroad, and that these persons are distributed over 46 countries and international organizations. Of course, this figure is underestimating the real size of brain drain because it ignores expatriate experts who are working for private firms and those who have changed their path of career. It is fact that most of them would be useful for a new industrial development strategy for Sudan.

Sudan to take advantage of the expertise in Diaspora, the results are so far very weak. Many collaboration programmes in the universities and the R&D sector of Sudan have failed.¹³

Figure 2: Migration of Sudanese Scientists



Source: Figure modified by the authors from: Nour, S. (2011a), Labour Market and Unemployment in Sudan, UNU-MERIT Working Papers # 2011-007

Various disparities exist in Sudan. There is a first disparity between requirements for a functioning research system and the realities on the ground. These disparities were already investigated for the case of Sudan, especially for the private business sector.¹⁴ A second disparity exists as both, endogenous and exogenous development paths are closely linked to a nation's capacity to acquire, to absorb, and to disseminate modern technologies. Although there is a huge demand for a high absorption capacity, the actual capacity on the ground is quite limited. The role of Foreign Direct Investment (FDI) is not contributing to increase the absorptive capacity. In Sudan, investment policies, and especially the promotion of FDI, aim primarily at generating more income from leasing land to cover the deficit in the

¹³ See on the failure of so many collaboration programmes in Sudan's R&D sector: <https://www.sudanknowledge.org/download/the-problems-of-research-and-the-plight-of-researchers-in-some-developing-countries-sudan-as-an-example/>. The failure has also to do with the sanctions on Sudan so that foreign firms cannot supply modern equipment for research. Research in Sudan cannot be continued in key sectors. Domestic funding for R&D cannot compensate this gap, so that there is a push for brain drain of researchers and skilled staff.

¹⁴ See on some sources: Discussion paper Number 44 by Professor Samia Nour, in: http://www.iwim.uni-bremen.de/sudan_economy_research_group/, and Volume 20 of the African Development Perspectives Yearbook, in: <http://www.iwim.uni-bremen.de/index.php?content=345&lng=de>

balance of payments. There is no explicit link between promoting FDI and the upgrading of the local technological capability. Legislations and policies to regulate the transfer of technology are lacking. Few analyses on the impact of technology transfer modes in Sudan are available.¹⁵ In a study for Africa, Abdoul G. Mijiyawa (2017) found that there are not significant effects of FDI and of urbanization on manufacturing development in Africa. Other authors (such as N. Hassan, 2017 in her PhD thesis) seek to investigate whether determinants of innovation pertaining to the accumulation of technological capabilities in LDCs of Sub-Saharan Africa are exhibiting country-specific or region-specific characteristics and whether conventional innovation concepts apply.

A third disparity concerns saving and investment. Gross domestic investment as a percentage of GDP of Sudan has declined from 22% in 1976 to 9% in 1989 (Sidahmed, A. S. & Sidahmed, A. 2005). Due to the collapse of national public and private savings in Sudan, a growing dependence on Foreign Direct Investment (FDI) has characterized the economy, but because of the structure of these investments (investing in land deals, not many for investments in manufacturing and agro-processing) the performance for reforming the structural defects of the national economy was limited. A considerable amount of savings was flowing from remittances of the Sudanese working in Arabic Gulf countries. The annual remittances from expatriates are estimated at US\$ 3.5 billion (Ahmed, M. M., 2010). But these savings are mostly utilized in real estate investments and for family house building, and rarely are these funds directed to investments in manufacturing and industry. Such an amount could be simply more than enough to finance investments in agro-industry. But most remittances escape official records, as they are channelled through the parallel foreign exchange market. Existing institutions and incentive systems are not effective in channelling private savings to invest in agro-industry. SDG 9 pointed to encourage private contributions to finance R&D, innovation, infrastructure, and small businesses. Here comes in the role of policy institutions to support a new culture for productive investments. The above discussion on the three disparities between the conditions suggested by the growth theories and the actual situation in Sudan has aimed to identify their causes. Such an identification might help to resolve the question how the endogenous growth theory can help to reshape policies towards structural transformation.

A proper interpretation of the new growth theory will make it positively contributing to the development of agro-industry in Sudan as well as in other LDCs. Still the indicators of SDG 9 will have its base in the new growth theory and could be derived from it by a better consideration of the conditions and the developmental status of the low developed countries. We suggest that the SDG 9.2 target is reformulated to suit the case of the LDCs. For example, the stock of knowledge denoted by the number of ideas in Romer's theory can effectively direct the STI

¹⁵ See the Reference number 13 on these issues.

strategies and policies when it is interpreted as increased innovations in agro-industry (a real output indicator) rather than as an increase in the number of researchers (merely an input indicator). It is suggested to reformulate the SDG 9.2 target in the following way: boosting the research output to industry, in terms of industrial innovations or new businesses based on research, i. e. using a market-driven indicator emphasizing outcome/output rather than merely expenditure/input (see table 2 on this approach). Conditions for competitiveness and incentive policies that emphasize boosting the innovations in terms of spinoffs or modernizing manufacturing processes in the agro-industry will - no doubt about it - strengthen the national technological capacity for more value adding. And that will enhance competitiveness of the agro-industry products and will help to integrate producers into the regional and international value chains. At the same time linkages among the nodes of the national innovation system (NIS) should be enhanced, particularly the research-industry linkage and the research – public policy linkage.

Table 2: Policies targeting labour efficiency in agro-industry

Policies	Outcome	Instruments/Tools
- Incentive policies that foster the innovative contribution of R&D.	- Continual accumulation of knowledge and expertise through problem-solving competences.	- Rewarding systems and management for better working environments. - Intellectual property rights framework. - Knowledge transfer system
- Increase private firms' contribution to R&D.	- Promoting positive spillover effects on industry and on the entire national economy.	- Consolidated NIS. - Market Incentive tools. - Incentive and Fiscal policies.
- Enhancing agricultural workers' technological knowledge.	- Aiming at higher productivity and expanding the technological absorptive capacity.	- Training and Exercising. - Introducing more advanced cultivation and processing technologies and practices.
- Skilled and trained labour instead of cheap and unskilled workers.	- Boosting structural transformation.	- Vocational centres and technical education.
- Enhancing fruitful learning approaches.	- Aiming at upgraded cognitive abilities and personal qualities of labour expedite.	- Developing educational syllabus in effective style.

Source: Table created by the authors

3 SDG 9 from the Perspective of the New Structural Economics (NSE) Approach

While the new growth theory offers some toolkits for policymakers, another approach is gaining ground. The New Structural Economics (NSE) approach to developing countries emphasizes the importance of technological learning, infrastructure, industrialization, and of pro-active government support. This framework is also often labelled as “a structural transformation guided by government and based on local endowments and comparative advantages”. The NSE is a strategy for achieving economic development based on the endowments of a country at a specific point of time; it is considered as necessary to adapt the national strategy continually to the changing environment in regard of the structural determinants. This framework was proposed by Lin (2011), who argues that without coordination and solving the externality problems the process of economic development may slow down; therefore, the government should play an active role in facilitating structural transformation through mitigating the coordination and solving the externality problems.

The NSE approach advances the neoclassical approach by studying the determinants and the dynamics of the economic structure. It postulates that the economic structure of an economy is endogenous to its factor endowment structure, and that sustained economic development is driven by changes in factor endowments and continuous technological innovation. It argues that building a good infrastructure and pursuing an industrial policy through supportive governments will allow it to achieve structural transformation in less than two decades. The rapid progress in infrastructure, industrialization, technological innovation, and ICTs in the developed countries and in East Asia make it harder for the LDCs to catch-up and to narrow the gap to the developed countries. Countries such as Sudan and other LDCs have only a chance to catch-up when they coordinate their development interventions carefully, such as envisaged by the NSE.

In recent years, the New Structural Economics (NSE) framework has attracted considerable attention. The international scholarship has focussed on the relationship between endowment structures and economic growth. It was suggested that pro-active governments of developing countries can give incentives to firms, also small firms, to upgrade their factor endowments. Policymakers may promote industrialization by upgrading their endowment structure for developing the productive sectors in line with the comparative advantages. The upgrading of the endowment structure requires a coordinated action from government and firms. To transform the Sudan into a high value-added economy, policymakers need to design effective development policies, which address the existing industrialization challenges in the developing countries. This requests coherent, comprehensive, and future-oriented structural policies managed jointly by the state and by the private sector.

Developing the industrial structure requires the upgrading of the factor endowment structure to one that is introducing new technologies and that is performing the corresponding improvement in infrastructure to facilitate economic operations. For Sudan to upgrade its agro-industries there is a need for improving the infrastructure, the finance system, the institutions, and the innovation system. Without a growing agro-industry sector, Sudan's economy will find it increasingly difficult to sustain growth and development. In Sudan, the agro-industry sector is an integral segment of the transformational industries sector. To become competitive, the infrastructure and investment gaps and the insufficient access to finance for agriculture and manufacturing must be overcome. The agro-industries must be developed to be able to adapt to new technologies and innovation. The Growth Identification and Facilitation Framework (GIFF) underlying the NSE framework proposes six steps to support the policies of upgrading and for catching-up (see Lin and Xu 2016).¹⁶ If applied, the economy will be most competitive, the economic surplus will be the largest, and the capital accumulation and the upgrading of the factor endowment structure will be the fastest possible. The state has an important role to improve on the functioning of the markets. In the case of Sudan, upgrading the agro-industries of the country according to the comparative advantages requires that the infrastructure, the foundations of the market system, the financial system, the system of capital allocation, the institutions, and the innovation system are developed and coordinated.

Historically, Sudan is considered as an agricultural country with a great share of the population working in this sector, as a country endowed with human resources and basic skills, and with rich natural resources. For instance, it is endowed with a wide spectrum of suitable agro-climatic conditions that allow the production of a broad range of diverse agricultural crops. However, during the last two decades the share of agriculture in total employment has declined to 33.7% (World Bank, Data Sudan/Overview 2017), although policy shifts towards employment in agriculture are now becoming visible. Sudan has been producing and exporting many agricultural commodities, which contribute 34% of the Gross Domestic Product (GDP). Until the early 1990s, the Sudan was a large exporter of cotton and livestock, and it has emerged as a leading exporter of Gum Arabic with a share of 80% of the global market volume for the raw product. Since 1999 Sudan is an exporter of oil, but the separation of South Sudan in 2011 has brought an end to this business for Sudan (except the revenues from the transit of oil from the South Sudan oil fields to Port Sudan).

¹⁶ The six steps derived from the NSE are: First, choosing the right target; second, removing binding constraints; third, attracting global investors; fourth, scaling-up self-discoveries; fifth, recognizing the power and magic of industrial parks; sixth, providing limited incentives to the right industries (Lin/Xu, 2016, pages 3-4). The Growth Identification and Facilitation Framework (GIFF) was applied to various African countries.

For decades, Sudan was exporting primary agricultural commodities as raw materials, such as cotton, Gum Arabic, and livestock, and the country is still lagging in processing, being unable to benefit from the availability of resources, including human and natural, and the favourable agro-climate conditions. The economic policies of 1960-1970 have provided the framework to concentrate on agro-based industries, a sector which now becomes again an option to diversify Sudan's economy. Sudan has learnt from other developing countries, especially after its independence, that exporting agricultural commodities as raw materials is not beneficial for an economy. In the early 1960s, the Sudanese government began with a series of ten-year plans to develop the productive sectors. One of the major programmes was the establishing of textiles factories, edible oil processing industries, flour industry establishments, and other food-processing industries. As part of broader structural adjustment programmes in the late 1970s, Sudan has attracted Arabic financial resources and has mobilized domestic savings to build the national economy; some sugar companies were established. The so-called "Bread-basket Strategy" of Sudan had some resemblance with the policy guidelines of the new structural economics (NSE), but the strategy was badly managed.¹⁷

In the years since 2011, the economic shock created by the secession of South Sudan was a cause for decreasing sharply the Sudan's economic growth rate. This shock happened because a Dutch Disease-inflicted economy, which was concentrating on the oil industry, has weakened the economic structure, by missing the opportunity to process agricultural products in agro-industrial processes. The guidelines of NSE were not upheld from the policymakers before 2011 and after; all the pillars of SDG 9 were neglected. Textile industry, the largest agro-industrial investment in Sudan, had been historically associated with the vast cotton plantation schemes. Both, cotton plantation schemes and textile factories deteriorated. Still, large parts of agricultural production do not receive further value addition due to lack of infrastructure for processing and commercialization. Urbanization, the middle class, and the subsequent increasing demand for diversified processed and semi-processed food opened new prospects for producing processed crops, particularly fruits and vegetables. Opportunities are created to overcome the huge post-harvest losses of perishable agro-commodities, which averaged in Sudan as well as in most of Sub-Saharan Africa 35-50% of the total attainable production. Integration in the regional market where Sudan is a member country, such as the Common Market for Eastern and Southern Africa (COMESA), is an opportunity for agro-processors.

¹⁷ The Sudan Economy Research Group (SERG) at the University of Bremen has worked for many years about this strategy; see: http://www.iwim.uni-bremen.de/strukturanpassungspolitik_und_wirtschaftsreform_im_sudan/

The creation of free trade areas (such as the African Continental Free Trade Area) with preferential trade agreements gives new chances for market penetration. Such agreements emphasize agro-industrial production in global and regional value chains. Such development opportunities would make real the huge potential for value addition and employment creation. Raising the share of the industrial sector through agro-processing would also solve many problems of poverty, unemployment, low productivity, and of poorly integrated and fragmented markets. If the government of Sudan is performing its facilitating role, then the agro-industry sector could transform the country to accelerate inclusive growth and sustainable economic development. The New Structural Economics (NSE) reminds us of the great task to develop a programme for this key sector (comprising all agriculture sub-sectors and all agro-industry branches), and to implement programmes related to the real transformation of the sector.

Sudan is characterized by large productivity gaps among economic sectors, and there was a large shift of labour out of agriculture to other sectors in the period 1980-2016. This shift could be the base of an important engine of growth (Lewis, 1955). In the case of Sudan, closing the large productivity gaps needs a bundle of effective measures to be implemented, as based on the prescriptions of the new structural economics (NSE). Over the period 1980-2016 the contribution of the petroleum sector to the GDP had increased from 2% in 1999 to 21% in 2008, and it sharply declined to 8% in 2010. The sharp rise in 2012 was due to the Oil Transit Agreement between Sudan and South Sudan, but the following events (disruption of oil production in South Sudan and civil war in South Sudan) led to a record low of a 1% contribution of petroleum afterwards. In contrast, the contribution of the agricultural sector to GDP in 1999 was 48% and started to decline to about 31% in 2010 but keeping since a share of around 30%. The contribution of the services sector to GDP was taking over the lead after the decline of the oil revenues after 2008; the share of the services sector in value-added has steadily increased over the years. The contribution of the services sector to GDP has seen a decline from 49 percent in 1995 to 36 percent in 2002, before it increased to the same levels as in the mid-1990s. In 2017 the services sector contributed 49.5 percent to the GDP. However, during this period there was no or only a slight change in the other sectors, including the manufacturing sector, building and construction, and electricity and water. Regrettably, there is a lack of data on changes within the sectors (agriculture, industry, services). Long-term data about GDP and employment are available from the African Development Bank, the World Bank, the Central Bank, and Statistical Office of the Sudan (see AfDB Group, 2019)

Another challenge for the Sudanese economy is that manufacturing technologies are obsolete (Nour, 2011b); this will delay industrial recovery for many years. Although Sudan has a rather diversified industrial structure, the share of the sector in value added is small. There is a need for major reforms in the agricultural and manufacturing sectors to create opportunities for businesses to set up competitive

companies and joint ventures, small and large ones, to enhance new development opportunities, and to develop the productive sectors more fully. In Sudan, there has been a change in the structure of the labour market during the past two decades; many workers have moved away from agriculture to non-agricultural activities. This move may make it harder to revitalize the agricultural sectors in line with Sudan's comparative advantages, as agriculture is a skills-intensive activity. Young entrepreneurs may be interested to step in, but the business environment must be favourable. However, there is no programme at large scale to support them.

Historically, Sudan kept its economic policy poorly related to agriculture; the policy was not strictly pro-agriculture, pro-agro-industry, and pro-agribusiness. But the country continued to promote economic growth, especially by promoting mining and by exporting oil. However, the landscape of Sudan's economy had changed fundamentally over the years from 2000 to 2012, and the structural change had a negative impact on the agriculture shares in GDP as labour and output shares moved from agriculture to services, and later to mining, but not to manufacturing. Furthermore, the share of agriculture even declined due to the exporting of oil in the early 2000s. Sudan's economy was drastically affected by civil wars (in the South until the peace agreement in 2005), by civil conflicts (since 2003 in Darfur), later by violent conflicts in the Southern states of Sudan and the civil war in South Sudan, by political conflicts between Sudan and South Sudan, and by sanctions from UN and Western countries, despite the Comprehensive Peace Agreement (CPA) of 2005. In the years which followed the secession of South Sudan (2011), the agricultural productivity has significantly improved, but the agriculture sector would have required more investment into its infrastructure, which was built in much earlier times. Cotton, gum Arabic, and peanuts production were relatively high between 2013 and 2016. The diversity of climate zones qualifies Sudan as a producer of agricultural and livestock commodities at comparatively low opportunity costs. As a result of Sudan's loss of 75% of the oil revenues in 2011, the gross value-added of agriculture has increased from 27.5 percent in 2011 to 40 percent in 2016. The employment shares for the agricultural sector declined to 43.2 percent in 2018, down from 51.1 percent in 1991. The share of employment in the services sector has been increasing rapidly; it increased from 34 percent in the early 1990s to 43.2 percent in 2018. The share of employment in the industrial sector has grown only slightly between 1991 and 2018. There was a major shift from agriculture to services in Sudan, making the change a negative type of structural change because of the very low impact on manufacturing. This type of structural change had a negative effect on overall labour productivity, widening the gap across countries (McMillan and Rodrik 2011). It is important to note that the new structural economics (NSE) emphasizes in its guidelines the need to support a structural transformation process also within sectors, especially towards more productive manufacturing, services, and industry sub-sectors.

4 Sudan's Industrialization and SDG 9 – The Potentials of Agro-industries

4.1 The Current Situation of Agro-Industries in Sudan

Agricultural value chains make it possible to use the huge potential of human and natural resources for generating value added and employment opportunities. And, raising the share of the industrial sector through agro-industries is a strategy for solving many problems simultaneously: reducing poverty, creating employment and foreign exchange, overcoming low productivity and inadequate infrastructure, and integrating fragmented markets (see Yagoub 2016 and 2019 on what we know about such a path of development for Sudan). When we move in development analysis along SDG 9 towards considering infrastructure, innovation and institutions, the huge potentials and the great challenges of agro-industries become visible.

The National Five-Year Programme for Economic Reform (2015-2019) is part of a Sudan Comprehensive Strategy (SCS), which was consented as a national planning framework for achieving the SDGs (see section 5 below on five targets of SDG 9), against which the effectiveness of economic and developmental activities can be judged (it is a programme issued by the GoS/Government of Sudan, Ministry of Cabinet 2015). The strategy for the industrial sector had assigned priority for comprehensive industrial progress through mobilizing the sector qualitatively and quantitatively, especially by upgrading and diversifying its products. Such a vision is aimed at realizing self-sufficiency, increasing exports, and creating employment. Such a vision is highly related to the second target of SDG 9 (SDG 9.2) that states: promoting inclusive and sustainable industrialization and raising significantly industry's share of employment. The resemblance between the national development policy (with the programme for 2015-2019) and the SDG 9 (especially SDG 9.2) seems to appear in the strategic objectives:

- To raise industry's contribution to the GDP in 2030 by 70%, an objective to be achieved by fostering private-public partnerships and by motivating the business sector to increase its contribution to 83% of capital investment.
- To provide for a fair allocation of resources across different Sudanese states, an objective characterized by a strategy of positive discrimination towards underprivileged regions and social strata.

However, such objectives were part of development plans and programmes in Sudan since the 1960s. Regrettably, too many plans and programmes remained mere statements on paper. A pretty collection of fine objectives and goals is stated in every public plan or policy. Yet, a big disparity exists between plan and reality, between policy and practice. A recent review (GoS, Government of Sudan, Ministry of Finance 2017) of the performance of the national development programme (2015-2019) reveals that:

- Industrial production was below the planned scale due to inadequate supply of inputs and finance.
- National investment in the agro-industries and other industrial sectors has contracted. The existing enterprises were not able to provide jobs due to low productivity, the lack of attracting FDI in industry, and the ineffectiveness of the country to boost technological development towards a higher national technical capacity.
- The rise in the unemployment rate (to 19%) and the limited impact of the policy to provide 5,000 jobs for graduates (GoS, Government of Sudan, Ministry of Finance, 2017) have shown that government policies lead to unsustainable interventions.
- FDI policies in agriculture are conflicting with concepts for youth employment and are administered at the expense of small farm businesses. Vast land is allocated to Arab investors and are put under animal forage plantation to supply animal-raising farms in the Gulf region.
- Access to finance from the traditional banking system remains the largest obstacle for small and medium-sized enterprises in Sudan as in other parts of Sub-Saharan Africa. Affected are SMEs in all economic sectors. Mostly, SMEs are financed from private and family funds.
- Except for the African Development Bank's (AfDB) case of private sector financing of the DAL Group in December 2018¹⁸, government facilitation for private sector access to international finance, by guaranteeing borrowing through state guarantees, had largely failed due to the inability of the government to overcome the US financial and economic sanctions.

Industrial sector development is also depressed by competition from cheap imported Chinese products. They are of low quality, but in a price-sensitive society consumer preference goes for the cheapest products. The national capacity in Sudan to measure and to prohibit dumping actions falls short of being able in protecting domestic producers. Traders (importers) have a greater power than industrialists to get their permissions quickly. At the same time, the cost of innovation is high in industry, and the investment into knowledge-acquisition is only reluctantly undertaken. There are many reasons for this behaviour (administrative problems, high cost of transactions, lack of intellectual property regulations, financing constraints, lack of competition on product and factor markets). Thus, Sudanese producers retreated to the corner of unprocessed commodity exports, having domestic markets dumped with Chinese products. On the other side, protection for

¹⁸ See on the African Development Bank/DAL Group transaction:
<https://www.afdb.org/en/news-and-events/sudan-african-development-bank-approves-us-75-million-to-dal-group-co-ltd-to-transform-countrys-food-and-agriculture-18868>

some industrial products in Sudan hinders innovation and the building of technological capacity, as firms gain high returns from selling their protected products; the motive to innovate is not strong in such cases.

The above discussion greatly supports the view that advances in industrialization depend not only on the building of physical infrastructure, but need to be shouldered by reliable, attainable and implementable plans. The failure of most of the industrial strategies in Sudan is attributed to the failure to set proper priorities and to match the ability to develop capacity and resources with the formation of realistic expectations. Of course, politics and geopolitics cannot be dismissed as determining factors in many African Sub-Saharan countries, including Sudan. Conditions such as the lack of democracy, of accountability and of transparency, and the inability to ensure responsibility and reliability in the governance of the country contribute to this failure of development strategies. Corruption affects the ability of unprivileged small and medium firms to modernize the firm and to upgrade products and production technologies. Large firms have an advantage as they are linked to government and military in Sudan.

4.2 A Development Path for Agro-industries

Sudan is characterized and endowed with fertile agricultural lands, varied climates and vast virgin areas. The productivity of the agricultural sector has increased somewhat in the years following the independence of South Sudan in 2011, and the agriculture sector of Sudan can still benefit from infrastructure which was developed earlier (especially for the irrigated agriculture sector). The country has a great variety of agro-industrial products. Table 3 (below) shows the Value Added of selected agro-industries in the years 2001 and 2014.

Table 3: Value Added and Share of selected agro-industry products and of other industries in 2001 and 2014

	Value Added (VA) in %	
	2001	2014
Food	64.63	62.11
Beverages and Tobacco	1.50	1.04
Textiles and Clothing	2.60	0.25
Leather and footwear	1.45	0.14
Agro-processing industries in total	70.18	63.54
Non-agro-industries	29.82	36.46
All Industries	100.00	100.00

Source: Data from CBoSt/Central Bureau of Statistics, Ministry of Finance and National Economy, Ministry of Industry and Trade

Food processing is the leading sector in adding value in agro-industries, although its share has slightly declined, followed by beverages and tobacco, textiles and clothing, and leather and footwear, sectors which have declined faster. The share of textiles and clothing has declined from 2.6% in 2001 to 0.25 percent in 2014; also, the Leather and Footwear sector has strongly declined. Beverages and Tobacco was in 2014 more important than the Textiles and Clothing industries and the Leather and Footwear industries. Other industries (non-agro-industries) have an increasing share (cement, fertilizer, metal industries, chemical industries, weapons, etc.). Specific products of agro-industries with great importance are discussed in the box 1 (below).

Box 1: The current Status of some important Agro-industrial Products

Meat: Sudan is endowed with huge animal resources, with a figure of 132 million heads in 2014. Besides that, there is a large quantity of fish resources; it is approximated at 100,000 tons for internal fisheries, and 10,000 tons for marine fisheries.

Sugarcane: Sudan is the third largest sugar producer in Africa after South Africa and Egypt. Around 1 million tons of sugar is produced per year out of which about 0.2 million tons is exported. The annual consumption in Sudan reaches 1.6 million tons. In general, there is a great potential in both sugar and ethanol production. Exports of ethanol have already taken place since 2009.

Sesame: Despite the civil wars and trade sanctions, Sudan has managed to sustain its sesame seed export industry. Annually, Sudan exports 44 percent of its sesame seeds. Processing activity is however insignificant.

Gum Arabic: Sudan is the world's largest producer of gum Arabic, which accounted for 80 percent of the global gum trade. Also, processing activity is still insignificant.

Source: Data provided by the Authors

The new structural economics (NSE) framework suggests that countries could enjoy high economic growth by identifying the industries that have a latent comparative advantage. NSE experts also have recommended to remove the binding constraints and to facilitate the private sector to move to those industries (Lin and Monga 2010). Based on the competitive advantage in view of its endowments structure, Sudan could develop the agro-industry sector by following comparative advantages in the products that can successfully compete in the domestic and international markets. This will enable Sudan to accumulate savings, which could be invested in the sectors which have the highest possible return. As Sudan has enormous potential for livestock-raising, farming activities, and fishery development alongside with a context of land, water and labour abundance, there is a great potential of increasing the production and processing of agricultural commodities.

However, neither infrastructure nor innovation capacity are developed for the sector of agro-industrial products. The benefits of backward and forward linkages are not exploited (see box 2).

Box 2: Backward and Forward Linkages

In Sudan, the infrastructure is not developed well enough to meet the potential of agro-industries in Sudan. In terms of backward and forward linkages of agriculture and manufacturing, the development of agriculture is the vital integral component for the development of the manufacturing sector and of the overall economy.

One of the most important forms of interrelationships associated with backward linkages is that agriculture supplies agro-based industries with the inputs like raw cotton, fruits and vegetables, gum Arabic, hides, etc. Similarly, agriculture demands industrial products for cultivation and post-harvest activities, as these include fertilizers, pesticides, implements, and equipment. Other forms of backward linkages are the link to financial institutions, energy sources and transport networks which are connecting agricultural areas to industrial zones. Except for sugar manufacturing factories, agricultural production is poorly matched with agro-industrial demand because most of the factories operate below capacity.

On the forward linkages side some logistic supports are necessary for making the agro-industrial products sector attractive; these include packaging-making and marketing channels. The forward linkages of agro-industry are crucial to be developed to allow for value addition in export, urban retail, and tourism sectors.

Source: the Authors

From the NSE perspective we argue that with such a blessed diversity of soils and weather patterns, the regional and the international trade opens the channels to countries such as the Sudan to climb up the industrial ladder by adapting export-promoting strategies (where the country is a global leader) and by import-substitution strategies (through a temporary protection to the infant industries till the industry becomes more competitive in the domestic, regional, and global markets). Table 4 presents the sub-sectors of agro-processing in terms of employment, sector size, production capacity, and capacity utilization. The food, beverages and tobacco industries are employing the highest number of workers relative to other agro-industry sectors, and these sub-sectors operate with 1,602 establishments. The capacity utilization in the food industries is very low. The new transition government (since 2019) plans to focus much more on agro-industries; it is expected that the production of these commodities will increase in the years to come (compared to the data for 2014 and 2016).

Table 4: Sudan's agro-based industries, sector's size, employment, and capacity utilization in 2015

Industry	Number of factories	Number of workers	Design capacity (Tons)	Actual Production Capacity (Tons)	Actual Capacity utilization (%)
Textiles*	38	10,226	463,086	122,500	73.5
Food, Beverages, and Tobacco	1,602	47,450	218,925	191,573	12.5
Sugar**	7	2,763	450,000	250,185	44.4
Edible Oils	223	805	35,043	12,290	64.9
Meat	15	5,294	15,197,205	10,639,411	30.0
Leather and footwear	308	1,037	523,982	13,814	72.6

Source: Authors' calculations using the comprehensive Industry Survey, issue 3 (March 2005), complemented with the data from the Industrial Chamber Union, 2013, the Ministry of Industry and Trade (2019), and from FAOSTAT, 2019. **Note:** * Data as in 2014. **Data as in 2016

Increasing the international competitiveness is a task and is feasible when economic policy reforms are envisaged. Trade analyses show that great divergencies exist for comparative advantages. Comparative advantage can be measured by two different methods, the Revealed Comparative Advantage (RCA) method, developed by Balassa (1977), and the Policy Analysis Matrix (PAM), delivered by Monke and Person (1989). In this study we used the RCA approach, which has been used widely. The following commodities were considered: cotton, gum Arabic, leather, and meat; this was done to identify which product has a high comparative advantage. The Revealed Comparative Advantage (RCA) measure is expressed as follows:

$$CA = \left(\frac{X_{i,j}}{X_{w,i}} \right) / \left(\frac{X_{i,tot}}{XW_{tot}} \right)$$

CA refers to comparative advantage, $X_{i,j}$ is a country i 's exports of product j ; $X_{i,tot}$ represents the country i 's total exports; $X_{w,j}$ refers to the world's (all countries) export of product j ; and XW_{tot} is the total exports in the world. According to the model, $CA \geq 1$ means that this product has a comparative advantage; by contrast, when $CA < 1$, this means that the product has no comparative advantage. The data for the analysis span the period 2014 to 2017 and were taken from secondary

data obtained from different sources. Some data were collected from the trade map and from publications of the Sudanese Ministry of Industry and Trade (see table 5).

Table 5: Estimation Results of RCA for Agro-industry commodities

Year	Cotton	Gum Arabic	Leather	Meat
2014	1.073	2.338	1.081	1.229
2015	1.092	3.873	1.062	1.008
2016	0.704	2.732	1.149	1.109
2017	1.187	2.079	1.201	1.402

Source: Yagoub 2019

Table 5 illustrates the revealed comparative advantage (RCA) of the primary commodities for export (meat, gum Arabic, leather, and cotton). The study found that in the period 2014–2017 the Sudan has a revealed comparative advantage in producing and exporting gum Arabic, leather, and meat. Cotton has had a comparative advantage during 2014–2017, but except in 2016. This confirms the fact that Sudan could sustain the comparative advantage of these commodities by supporting agricultural and meat processing to reach their full capacities; better policies, infrastructures, innovations, and finance systems could even improve the RCA values. Table 5 shows historical data, as the environment for producing agricultural commodities is changing rapidly (through changing cost and price relations, exchange rate changes, climate change factors, internal and export taxes, violence and civil wars, deterioration of the quality of infrastructure, etc.). But aligning to the SDG 9 targets could help to improve the competitiveness. Both, the new structural economics (NSE) approach and the endogenous growth theory (EGT) approach point to the need to look at all these changes when designing structural policies.

5 Relating National Development Strategies of Sudan to the SDGs, especially SDG 9

The National Five-Year Programme for Economic Reform (2015- 2019), a part of the National Comprehensive Strategy (NCS) for Sudan, was consented as a national planning framework for achieving the SDGs against which the effectiveness of economic and developmental activities can be judged. The strategy for the industry and mining sectors was assigned priority for comprehensive industrial progress, through mobilizing the sector, through qualitative and quantitative development/upgrading and diversifying the industrial products in the direction of self-sufficiency, through promoting exports and employment. In fact, such a vision is

highly related to the second target of SDG 9 (SDG 9.2) of promoting inclusive and sustainable industrialization and raising industry's share of employment. The interlinkages between the national policy and the sustainable development goal (SDG) 9 seems to appear in the objective strategic concern to raise substantially industry's contribution to GDP by 2030. This goal is to be achieved by fostering the private-public partnerships and by motivating the business sector to increase its contribution to 83% of overall capital investment.

The programme provides a national framework to achieve the sustainable development goals (SDGs). It determines the manufacturing and mining sectors as priority sectors to sustain economic development. This programme aims at achieving economic stability and high and sustainable economic growth rates, aimed at creating more employment opportunities to transform the economy and to expand and to diversify its production base. However, the programme has been facing many challenges, such as the US unilateral economic sanctions, the worsening debt problem, the insufficiency of financial resources which would be necessary to implement the programme, and the continuation of conflicts and civil wars in the country.

In the context of the framework of SDGs, the public policy towards SDG 9 was recognized. Recognized was a growing role of infrastructure development, the promotion of science and technology, and a modern and deeper industrialization. The linkages of SDG 9 to state policies and to the codification of social responsibility of businesses and companies were observed, with their economic, social, and environmental dimensions, and with the ambition to regulate them with legislation, policies, and incentives.

There is a pervasive inefficiency of small and medium scale industries, of farming sectors, and of large-scale state-owned companies and (irrigation) schemes, as they are producing significantly below their thresholds. However, small-holder farms remain trapped within the informal economy due to a lack of market infrastructure, such as pack-houses, abattoirs, silos, and processing plants. We argue that the reason why production is below the optimal level is that land degradation, inconsistent agricultural and industrial policies, and major infrastructure gaps limit the expansion of production. This has resulted in fluctuating and low productivity per worker and per area. Sudan has a growing working age population, representing a potential demographic dividend for the country. But the problem is the absorption of the growing labour force on the labour market.

Even though Sudan has constructed five dams that provide water for irrigation, fishing opportunities, and means to generate electricity, these dams are resulting in inefficient irrigation systems due to the lack of public and private investments to increase the capacity for producing agricultural equipment and inputs (Abdalla and Mohamed 2010). However, the five-year programme of economic reform for the period 2015-2019 is a comprehensive strategy that emphasises important targets of SDG 9. However, SDG 9 places a great emphasis on the roles to

be played by research & development and by technological upgrading and innovation; focus is on industrialization and increasing the share of industry in GDP and employment. The following tables show the linkages between SDG 9 targets and programme components.

Table 6 below presents the linkages between the national development strategies and developing sustainable resilient and inclusive infrastructure according to SDG 9.1. Sudan has been seeking to enhance the partnership with the private sector to increase its investments in infrastructure.

Table 7 illustrates the linkages between the national development strategies and the SDG 9.2 for promoting inclusive and sustainable industrialization.

Table 6: Sudan's Development Strategies and SDG 9.1

Target 9.1: Developing Sustainable, Resilient and Inclusive Infrastructure			
Sudan's macro- and sectoral policies	Status of the five-year programme	Obstacles	Challenges facing development
<ul style="list-style-type: none"> - Expansion of infrastructure; - New sources of energy; - Emphasis on power, railways, roads and irrigation; - Permission for private sector entry into electricity generation; - Joining the African initiatives and agreements for infrastructure development.¹⁹ 	<ul style="list-style-type: none"> - New roads and bridges accomplished; - Expanding the application of modern ICT systems; - Introduction in infrastructure of effective utilities management; - Managing the infrastructure by information and communications technology (energy networks, water supply and transportation systems). 	<ul style="list-style-type: none"> - Low quality road system and lack of conformity with specifications and standards; - Very slow progress on development projects; - Weak funding and poor contribution of private business. 	<ul style="list-style-type: none"> - Connecting the agricultural production areas with industrial establishments, markets, roads and ports; - Enhancing the capability for the utilization of regional and world assistance; - Attracting foreign investment in infrastructure.

Source: Developed by the authors; data from the UN Sustainable Development Goals, 2015, and from GoS, Ministry of Cabinet, 2015, The Five-year Programme for Economic Reform, 2015-2019.

¹⁹ See the following African initiatives and agreements: Information & Communication Technologies (ICT) for trade and regional integration - complementary initiatives; Common Market for Eastern and Southern Africa COMESA); African Transborder-Roads and Railways Agreement; Nile Basin Initiative for Electricity and Irrigation.

Table 7: Sudan's Development Strategies and SDG 9.2

Target 9.2: Promoting Inclusive and Sustainable Industrialization			
Sudan's Macro & Sectoral policies	Status of the Five-year Programme	Obstacles	Challenges facing Development
<ul style="list-style-type: none"> - Increase the contribution of industry to GDP at a rate of 70% by 2030; - Private sector to contribute at a rate of 83.4% to capital investments; - Equitable distribution of wealth and balanced regional development; - Positive development discrimination for conflict areas; - Youth and women employment; - Guaranteeing private borrowing from regional and world financiers; - Import of industrial inputs and machinery with nil value. 	<ul style="list-style-type: none"> - Achieving a rate of 40% of targeted training to youth, industrial workers and those having handicraft skills across the country; - Addressing the factors which are causing the shutdown of so many factories, including the remaining textiles factories. 	<ul style="list-style-type: none"> - Declining industrial production; deviations from the targeted volumes and values (shortages of finance and inputs); - Contraction of national investments; firms are not able to provide additional jobs; - Limited interest of foreign investors in key productive sectors, except for investments into large agricultural land areas by Gulf business groups; - Only few sustainable FDI in agriculture and industry, with poor impact on technology, exports and employment. 	<ul style="list-style-type: none"> - Create institutions that maintain consistency between policy and implementation; - Improve supply chains for agro-industry; - Identify agro-industry with comparative advantage; - Cease export of raw agricultural commodities and encourage export of processed agricultural products; - Regulations on FDI to provide decent jobs; - Actions on Brain Drain are needed; - End local wars and conflicts as they affect economy and society; - End internal, cross-border and regional conflicts as they affect business and society.

Source: Developed by the authors; data from the UN, Sustainable Development Goals, Agenda 2030 for Sustainable Development, UN SDGs, and from the GoS, Ministry of Cabinet, 2015, The 2015-2019 Five-year Programme of Economic Reform, and GoS, Ministry of Finance, 2017, Progress Report on the Economic Reform Programme, Ministry of Finance, 2017

As shown in table 7, the implementation of the inclusive industrialization strategies in Sudan came short of the targeted objectives, and it is weakened further by focusing on agricultural projects that provide low value adding. Public policy in Sudan however stressed developing production and technical and managerial

skills aiming to increase productivity and to open new markets. There is a huge gap between published and announced policy frameworks and the reality of implementation.

This leads us to table 8, which shows the linkages between the national development strategies and increasing the access to small-scale industries to finance in SDG 9.3.

Table 8: Sudan's Development Strategies and SDG 9.3

Target 9.3: Increasing the Access of Small-scale Industries to Finance and their Integration into Value Chains and Markets			
Sudan's Macro & Sectoral policies	Status of the Five-year Programme	Obstacles	Challenges facing Development
<ul style="list-style-type: none"> - Expanding and developing the direct support to small enterprises through national funds and employment strategies; - Empowering youths and women to participate in the development of small enterprises and in ventures to eradicate poverty; - Providing the required raw materials for SMEs; - Building capacity for employment creation and improving management systems. 	<ul style="list-style-type: none"> - Shutdown of more than 65% of the SMEs in textiles industries; - Lack of a major national programme to support the establishment of small processing industries; - Contraction in shoe industries and leather products. 	<ul style="list-style-type: none"> - Commercial banks' mode of mortgage financing does not suit small-scale industries; - Ceiling of Micro-finance is not appropriate for SMEs; - Complete ignorance of SMEs in strategies for developing industrial establishments; - Lack of linkages between SMEs and larger enterprises; - The domestic markets are dumped by Chinese commodities; lack of trade policy actions. 	<ul style="list-style-type: none"> - Developing flexible modes for financing SMEs; - Make SMEs to benefit from international and regional donors; - Developing and complying with the standards and specifications to integrate the SMEs into the international and regional value chains; - Analyse implications for the accession to the World Trade Organization (WTO).

Source: Developed by the authors, with data from the UN Sustainable Development Goals, 2015, and from GoS, Ministry of Cabinet, 2015, The GoS 2015-2019 Five-year Programme of Economic Reform, Khartoum, Sudan.

One of the options for policymaking in Sudan is to integrate the specialized banks with associations for the support of the small-scale sector under one organization

that offers finance to SMEs. Support for SMEs needs to be organized at a much larger scale and for all states of Sudan.

Table 9 below shows the linkages between the national development strategies and the need of upgrading infrastructure and of retrofitting industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes. Table 9 illustrates the importance of strengthening the concept of social accountability by implementing cleaner production procedures to maintain resources and to minimize waste and the emission of greenhouse gases.

Table 9: Sudan's Development Strategies and SDG 9.4

Target 9.4: Improve infrastructure and industry modernization for sustainability, increased resource-use efficiency and adoption of clean and environmentally sound technologies and industrial processes			
Sudan's General Goals Macro-policy & Sectoral Policies	Status of the five-year program	Obstacles	Challenges facing development
<ul style="list-style-type: none"> - Redirect the industrialization pattern towards inclusive and green growth; - Full Resource Utilization and minimizing the waste along the value chains; - Use of environment- friendly- and economically - efficient technologies; - Adoption of Cleaner Production Protocols to conform with global climate protection action. 	<ul style="list-style-type: none"> - Strengthening the civil society responsiveness for the global environmental challenges; - Setting up of a cleaner production research institute at IRCC (Industrial Research and Consultancy Centre), and setting up research centres at universities and agricultural research institutions; - Setting up of a database for the status of cleaner production in Sudan. 	<ul style="list-style-type: none"> - Absence of a national commitment on adapting the technologies to the environmental challenges; - Insufficient evaluation and monitoring of the technologies for clean production and energy supplies. 	<ul style="list-style-type: none"> - Participation of the actors in the productive sectors in the process of formulating policies and strategies; - Integration of economic and environmental policies into visions, plans and implementation strategies.

Source: Developed by the authors; data from the UN Sustainable Development Goals, 2015, UN SDGs, and from GoS, Ministry of Cabinet, 2015, The GoS 2015-2019 Five-year Programme of Economic Reform, Khartoum, Sudan.

Table 10 below shows the linkages between the national development strategies and the SDG 9.5 target: Enhancing scientific research and upgrading the technological capabilities of industrial sectors.

Table 10: Sudan's Development Strategies and SDG 9.5

Target 9.5: Enhancing scientific research, and upgrading the technological capabilities of industrial sectors			
General Goals Macro-policy & Sectoral Policies	Status of the Five- year Programme	Obstacles	Challenges facing De- velopment
<ul style="list-style-type: none"> - Increasing the expenditures for R&D to 1% of the GDP; - Adoption and Development of advanced technologies for a competitive production of national commodities; - Joining the Science, Technology and Innovation Strategy for Africa (STISA); - Upgrading the production of local materials and the technical capabilities for developing manufacturing technologies. 	<ul style="list-style-type: none"> - Less than 0.3% as the total share of expenditures on R&D per GDP, and a very low share of the private sector in total R&D spending; - Increasing awareness of total quality management in higher education and R&D organizations; - Failure to utilize Sudanese expertise in climate change mitigation and adaptation; - GIAD Industrial Group²⁰ undertakes efforts to develop engineering industries and capacities (vehicles and electronics); - Low ranking in the Global Innovation Index (GII); - UNIDO and Japan give technical assistance to the soybean value chain. 	<ul style="list-style-type: none"> - Absence of a national vision towards STI; - Fragmentation of the national innovation system (NIS), while R&D programmes lack coordination; - Evidence-based decisions are lacking, what is affecting the overall research output; - Absence of a vision that mobilizes global and local expertise; - Fragile technology transfer policies to support productive sectors. 	<ul style="list-style-type: none"> - Provide an enabling environment for innovation and creativity; - Develop an STI vision to upgrade agro-industry and utilize engineering facilities to support agro-industry linkages; - Because of a very low rank in the Global Innovation Index (GII), the Sudan needs to improve on a great number of STI criteria and indicators; - Overcoming the negative impact of the US sanctions on the technological capacity of Sudan; - Maximizing the benefits from international and regional donors to support national technological capabilities, especially in agro-industry; - Brain Gain- Challenge.

Source: Developed by the author; data are from the UN Sustainable Development Goals, 2015, UN SDGs, and from GoS, Ministry of the Cabinet, 2015, The GoS 2015-2019 Five-year Programme of Economic Reform, Khartoum, Sudan.

Target 9.5 stresses the need to encourage innovation and to increase substantially the number of research and development (R&D) workers per 1 million people and

²⁰ See on the activities of the GIAD Industrial Group: <http://www.giad.com/en/>

public and private research and development (R&D) spending. How relevant is this concept in regard of meeting the requirements for growth in the LDCs? The R&D sector and the final goods-producing sector are not interlinked in LDCs because R&D activities are carried out only in public institutions, not in private firms. The public institutions do not cooperate in a meaningful way with private firms. Private sector firms cannot afford the relatively high cost of doing research. So, the task of R&D is taken by public research centres, but with limited effect on products of private firms.

From table 10 it can be noted that efforts were not sufficient to encourage innovation capacities and the accumulation of technological capabilities by raising the share of public and private R&D expenditures related to GDP. A rise of the ratio and a better coordination of private and public actors on R&D would help in identifying the society needs and in translating the local technical capacities into products and services. It is necessary to support initiatives that focus on innovative ventures and the cooperation among producers, R&D organizations, and industrial and agricultural sectors.

While we explore the case of Sudan regarding the first 5 targets of SDG 9 (9.1 – 9.5), we consider the other three targets (9.A, 9.B and 9.C) as the targets which are communicated to world donors and to responsive internal development agencies. Of course, the responsibility is laid on developing and least developed countries to enhance their capacities for negotiation and for winning and utilizing the global assistance provided by the donors.

6 Conclusions and Policy Implications

In this chapter we have focused on SDG 9 targets to illustrate the critical importance of capital and institutions to promote industrialization and manufacturing that create job opportunities and sustain economic growth. Focus is on agro-based industries in Sudan as the country is endowed with human and natural resources to become part of national, regional, and global agro-industrial value chains. This chapter has attempted to identify the status of SDG 9 and its interconnected pillars that are expected to play a highly significant and continuing role in implementing and achieving the SDGs. In this chapter, we focus specifically on reviewing the sustainable development literature related to economic growth and structural change, and we contrast the SDG 9 targets 1 to 5 with the most recent economic reform programme of Sudan for the years 2015-2019. It is argued that SDG 9 gives guidelines for a new economic policy approach to improve innovation and infrastructure, to raise the labour efficiency of the workers and farmers, and to facilitate the private sector to lead the agricultural and manufacturing sub-sectors.

Our conclusion is that although Sudan has some institutions to promote science & technology (S&T) and innovation policies, a number of constraints are identified which prevent an effective work of these institutions: these institutions

are affected by poor governance and weak linkages; there is a lack of connections between R&D organizations and the industrial sector; key economic sectors, such as agriculture, agribusiness and agro-industries, were neglected by the public R&D sector; and, even large companies are not strong in terms of in-firm R&D because of high cost and lack of support from government. SDG 9 proposes guidelines for an integrated strategy to link innovation and infrastructure with industry development.

Given these findings in the chapter, some policy recommendations that emerge are presented below:

1. Building a political consensus to develop agro-industries based on coherent policies and frameworks to support agribusiness in a long-term vision. A political consensus between producers, processors, consumers, researcher, policy-makers, and administrators should be envisaged.

2. Promoting innovation, science and technology policy aiming to support agro-processing and developing those commodities which have a probability to compete on the regional and international markets. There is a potential to support commodities which can capture larger market shares.

3. Restructuring industrial policy to support the agro-industry sector by developing agribusiness and by transforming SMEs and industrial incubators into technological and industrial clusters. A new industrial policy should have clear policy objectives and a toolkit of instruments to implement policies.

4. Reforming education/training, trade, and investment policies so that the Sudan can overcome its lack of an absorption capacity, especially for direct investments towards key productive sectors, like manufacturing, agriculture, agribusiness, and agro-industries. The technological absorption capacity is a determinant of inclusive growth and sustainable development.

5. Improving public-private partnerships, private sector associations, professional societies, and farmers' cooperatives. This strategy for collaboration would help in developing value chains of agro-industries to supply higher value-added products for domestic, regional and global markets.

6. Strengthening science and technology (S&T) policy to improve the innovation capabilities in agro-industries sub-sectors toward realising the sustainable development goals (SDGs). Connecting R&D organizations better with industries is a necessary precondition for the development of targeted interventions that realize the full potential of innovation for sustainable development.

7. Facilitating the private sector's industrial upgrading and diversification. Government could prioritize and facilitate the innovation and extension of agricultural technology and the improvement of infrastructure for agricultural and industrial production.

8. Developing the patents system toward sustainable development and the methods of granting intellectual property (IP) protection in a way that considers all stages of the innovation and technological transfer process is a great task to

create competitive and innovative conditions in the private sector. Focussing in the patents system just on the quantity of patents to improve the innovation ranking is not enough.

9. Adapting an unbalanced growth strategy by focusing on specific industries that already have linkages with other economic sectors and with the R&D system may be a first step towards re-industrialization. It is recommended that Sudan follows a step-by-step strategy in developing agro-industries towards higher complexity and increasing value-added. There are constraints on productivity growth in the agro-industry, which can be overcome, including a lack of innovation capacity, an incoherent strategy and policy, and a gap in industrial infrastructure. Only by removing these constraints a transition from the level of marketing primary commodities to the level of higher productivity value chains may be successful, and the removal of those constraints could induce a larger structural shift in the future.

10. Introducing institutional reforms to ensure better coordination between and complementarity among institutions. There is a need for collaboration among key institutions and for strengthening management capabilities in the R&D sector, especially also for all the institutions of importance for a dynamic development of the agro-industries.

References

- Abdalla, S. and Mohamed, K. (2010). Water Policy of Sudan: National and Co-Basin Approach, Ministry of Irrigation and Water Resources, Sudan. Regional Centre on Urban Water Management/RCUWM. Tehran.
- AfDB Group/African Development Bank Group (2019), Socio Economic Database, accessed in November 4th, 2019, and available at: <http://com-stat.comesa.int/wiqcbkg/afdb-socio-economic-database-1960-2019#>
- Ahmed, Medani M., 2010, Global Financial Crisis Discussion Series Paper 19: Sudan Phase 2, February 2010, 50 pages, Overseas Development Institute (ODI), London, UK; see online: <https://www.odi.org/files/publications-opinion-files>
- ASTI/Agricultural Science and Technology Indicators, Agricultural R&D Indicators Factsheet, December 2013; access online: <https://www.asti.cgiar.org/pdf/factsheets/Sudan-Factsheet.pdf>
- Balassa, B. (1977). "Revealed" Comparative Advantage Revisited: An Analysis of Relative Export Shares of the Industrial Countries 1953-1971. The Manchester School, 45, pp. 327-344.
- Central Bank of Sudan (CBoS), 2017, Foreign Trade Statistical Digest; access online: <https://cbos.gov.sd/en/publication-type/foreign-trade-statistical-digest>
- Central Bank of Sudan (CBoS), annual reports (various issues); Access: <https://cbos.gov.sd/en/publication-type/annual-reports>

- Central Bank of Sudan (CBoS), April 2014, Sudan Annual Economic Indicators, Issue 3, Vol. 55; Access: <https://cbos.gov.sd/en/publication-type/economic-and-financial-statistic-review>
- GoS/Government of Sudan, 2015, The 2015-2019 Five-year Programme of Economic Reform, GoS, Ministry of Cabinet, Khartoum, Sudan
- GoS/Government of Sudan, 2017, Progress report on the 2015-2019 Five Year Economic Programme, Ministry of Finance, Khartoum, Sudan
- Hassan, Nadia, 2017, unpublished PhD thesis: "Determinants of Technological innovation in Developing Countries and the Relevance of Innovation Concepts", Karary University, Omdurman, Sudan
- Kormawa, P. M., Wohlmuth, K. & Devlin, J. 2012. Agribusiness for Africa's Prosperity. Country Case Studies. Working Paper. Second Edition. April. Vienna, United Nations Industrial Development Organization (UNIDO). Available at: https://www.unido.org/sites/default/files/2012-09/AAP_CCS_v4_0.pdf
- Lewis, W. A. (1955). The Theory of Economic Growth, Homewood, Illinois: Richard D. Irwin, Pp 453.
- Lin, J. Y. (2011) "New structural economics: A framework for rethinking development", The World Bank Research Observer, Volume 26 (Issue 2), August 2011, pages 193–221.
- Lin, J. Y., 2012, New Structural Economics, A Framework for Rethinking Development and Policy, Washington D.C.: The World Bank; Access: siteresources.worldbank.org/DEC/Resources/84797.../NSE-Book.pdf
- Lin, J. Y. and Monga, C. (2010). Growth Identification and Facilitation, The Role of the State in the Dynamics of Structural Change. Policy Research Working Paper 5313. World Bank, Development Economics, Office of the Vice President. Washington, D.C., May 2010; Access: <http://documents.worldbank.org/curated/en/438321468164948980/Growth-identification-and-facilitation-the-role-of-the-state-in-the-dynamics-of-structural-change>
- Lin, J. Y. and Treichel, V. (2014). Making Industrial Policy Work for Development. Pp 65, Chapter 2, In: Jose M. Salazar-Xirinachs, I. Nübler, and R Kozul-Wright, Transforming Economies, Making industrial policy work for growth, jobs and development, Geneva: International Labour Office, Geneva: International Labour Organization (ILO), First Edition 2014. Access: https://www.ilo.org/global/publications/books/WCMS_242878/lang-en/index.htm
- Lin, J. Y. and J. Xu, 2016, Applying the Growth Identification and Facilitation Framework to the Least Developed Countries: The Case of Uganda, United Nations, Department of Economic & Social Affairs, Committee for Development Policy/CDP Background Paper No. 32, ST/ESA/2016/CDP/32, June 2016; access: <https://www.un.org/development/desa.../publication/C...>

- McMillan, M. and D. Rodrik (2011). Globalization, Structural Change and Productivity Growth. Pp 49-84, In: M. Bacchetta and M. Jansen, Making Globalization Socially Sustainable. Geneva: International Labour Organization (ILO) and World Trade Organization (WTO). Access: https://www.wto.org/english/res_e/booksp_e/glob_soc_sus_e.pdf
- Mijiyawa, Abdoul' Ganiou, 2017. Drivers of Structural Transformation: The Case of the Manufacturing Sector in Africa, In: World Development, Elsevier, vol. 99(C), pages 141-159.
- MOHE/Ministry of Higher Education and Scientific Research, The Scientific Research and Innovation Commission (SRIC), April, 2019; access: <https://fundit.fr/en/institutions/ministry-higher-education-and-scientific-research-sudan-mohe>
- Ministry of Industry/MOI, 2005, Comprehensive Industry Survey, issue 3, March 2005, Government of Sudan/GoS, Khartoum, Sudan.
- Ministry of Industry/MOI, 2019, Government of Sudan/GoS, Khartoum, Sudan; online access: <https://sudandaily.org/en/2019/09/15/sudans-ministry-of-industry-denies-ban-on-the-import-of-cosmetics/Ministry>
- Monke, Eric A. and Scott R. Pearson (1989). The Policy Analysis Matrix for Agricultural Development. Outreach Program, Ithaca: Cornell University Press. Online Access: https://www.cepal.org/default/files/courses/files/03_3_pambook
- Nour S. (2011a), Labour Market and Unemployment in Sudan, UNU-MERIT Working Paper Series 2011- 007, Maastricht University, Maastricht, 48 pages; Online Access: <https://www.merit.unu.edu/2011/wp2011-007>
- Nour, S. (2011b), Assessment of industrial performance and the relationship between skill, technology and input-output indicators in Sudan, Working Paper Series 2011-030. UNU-MERIT, Maastricht University, Maastricht, ISSN 1871-9872; Available from: <https://www.merit.unu.edu/publications/working-papers/abstract/?id=4428>
- Romer, Paul M. (1987), Growth Based on Increasing Returns Due to Specialization, in: The American Economic Review, Vol. 77, No. 2, Papers and Proceedings of the Ninety-ninth Annual Meeting of the American Economic Association, May 1987, pp. 56-62
- Romer, P. M. (1990), Endogenous technological change, in: Journal of Political Economy, Volume 98, Number 5, Part 2, pp. 71-102
- Sidahmed, Abdel Salam & Alsir Sidahmed, (2005), Sudan: The Contemporary Middle East, London/New York, Routledge, 2005, 180 pp., electronic source; see info: https://trove.nla.gov.au/work/11334429?q&sort=hold-ings+desc&_id=1571588020025&versionId=217708143
- Stiglitz, J. E., J. Lin, C. Monga, and E. Patel (2013) Industrial Policy in the African Context, Washington, D.C., Policy Research Working Paper 6633, The World Bank. Development Economics Vice Presidency, Office of the Chief Economist, September 2013 <http://documents.worldbank.org/curated/en/443841468002407129/Industrial-policy-in-the-African-context>
- Sudanese Industrial Chambers Union, National Industry Survey, 2009

- The World Bank, World Development Indicators Database; access: <https://data-bank.worldbank.org/source/world-development-indicators> and: <http://datatopics.worldbank.org/world-development-indicators/>
- The World Bank, Data Sudan, 2017; online access: <https://data.worldbank.org/country/sudan>
- The World Bank, Overview Sudan 2018; online access: <https://www.worldbank.org/en/country/sudan/overview>
- The World Bank, Science & Technology Data, 2019; online access: <https://data.worldbank.org/topic/science-and-technology>
- UN/United Nations, Sustainable Development Goals, 2015, Agenda 2030 for Sustainable Development, United Nations, website accessed in 2019; access for download: <https://sustainabledevelopment.un.org/?menu=1300>
- UNIDO. 2009. Industrial Development Report 2009. Breaking In and Moving Up. New Industrial Challenges for the Bottom Billion and the Middle-Income Countries. Vienna, United Nations Industrial Development Organization. Access: https://www.unido.org/sites/default/files/2009-02/IDR_2009_print_0.PDF
- Yagoub, E., 2016, Analysis of recent industrial policies on the new structural economic framework: the way towards economic transformation. In: *Journal of Behavioural Economics, Finance, Entrepreneurship, Accounting and Transport* 4(3), August 2016, pages 76-80; available from: https://www.researchgate.net/publication/322819775_Analysis_of_recent_industrial_policies_on_the_new_structural_economic_framework_the_way_towards_economic_transformation
- Yagoub, E., 2019, On the Priorities of Comparative Advantage of Agro-industry Commodities: the way towards Economic Transformation. In: *Research in Business and Management*, ISSN 2330-8362, 2019, Vol. 6, No. 1, pages 13-47; access: www.macrothink.org/journal/index.php/rbm/.../14377

Improving Electricity Access in Africa using Decentralised Solar Photovoltaic Systems: The Case of Urban Lagos, Nigeria

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1 Introduction

As the continent with the largest number of people and with the least electricity supply and access, Africa faces the twin challenge of increasing electricity access and supply for its citizens while limiting carbon emissions. For Nigeria, this challenge is evidenced by the low per capita electricity consumption of 144 kWh/per capita compared to 5,129 kWh/per capita in the UK or even 4,198 kWh/per capita in South Africa (World Bank, 2019). This low-level grid electricity access and the inadequate electricity supply to end-users have hindered socio-economic growth. Also, the overreliance on conventional fuels and combustible energy sources poses an environmental threat to the health and safety of the citizens.

This study focuses on the Sustainable Development Goal 9 but also aligns with the SDGs 7, 8, 11, 12 and 13. The focal point of this study is on SDGs 7 and 9. SDG 7 is geared towards significantly raising the global share of renewable energy sources (RES). To achieve this, it is targeted that by the year 2030, universal access to affordable and cleaner energy sources should be the norm particularly for less developed countries. It is further targeted that by 2030, international co-operation on cleaner energy research and technology and on energy efficiency be encouraged. In addition, SDG 7 has the target to expand the energy infrastructure for distributing energy services such as electricity in developing countries, in line with the concerned nation's programmes of support.

Similarly, SDG 9 is aimed at facilitating the development of sustainable infrastructure (including electricity) through increased financial support (via affordable credit) and of technological innovation for less developed countries (in Africa). On this background, SDG 9 specifically targets that by 2030 in addition to increases in small-scale industries there should be upgrades to existing energy infrastructure and retrofit industries to make them more sustainable. Regarding Nigeria, the retrofit industries that could be of focus with a high potential for collaboration include the solar PV cell and module sales, marketing and manufacturing industry

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and the building construction industry. Collectively, SDG 7 and 9 target that by the year 2030, the use of RES in countries like Nigeria should have increased meaningfully to reflect this expected diversity in the national energy mix. Investments in solar PV technologies will enable this to quickly materialise. Through learning-by-doing and learning-by-using, the industries involved can gain a good share of the market by being early entrants.

Using Lagos State, Nigeria as a case study, this report investigates the factors hindering off-grid urban solar photovoltaic (PV) adoption. It addresses issues related to making electricity more affordable and promoting cleaner energy. In this way, the gap in power supply between the urban and rural areas in Africa can be reduced and living standards can be improved for citizens by the UN's target year of 2030.

In terms of industrialisation, small and medium enterprises (SMEs) are the largest job creators employing between 50-60% globally. It is reported that constraints by immature energy infrastructure in Africa impact firm productivity by as much as 40% (UN, 2018). As Nigeria's vision 20:2020 agenda and the target year of 2030 for SDG 9 initiatives draw closer, it is vital that domestic technology development is supported through a stimulating policy environment. Using modern energy technologies to advance the power sector in Nigeria has the potential to reduce inequality, and to boost manufacturing industries in innovative technologies, thereby creating employment particularly for the local workforce.

Such infrastructure investments will make communities and cities more sustainable through less environmentally polluting power generation and consumption, thus helping to mitigate climate change. These are responsible actions that align with SDG 7 through to SDG 13 which the African Development Perspectives Yearbook seeks to contribute towards. Essentially, the SDG 9 is vital to the vision to increase electricity access in Africa while improving supply through sustainable infrastructure investments.

This study contributes primarily to SDG 9 on innovation, industrialization, and infrastructure development. The study is structured as follows. The next section 2 opens with the status quo of electricity in and the energy scenarios for Nigeria and focusses also on the socio-economic and environmental implications. Section 3 touches on renewable energy policies in Nigeria and the conceptual background of technology adoption and the role of innovation studies. This is followed by the research methodology in section 4. Section 5 presents the analysis and the results. Section 6 is on the design of a PV promotion framework, following the levelized cost of electricity (LCOE) calculations. Section 7 concludes the study with suggestions for policy.

2 Status of power generation and consumption in Nigeria

For decades, electricity in Nigeria has been generated from a combination of thermal plants and large hydropower installations. Thermal plants generate a greater part of total electricity production while the remainder comes largely from hydropower (Aliyu et al. 2015). The national grid installed capacity in Nigeria is about 11 GW, with an operational size of approximately 6 GW (Adhekpukoli, 2018). The grid network regularly operates below capacity. This means that Nigerian households experience frequent power outage which they try to bridge by using petrol and diesel power generators. Nigeria is also rich in crude oil with crude petroleum sales representing over 75% of the government's revenue bringing in close to \$100 bn per year from 2011-2013 (Aliyu et al. 2015).

However, in recent years, the oil revenues have fallen due to the decline in oil prices to below \$100 per barrel for the first time since 2014. Also, the discovery of shale gas in the United States of America, which was Nigeria's largest export market (EIA, 2014), has resulted in a reduced source of revenue for the Nigerian economy. This revenue drop is another reason for the country wanting to divest from fossil fuels and moving to cleaner energy sources which are subject to lesser market fluctuations.

2.1 Electricity and energy poverty

Energy poverty can be defined as the inability of a household to meet its basic energy needs (Makdissi and Wodon, 2006). This basic energy needs include unhindered access to electricity for household demand and fuel for cooking purposes. Electricity and energy poverty are detrimental to human progress. Energy poverty is the reason behind the Government's, Non-Governmental Organizations (NGOs)' and donor agencies' support of increasing electricity access in developing countries. Energy poverty is determined by using single factor measures or multiple measures in order to categorise the degree of energy deprivation (Sanusi and Owoyele, 2016).

For the purpose of this report, the two most important metrics that indicate absolute energy poverty are the Minimum Energy Poverty Index (MEPI) and the Energy Development Index (EDI) used by the International Energy Agency (IEA²). The MEPI consists of five dimensions including electricity for lighting, use of appliances, and electricity for entertainment/education, communication, and cooking. Likewise, the EDI employs two indicators in its assessment which consist of household access to electricity and access to clean energy for cooking purposes.

What is apparent from both indexes is that energy poverty is linked to available, adequate, reliable and affordable supply. It is also obvious that energy poverty

² See on the role of IEA: <https://www.iea.org/>

does not distinguish between rural and urban locations. The rate of general energy poverty is high affecting most households in rural and urban locations. However, there is disparity between the levels of energy poverty in states and local government areas. For states or cities like Lagos, there is a lower incidence of electricity, fuel and energy poverty compared to states in the northern regions of Nigeria (Monyei et al. 2018; Sanusi and Owoyele, 2016), but in overall terms the supply is still inadequate.

Energy poverty is broadly grouped into two categories: Western-Urban and Developing-Rural. Thus, it affects all societies (Chidebell-Emordi, 2015). In Nigeria, urban energy poverty is not entirely a function of income. Rather, it is the result of the Government's inability to provide enough energy services for households. Given the presence of subsidies and the payment modes (part payment is allowed), urban households are generally able to pay for electricity which is supplied to their homes. Energy poverty is essentially a determinant of three household factors: income, energy prices, and energy efficiency of dwellings (Santamouris et al. 2013), but the term should also include grid supply efficiency as in the case of Nigeria.

For improved access and reduced energy poverty, electricity supply needs to improve to meet a Minimum Energy Poverty Line (MEPL) of 3,068 kWh per capita which is considered as ideal for households in Nigeria. MEPL is the minimum energy required to meet the subsistence needs of urban households per year (Chidebell-Emordi, 2015). Attaining this MEPL level would necessitate a shift from the current energy systems. For electricity supply and consumption, it would mean not only expanding the national grid infrastructure but doing so to ensure more efficient power transmission and distribution across the networks to reach households everywhere. In order to reach households in remote rural locations, there may be a need to have mini decentralised grids to serve these locations. Most importantly, it would demand a substantial investment in cleaner renewable electricity sources such as solar PV and concentrated solar power (CSP), managed centrally by an independent PV company to ensure transparency and efficiency. In this way, adequate monitoring and technical support can be easily provided when problems arise.

2.2 Carbon emissions prospect of Nigeria

As Nigeria experiences population growth and becomes more industrialised, energy use and carbon intensity will increase in like measure. It is therefore important to make key changes to keep the level of emissions low by investing in energy-efficient technologies and low carbon appliances for buildings, especially dwellings. A study that examined low-carbon development in Nigeria revealed that adopting a low-carbon path through to the year 2035 will reduce greenhouse gases (GHGs) emissions by 43% from 4,335 to 2,475 mt CO₂e (million tonnes of

CO₂ equivalent). Doing so is also expected to save 7% in investment costs (ES-MAP, 2013). The Nigerian government's allure to pursue a fossil-based development path is cost-related because fossil fuels technology appears cheaper in the short run. In the long term, renewable energy sources are more cost-effective. But to avoid "carbon copying", the development paths followed by advanced countries, it is imperative than the Nigerian government quickly begins to switch to RES. Having also ratified the Paris Agreement, incorporating RES in the national electricity mix is both timely and sustainable.

3 Renewable energy and electricity policies in Nigeria

The challenge of the Nigerian central power utility is that it frequently is operating under capacity, and the resultant load-shedding is widely known. Its persistence has led to the review of energy policies in Nigeria. The electric power sector reform in the early 2000s led to the introduction of selected policies in favour of RES, including the Renewable Energy Master Plan (REMP). REMP was introduced as a commitment to improve power supply by using renewable energy systems (Ozoegwu et al. 2017). It was through this restructuring of the energy policies and the energy sector that the role of RES for improving access and supply was first acknowledged. Realising the scale of the electricity sector challenge, the Nigerian Government now has a set target to generate 13 GW of electricity from solar PV by 2030, up from the present national capacity estimated at 1 MW (Aliyu et al. 2015).

Evidence shows that, as with many infrastructure projects, government support is required for solar PV adoption by the private sector. Government support, widespread private sector participation, and large-scale investments eventually lead to innovation diffusion (Sovacool, 2016).

3.1 Innovation diffusion theories

Theories and models deployed in PV diffusion studies from the consumers' standpoint are predominantly based on social psychological perspectives (Claudy et al. 2011). Fewer studies are embedded in economic principles (Sardianou and Genoudi, 2013). As an intention model, Ajzen's (1991) theory of planned behaviour or reasoned action is one of the most frequently cited one in technology adoption and innovation discourses. The theory of planned behaviour proposes that attitudes (such as, perceived reputation of utility suppliers), subjective norms (e. g. concern for environment), and perceived control (e.g. technology affinity), drive behaviour. Attitudes, norms, and perceived control impact intention and subsequently behaviour (Leenheer et al. 2011).

The economic model is founded on the classical economic principle of utility and centred on rational choice. It assumes that, given capital constraints, consumers make consumption decisions based on least cost and welfare maximisation (Sardianou and Genoudi, 2013). It further views the performance of any purchase behaviour as a reflection of an individual's underlying needs. This need is driven by the quest to maximise the satisfaction gained from consuming a product or service. As a result, for any demand for a good or service, there is a conflict with an alternative good or service, as the scarce financial resource face stiff competition from both desired goods (Sardianou and Genoudi, 2013).

3.2 National and firm-level innovation diffusion theories

Studies have shown that the hindrances to the adoption of a novel technology and innovation occur in relation to government policy miscalculation as well as the firm level resistance (Lüthi, 2010). Often the major barrier to the diffusion of an innovation at the national and firm level is the dominant design. The reason for this is that current technologies that have existed for decades or even a millennium are already established, making it difficult for a shift to novel, more sustainable technologies with greater benefits (Sovacool, 2009). This is the case in all kinds of innovative technologies including telecommunications. The old landline telephone technologies used pre-1980s were stable and locked-in (Unruh, 2000) until the advent of mobile telephones.

Therefore, hindrances to the diffusion of PV arise from scale economies, path dependency, and policy inertia (Lüthi, 2010). Carbon lock-in is the chief reason why the diffusion of PV has been slow, despite of the fact that over 50% of the consumers have shown preference for renewables in many locations (Kaenzig et al. 2013). In addition, organizations or utilities will usually resist or reject new radical technologies that they perceive to be disruptive (Sovacool, 2009). This is because institutions have huge influence on the path on which an innovation follows (Sovacool, 2009). The influences exerted by power-wielding actors in many institutions have considerable impact that hinders the diffusion of novel technologies (Foxon and Pearson, 2008).

When institutions struggle to promote a new technology because of path-dependence and when the new technologies are hurriedly implemented, due in part to bounded rationality, circumstances leading to market failures may result. Therefore, market failure arises as a result of not properly implementing change. Market failures take place when energy prices do not take into full account the negative environmental and social costs of production. Market failures arise from concerns about knowledge spill-overs (the ease with which a new technology can be copied, leaving the innovators unable to reap the full benefits of their ideas) and negative externalities (Foxon and Pearson, 2008). This is the major reason why governments support novel technologies through research and development and incentive

policies, such as the highly successful Feed-in-tariffs (FITs) and the Renewable Portfolio Standards (RPS) system (Sovacool, 2016).

3.3 Renewable energy development opportunities for Nigeria

Nigeria has a late-comers advantage (Collier and Venables, 2012) because its electricity infrastructure is not as mature as that of advanced countries which was primarily founded on fossil fuels. It will be cheaper for Nigeria to switch to cleaner sources, avoiding paths followed by most advanced countries, now desperate to divest from fossil-fuels. Given the Vision 20:2020 agenda, if Nigeria continues to favour conventional fossil-based energy sources in the electricity, agriculture and transport sectors, the amount of atmospheric GHG emissions is predicted to double by the year 2035, adding over 11 billion tons of CO₂ to the atmosphere. Following a low-carbon development path in Nigeria would not only yield environmental benefits of cleaner air and better health quality, but also may result in net economic benefits to the tune of 2% of the gross domestic product (GDP) (ESMAP, 2013). It would also starve the world of 2.3 billion tons of CO₂ emissions over a period of 25 years. Most importantly, a more diversified electricity portfolio makes the nation stand to gain about 7% savings on the national energy expenditure. This is vital because half of the CO₂-abatement potential lies in the power-generating sector of Nigeria (ESMAP, 2013).

3.4 Manufacturing, PV innovation and investments in Lagos, Nigeria

The growth and development of the manufacturing sector in Nigeria was restricted by the oil boom of the 1970s. Before this time, manufacturing represented about 10% of total economic output (Nigerian Bureau of Statistics/NBS, 2015). The decades-long heavy reliance on revenues from crude oil export has meant that manufacturing had not moved beyond the traditional food and beverage, textiles and cement composition that it has always been (NBS, 2015). Until 2013, these three sectors dominated the manufacturing industries in Nigeria, albeit at a small-scale compared to the energy sector.

The sector that benefitted more during this period from the crude oil sales was the construction industry as many real estate development projects were carried out by the international firms that were largely involved using imported materials and human resources. Over the years, the construction sector has grown due to the rise in population and the demand for housing and real estate for businesses, creating opportunities for the local population. Between 2010 and 2012, average growth rate for the construction industry was 18% (NBS, 2014). This has impacted the development of service industries such as banks that give loan facilities to the

industry, and the metal, steel and wood industries that provide intermediate services to the construction industry. Presently, the industry has a larger proportion of local workforce than it once did.

In Lagos, few solar energy companies and SMEs have emerged with the plan to make profit while helping to lighten the electricity crisis through solar PV. Many of these businesses are involved in the importation of PV system components, manufacturing and assembly of some module kits, module sales, marketing and installation of PV for consumers. They have somewhat helped to create more awareness about the technical and long-term economic feasibility of using PV for electricity production in dwellings. Some of these PV companies, operating in Lagos, include Rubitec Solar in Ikeja, Lagos Proactive Technologies, and Solex Energy Services which focuses on solar street lighting projects. Details of their business activities can be found on their websites. These and few other SMEs, who are yet to have online presence, are contributing towards improving the power sector in Nigeria. This they presently do in the absence of government regulatory and monetary support. This implies that with some incentives and support policies, the PV market in Nigeria can be quickly transformed.

With the constantly rising electricity tariffs and petroleum product prices in Nigeria and the continued international decline of solar PV cell/module costs, fresh opportunities are created for the advancement of modern energy sources. The fall in global demand for Nigeria's crude petroleum products especially from its largest market - the USA - has the potential to spark a return to modern manufacturing. This presents opportunities for innovative electricity, like solar PV cell and module manufacturing, industries to be set up and supported on a larger scale. In the next section, the location and data collection methods for the analysis are discussed.

4 Research methods

4.1 The case study of Lagos

The urban area Lagos state, Nigeria, serves as the case study in this report. One of the primary conditions for choosing any energy system in every location is resource availability. Although most places in Nigeria are suitable for PV, the average solar intensity in Lagos ranges between 3.5-5.0 kWh/m²/day (Fadare, 2009), an ideal base for off-grid PV. Furthermore, at over 20 million people, the city of Lagos has the largest population in Nigeria. It was the former federal capital with leading infrastructural developments. It is the industrial and commercial centre of Nigeria, with about 60% of total industrial investments and foreign trade taking place in this coastal city. It also has the largest ports in Nigeria facilitating imports and exports of goods and services. As a central location, this metropolitan city's

gross revenue to the year end 2017 was \$136 billion, representing about 75% of national GDP (Financial Times, 2018). This has been made possible by the expanding manufacturing base and the ever-growing financial sector which is attracting private sector investments. Other more important factors for choosing Lagos as a location for study include the following: solar radiation intensity; high urban population and number of energy users; a diverse mix of people encompassing the affluent, the middle class and the poor; and a good portfolio of buildings, especially those suited to roof-top PV. In addition, Lagos is a coastal city which suits PV as the technology works best under a bit cooler temperature. Extreme heat affects PV performance and accelerates degradation. The solar radiation intensity of Lagos is therefore excellent for decentralised roof-top PV installations.

Plans to promote and increase local manufacturing have been in place in Lagos state since 2010 (Reuters, 2019). The manufacturing sector performance in Lagos has often surpassed those of other states and in the years 2001-2009 its contribution to the state's GDP was 23% (World Bank, 2011), making Lagos an excellent location for promoting solar power investments and other renewable energy sources. However, expected progress has not been made during this time as public-private sector joint participation and public-private partnership has been slow. To improve the situation, the Nigerian Government has announced its intention to increase the share of manufacturing to 20% of GDP with the aim to generate via project MINE (Made in Nigeria for Export) over \$30 billion yearly by 2025 for the economy (Reuters, 2019). The Nigerian government considers the manufacturing sector as important, especially given the decline in oil revenues in recent years affecting economic growth. Dwindling revenues mean that the economy needs to diversify promptly if it is to sustain its development.

4.2 The case for urban PV promotion

The study explores PV adoption barriers from the perspective of energy consumers in urban Lagos. It does not examine the hindrances in rural areas as this is well understood and covered in the literature (Sovacool et al, 2011; Crossland et al, 2015). The major problem with trying to promote renewable technologies, such as decentralised PV in rural areas, is that in addition to practical concerns as to how to reach the oftentimes remote areas are issues that can be described as mainly socio-cultural (Tillmans and Schweizer-Reis, 2011; Ahlborg and Hammar, 2014; Crossland et al, 2015). The beliefs, misbeliefs and unrealistic expectations of the rural population have made it challenging to diffuse these modern technologies in these locations. Technical knowledge of the systems is also lower for this group. To diffuse PV technology in rural areas would require a different approach, such as pay as you go (PAYG) solar or community systems.

The proportion of the urban population is also an important one. At a share of roughly 47%, the urban households' population in Nigeria is near the world's average of 53% (World Bank, 2015). This is advantageous for PV promotion purposes and energy efficiency initiatives. On its own, at 37%, Lagos state accounts for 80% of the total urban population of Nigeria (World Bank, 2015). This implies that it is a desired location for both rural-urban and urban-urban migration. It also means that electricity and total energy demand would be high in comparison to other parts of Nigeria, due in part to the prevailing rates of own-power generation. There is a link between higher energy demand and income (Sardianou and Genoudi, 2013).

Rural residents on the other hand are in majority low-income households, with most of them not able to afford solar PV, even solar home systems (<100Wp/Watt peak capacity), commonly used in rural areas in poorer countries (Jacobson, 2007). Most rural residents in Africa tend to be small-scale farmers who work for subsistence while relying on their families' residents living in cities and their transfers for remittances. In fact, some have argued, since rural dwellers use mainly biomass for cooking, that electricity is not an important option for them (Karakezi and Kithyoma, 2002). It is important but the costs of acquiring these modern power systems make it appear unimportant. As a result, the use of solar PV in most rural locations is primarily sustained by donor programmes, such as the Climate Investment Fund (CIF), the Global Environment Facility (GEF), and programmes by the World Bank (Gujba et al. 2012).

There are other socio-economic benefits of promoting solar PV manufacturing, SMEs, consumer uptake, and energy efficiency programmes through urban dwellers rather than the rural citizens. Urban dwellers would be expected to earn more and incur higher expense on such utilities than rural residents. Rising rural-urban and urban-urban migration is another case in point. Promoting PV and similar low carbon technologies in cities is proactive and will enable end-users to save costs on utility bills, cut government fuel and electricity subsidies, as well as saving costs of investments in energy infrastructure. Additionally, city dwellers and metropolitan households have been shown to be the more willing to pay for RES than rural residents (Soon and Ahmad, 2015).

It becomes clear that the adoption of PV by households in cities would help spread it to rural areas. An example of how this would happen can be seen from the mobile-telephone industry in Nigeria which took less than 10 years to reach the rural population. Today, people in rural areas make use of mobile phones and landlines in ways that would have been impossible prior to the advent of mobile phone technology. In the meantime, the best way to promote solar energy in rural locations would be through community PV systems. But this would require careful planning with technical teams situated nearby to deal with the daily operation and management of the system. This approach was successfully applied in Cuba (Jenny et al. 2006).

4.3 Survey design and data collection

Using mixed survey methods (questionnaires and interviews), qualitative and quantitative data were collected in Lagos, Nigeria. Following multi-cluster sampling, the questionnaires were distributed. This sampling method allows for the division and sub-division of a city into districts or clusters from which smaller areas can be obtained. This method was followed because of the geographically dispersed nature of Lagos and allowed for a wider reach. It is effective where there are many municipalities that present logistical challenge and have found application in green power promotion studies (Guo et al. 2014). Information collected from the Lagos State House of Assembly (LSHA) library and from the Nigerian Meteorological Agency (NIMET) led to the effective use of multi-stage cluster sampling. The LSHA directories were used to organise for studying the LGAs and municipalities. This approach resulted to a breakdown of Lagos State into 5 major districts known as IBILE which is an acronym for Ikeja, Badagry, Ikorodu, Lagos Island, and Epe (Lagos State Government, 2014). Through this approach, all the 20 Local Government Areas (LGAs) and most of the 37 Local Council Development Areas (LCDAs) were covered in the survey, accommodating energy consumers far and near. Furthermore, as part of the semi-structured and open-ended questionnaire design and the interviews, a description of a 5kWp PV module that could help meet most of the household energy demand was given. This description also gave the costs of this PV module size based on the quotes obtained from installers. The 5kWp PV module proposed was arrived at following an energy audit which was effectively carried out to ascertain the energy usage of the households to identify the suitable PV module size that would help meet the households' energy demand. Table 1 illustrates the energy audit for a typical home in Lagos. From this, a 5kWp PV module was considered ideal. For valuation purposes in this study, five different quotes were obtained from installers. Also, solar radiation data were obtained for Lagos using the RETScreen software. This helped to determine the annual output from a 5kWp PV module which was considered ideal. Often studies indicate system capacity of 3kWp as suitable especially where heating requirements are excluded from the PV device.

From the energy use audit, it becomes clear that a 5kWp system will meet at least 80% of the average household's demand. However, this will depend on the number, ratings and combination of appliances used in the dwelling. In fact, the proposed 5kWp system meets average power demand comfortably, leaving a good margin to accommodate the high starting power of refrigerators. Note that most listed appliances are non-continuous loads which mean that other smaller electronic devices such as mobile phones, tablets and radio can be easily accommodated. Also, if more energy-efficient appliances are used, the entire household demand would be met by the proposed system.

Table 1: Energy audit for a typical home in Lagos, Nigeria

Appliance	Unit	Power/Unit (Watt)	Power (Watt)	Hours in Operation	Daily Energy Requirement (Watt Hours)
Refrigerator	1	500	500	12	6,000
Freezer	0	500	0	24	0
Flat Screen TV	1	1,000	1,000	8	8,000
CD Player	1	30	30	8	240
Air Conditioner	0	1,100	0	12	0
Ceiling Fan	2	80	160	9	1,440
Standing Fan	1	80	80	9	720
Computers	2	240	480	8	3,840
Light Bulbs	5	60	300	8	2,400
Pressing Iron	1	1,000	1,000	1	1,000
Microwave	1	750	750	1	750
Blender	1	300	300	1	300
Washing Machine	1	400	400	3	1,200
Water-Pump (1/3 HP)	0	1,200	0	1	0
			5,000	25,890	

Notes: From the RETScreen data PV annual output computation: Available Energy in a Day=7843.39kWh/365days=> 21.49kWh Percentage Daily Availability = 21.49kWh/25.89kWh * 100 => 83%. HP for Horsepower (calculation). **Source:** Ugulu (2016)

4.4 Questionnaire and interview analysis

In general, two techniques were used in the questionnaire analysis. The first aspect involved the use of descriptive statistics such as frequency tables, contingency tables and cross-tabulation. This exercise was carried out to examine the data so to evaluate the opportunities for further analysis. Observed patterns were subjected to tests of significant relationships and differences resulting in the identification of further important trends. The second aspect of the questionnaire analysis involved the use of inferential statistics. Following normal distribution tests using Kolmogorov-Smirnov and Shapiro-Wilk normality tests, Spearman's Correlation analysis was used to check existing relationships, strengths, and the direction of relations. The tests were reported showing the correlation coefficient (r) and prob-

ability (p). The Spearman's Correlation analyses the association between demographic and socio-economic and technological factors impacting residential off-grid PV uptake.

4.5 Limitations of the methodology

As a study that focuses mainly on urban households and on those SMEs affected by electricity access and shortages, a grassroots approach was taken. Through semi-structured questionnaires and interviews the barriers to the adoption of decentralised solar systems was investigated. Using Lagos state, Nigeria, as a case study the relevant dependent and independent variables were examined, and the combined results were triangulated in the analysis. The advantage of doing this is that any shortcoming in one approach is complemented by the benefits in the other and vice versa. Such analytical approach yields more reliable results.

A key limitation of the applied methodology was that in addition to generating large volumes of data, it was time-consuming. Also, reaching the participants residing in different parts of the city presented some challenges. For these reasons, it is recommended that future research work in this field considers using focus groups with larger samples for data gathering.

5 Results

5.1 Descriptive statistics

Heads of households were asked to complete the questionnaire survey. From the 200 responses returned, 75% were men while 25% were women. Most of the respondents were between the ages of 31 and 44 years (53.5%). 29% were between 45 and 64 years; 14.5% were between 18 to 30 years, while 3% were 65 years and above. In relation to education levels attained, 85% had post-graduate education; 11% had an undergraduate degree; those with secondary education represented 3%, with 1% being the respondents with informal education. There was no significant gender difference in educational levels. Household size can impact the participation decision and total energy consumption. Small households of 3 or less represented 55% of the sample.

The income of the respondents was another variable of interest which could help to explain the response to domestic PV for power generation. The table 2 below details the average monthly income bands of the surveyed households.

Table 2: Income bands of the surveyed households

Income bands (£)/month	Percentage
Less than £330	14.3
£330-999	28.6
£1000-1665	25.5
£1666-3300	15.8
£3301-8000	10.7
£8000 plus	5.1
Total	100%

Source: Author

Overall, for a developing country, about 31% (£1666+ earners) of the respondents can be classified as medium to high income earners. It is important to note that most households in Nigeria have a secondary source of income.

Home ownership can impact willingness to pay for micro-power generation technologies. This was explored in the survey. About 36% of the sampled population reported owning their own homes. The remainder, i.e. 64%, reported renting their homes. Of this total, 25% were self-built and 10% were purchased outright from property developers and 1% was owned through mortgage. A higher proportion (63%) reported renting their homes. In terms of dwelling types, households who lived in duplexes and bungalows made up the second and third largest category in the property types, next only to households who lived in flats (53%). Thus, all other things being equal, a great number of the dwelling types is suitable for mounting solar PV modules.

5.2 Summary of identified barriers to PV adoption in Lagos, Nigeria

The Spearman's correlation results identified factors that impact PV uptake as including Social, Technical, Economic, Environmental, and Regulatory (STEER). The level of electricity received by a household can impact the PV adoption. The results indicate that the degree of power outages shares a negative correlation with PV investment decision. For example, households with more than 6 hours electricity supply per day were less likely to invest in PV than those with less than 6 hours daily. Likewise, lack of finance or fiscal incentives was found to impact adoption. The absence of or the lower the fiscal support incentives, the less willing householders are towards installing PV. This means that household concerns about the high initial cost of PV in the absence of financial support are a deterrent to the uptake. Other factors are tenancy type and the likelihood of moving home. Demographic factors were not as significant as the socio-technical and economic factors. Table 3 below details the major identified barriers and possible solutions.

Table 3: Summary table of the STEER barriers and some solutions

Dimension	Barriers	Solutions
Socio-cultural	Low level of PV awareness	Awareness creation through targeted education using all possible media platforms.
Technical	Improper maintenance culture	Scheduled cleaning of solar panels. Dust particles and bird droppings can affect PV performance
	Incompetent/dishonest PV installers	Create a certification programme monitored by an independent body
Economic	High capital cost and lack of finance	Providing low cost loans and leasing schemes
Environmental	Non-recognition and absence of reward	Government reward system e.g. through lower taxes
Regulatory	Lack of incentives and weak regulation	Munificent but well-designed incentive policies like feed-in tariff (FITs) can promote quicker diffusion

Source: Author

5.3 Motives and challenges identified from the interview results

Findings from the interview verified much of the questionnaire results. The significant socio-demographic characteristics identified in the Spearman’s correlation were age, income, education, and home ownership. The interview analysis resulted in some important findings regarding the major barriers to residential PV adoption. High initial cost, lack of finance, product quality concerns, perception on PV efficiency and use of energy saving appliances all validate the Spearman’s correlation result as key barriers. The supplementary barriers identified from the interview analysis, which were not revealed in the questionnaire correlation results, were: unskilled and dishonest installers, low level of awareness and poor PV maintenance culture, weak regulatory environment, and non-recognition and reward for adopting households.

Also, the adopters were not asked questions regarding house-move even though this appeared highly significant in the Spearman’s correlation. But, based upon the finding that home ownership was not an important predictor of uptake, it is plausible to expect that the effect of house-move in the adoption decision would be minimal. When asked how they could install PV on a property they were renting, the adopting tenants simply said that there were no objections and that their landlords were even happy about it. It is reasonable to expect that a tenant installing PV on the building they are renting signals to the landlord that they are staying in property for long guaranteeing rental income. The interview results also enhanced the questionnaire finding with respect to four key findings. It was found

that PV adoption is a function of its cost-effectiveness. Also, PV helps control fraudulent generator fuel use behaviour and enables owners to save costs. PV use in Nigeria has increased due to dealer adopters promoting their business and it was found that PV use can encourage energy conservation leading to more efficient energy use.

The final point above is important because of its implication for increase in access to the unconnected. The reason behind the energy conservation attitude identified from the interview was the cost of installing a sizeable PV and the efficiency limits of a PV module due to capacity factors. However, the interviewed PV users did not consider the energy management to be inconvenient or a hindrance. Rather, it pointed to the importance of managing scarce resources as only essential home appliances were connected to the PV as a means of conserving power. The users also pointed to how they have become more aware of the workings of electricity, when the PV users have never experienced before with grid-supplied electricity or private generator use.

The reason for this is that the central grid network in most countries is often located in isolated places outside the reach of residents. While logical, this has a major disadvantage. The “out-of-sight” nature of most central grid infrastructures would mean that citizens cannot easily see the links between their energy consumption and the emissions. This is simply because of the dispatch nature of grid-supplied electricity. However, with decentralised domestic solar PV, electricity and energy consumers become more involved with the production and consumption of energy, partly due to capacity margin factors and due to the intermittency of solar radiation. This is where increased understanding of electricity and energy demand is gained and what leads to energy use conservation.

In the next section, using the RETScreen and the power audit data, which are needed to identify the ideal PV size for a typical Lagos household, a model for faster diffusion of RETs is drawn up. First, the levelized cost of electricity (LCOE) breakdown is presented, comparing the cost differentials between PV use in Lagos, use of a diesel generator, and access to grid-supplied electricity.

6 The levelized cost of electricity (LCOE) approach to evaluate investment of solar PV systems and a framework for the faster diffusion of PV systems

In carrying out an economic evaluation of solar PV systems investment, various methods are used, including the net present value (NPV), the discounted payback time (DPBT), the internal rate of return (IRR), and the levelized cost of electricity (LCOE) approach. LCOE details the constant and theoretical cost of each kWh produced by an energy generation technology throughout its useful life (Branker

et al. 2011). In this way, LCOE helps to establish grid parity where this is uncovered from the cost comparison evaluation.

In this study, all the key STEER factors identified in the previous section as impacting PV adoption were considered. After weighing the findings, it was decided that power outages and cost be accorded the heaviest weight. For the same reason and because the tool is meant to be for grassroots, a more realistic yardstick reflecting earnings (see descriptive statistics) in Lagos, Nigeria was used as household income bands.

6.1 RETScreen data of annual PV yield in Lagos, Nigeria

RETScreen is the software used for the performance analysis of renewable energy and energy efficiency projects. It aids in determining the technical and financial viability of a clean energy project. Using this software, the total yield for a 5kWp roof-mounted PV system in a typical Lagos dwelling was computed.

Annual kWh Total for 1m^2 of PV unit = 1,735.56

Annual kWh Total for an array of 15,289kW PV system^2 = 7,843.39

6.2 The LCOE for a 5kWp PV

LCOE or Levelized Energy Cost (LEC) is a benchmarking tool. It is the net present value of the unit cost of electricity over the lifetime of a generating asset (Branker et al. 2011). As an assessment tool, the LCOE is used to compare power generation sources, especially PV systems. It aids in the assessment of the feasibility of energy investments to support policymakers on green energy promotion initiatives (Talavera et al. 2015). LCOE can further help in ascertaining the optimal quantities for variable or intermittent RES. Using RETScreen software data and the 5kWp PV system dimensions data from EMNI Sustainable Solar Abuja, it was shown that a 5kWp PV system in Lagos, Nigeria would generate 7843.39kWh/year at roughly 21.49kW per day. Also, the PV lifespan of 24 years used here in the LCOE calculations is consistent with other studies (Branker et al. 2011).

LCOE =
$$\frac{\text{Sum of costs over lifetime}}{\text{Sum of electrical energy produced over lifetime}}$$

$$\frac{\sum_{t=1}^n \frac{It + Mt + Ft}{(1 + r)^t}}{\sum_{t=1}^n \frac{Et}{(1 + r)^t}}$$

Where:

It: investment expenditures in the year t

Mt: operation and maintenance expenditures in the year t

Ft: fuel expenditure in the year t

Et: electrical energy generated in the year t

r : discount rate

n : expected lifetime of system.

Therefore:

It: 1,938,000 Naira³ (one-off investment expenditure) + 600,000 Naira (total cost of replacement of batteries every 8 years).

Mt: 20,000 Naira

Ft: 0

Et: 7843.39kWh/year

r : 10% (nominal); n : 24 years

In the absence of a reliable national discount rate (r), a 10% nominal rate (r) was applied to the calculation. To take every possible unique factor (e.g. year-on-year inflation, depreciation etc.) into consideration would require that the above project is calculated for every year for 24 years and summed up. Also, while maintenance cost of ₦20, 000 per year is used (as shown in the table on the next page), PV is largely maintenance-free. Detailed below are the LCOE for a 5kWp PV (table 4) and a 6.5kVA (Kilovolt-amperes for kVA) diesel generator (table 5).

Thus, LCOE for PV with a lifespan of 24 years = ₦29.78k/kWh. Note that the electricity tariff for domestic electricity in Nigeria during this period was ₦24/kWh (PHCN, 2015), making PV-generated-power to be near grid parity. It is known that PV has reached grid parity in many locations (IEA, 2014; Jung and Tyner, 2014). However, its cost advantage is dependent on the system staying fully functional for as long as advertised. Therefore, PV is only cost competitive if it remains functional for as long as marketed. There are reports of PV lasting up to 30 years (Branker et al. 2011), and so it becomes important for this to remain the case in every installation. From the RETScreen output, it was estimated that a 5kWp system in Lagos, Nigeria will generate 7,843.39kWh/year. This is a reasonable yield and is particularly important for energy efficiency reasons, that is, so as not to encourage overconsumption.

³ The Nigerian currency is represented by the symbol ₦

Table 4: LCOE for a 5kWp PV system at a 10% discount rate

LCoE For 5kW PV System @ 10% Discount Rate								
Year	Investment Expenditure $I(\text{Naira})$	Time value of $I = [It/(1+r)^t]$	Maintenance cost $M(\text{Naira})$	Time value of $M = [Mt/(1+r)^t]$	Fuel costs $F(\text{Naira})$	Time value of $F = [Ft/(1+r)^t]$	Electrical Energy Generated E (kWh)	Time value of $E = [Et/(1+r)^t]$
1	1,938,000.00	1,761,818.18	20,000.00	18,181.82	0.00	0.00	7,843.39	7,130.35
2	0	0.00	20,000.00	16,528.93	0.00	0.00	7,843.39	6,482.14
3	0	0.00	20,000.00	15,026.30	0.00	0.00	7,843.39	5,892.85
4	0	0.00	20,000.00	13,660.27	0.00	0.00	7,843.39	5,357.14
5	0	0.00	20,000.00	12,418.43	0.00	0.00	7,843.39	4,870.13
6	0	0.00	20,000.00	11,289.48	0.00	0.00	7,843.39	4,427.39
7	0	0.00	20,000.00	10,263.16	0.00	0.00	7,843.39	4,024.90
8	0	0.00	220,000.00	102,631.62	0.00	0.00	7,843.39	3,659.00
9	0	0.00	20,000.00	8,481.95	0.00	0.00	7,843.39	3,326.36
10	0	0.00	20,000.00	7,710.87	0.00	0.00	7,843.39	3,023.97
11	0	0.00	20,000.00	7,009.88	0.00	0.00	7,843.39	2,749.06
12	0	0.00	20,000.00	6,372.62	0.00	0.00	7,843.39	2,499.15
13	0	0.00	20,000.00	5,793.29	0.00	0.00	7,843.39	2,271.95
14	0	0.00	20,000.00	5,266.63	0.00	0.00	7,843.39	2,065.41
15	0	0.00	20,000.00	4,787.84	0.00	0.00	7,843.39	1,877.65
16	0	0.00	220,000.00	47,878.41	0.00	0.00	7,843.39	1,706.95
17	0	0.00	20,000.00	3,956.89	0.00	0.00	7,843.39	1,551.77
18	0	0.00	20,000.00	3,597.18	0.00	0.00	7,843.39	1,410.70
19	0	0.00	20,000.00	3,270.16	0.00	0.00	7,843.39	1,282.46
20	0	0.00	20,000.00	2,972.87	0.00	0.00	7,843.39	1,165.87
21	0	0.00	20,000.00	2,702.61	0.00	0.00	7,843.39	1,059.88
22	0	0.00	20,000.00	2,456.92	0.00	0.00	7,843.39	963.53
23	0	0.00	20,000.00	2,233.56	0.00	0.00	7,843.39	875.94
24	0	0.00	220,000.00	22,335.63	0.00	0.00	7,843.39	796.30
		$\Sigma=1,761,818.18$	$\Sigma=336,827.30$		$\Sigma=0.00$		$\Sigma=70,470.85$	

$$\text{LCOE(PV)} = 29.78/\text{kWh}$$

Source: Ugulu (2016)

Table 5: LCOE for a 6.5KVA (5 kWp) Gasoline generator set at a 10% discount rate

LCOE For 6.5kVA (5.2kW) Gasoline Gen set @ 10% Discount Rate								
Year	Investment Expenditure I(Naira)	Time value of I.= [It/(1+r)^t]	Maintenance cost M(Naira)	Time value of M.= [Mt/(1+r)^t]	Fuel costs F(Naira)	Time value of F.= [Ft/(1+r)^t]	Electrical Energy Generated E (kWh)	Time value of E.= [Et/(1+r)^t]
1	165,000.00	150,000.00	18,000.00	16,363.64	552,464.00	502,240.00	12,147.00	11,042.73
2	0	0.00	18,000.00	14,876.03	552,464.00	456,581.82	12,147.00	10,038.84
3	0	0.00	18,000.00	13,523.67	552,464.00	415,074.38	12,147.00	9,126.22
4	0	0.00	18,000.00	12,294.24	552,464.00	377,340.35	12,147.00	8,296.56
5	0	0.00	18,000.00	11,176.58	552,464.00	343,036.68	12,147.00	7,542.33
		<u>Σ=150,000.00</u>			<u>Σ=68,234.16</u>	<u>Σ=2,094,273.22</u>		
							<u>Σ=46,046.69</u>	

LCOE = 50.22/kWh

$$LCOE = [It/(1+r)^t] + [Mt/(1+r)^t] + [Ft/(1+r)^t] / [Et/(1+r)^t]$$

Source: Ugulu (2016)

6.3 LCOE for a 6.5kVA Diesel generator (Equivalent to a 5kWp PV module)

To reach useful conclusions, a LCOE comparison with diesel power generation was done.

$$LCOE = \frac{\text{sum of costs over lifetime}}{\text{sum of electrical energy produced over lifetime}}$$

$$\frac{\sum_{t=1}^n \frac{It + Mt + Ft}{(1 + r)t}}{\sum_{t=1}^n \frac{Et}{(1 + r)t}}$$

Where:

- It: investment expenditures in the year *t*
- Mt: operation and maintenance expenditures in the year *t*
- Ft: fuel expenditure in the year *t*
- Et: electrical energy generated in the year *t*
- r: discount rate
- n: expected lifetime of system.

Therefore:

It: ₦150,000 (one-off investment for a 6.5kVA gasoline generator) + ₦15,000 (cost of installation and labour)

Mt: ₦1, 500 per month (1,500 x 12months) = ₦18,000 a year

Ft: 2.2Liters per hour at full load. If the generator runs for 8 hours a day, then daily fuel consumption will be 2.2 x 8 =17.6L.

17.6 x 365 days = 6424L a year.

At the cost of ₦86 / L, it gives: 86 x 6424L = ₦552,464,00

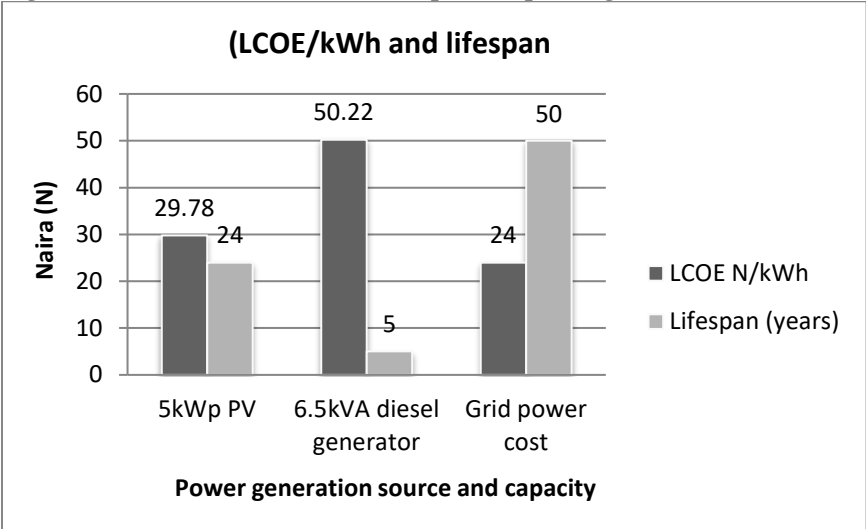
Et: If the generator runs for 8hrs every day and will run at 80% of its rated capacity (0.8 x 5.2kW = 4.16kW), then it generates 4.16kW x 8hrs (33.28kWh of energy/day). So, in a year it generates 365 days x 33.28kWh = 12,147kWh of energy.

r: 10% nominal

n: 5 years

Hence: LCOE for a 6.5kVA diesel generator = **₦50.22k / kWh**. Therefore, LCOE for an equivalent-sized diesel generator to the 5kWp PV module is ₦50.22k/kWh. This is about £0.20/kWh. Figure 1 below represents the scenario testing of the LCOE for a 5kWp PV and 6.5kVA diesel generator plus grid electricity costs/kWh and lifespan. Of the different power generation sources examined (PV, diesel generator, and grid power) PV has the least cost/kWh compared to diesel generation but is a little costlier than base-load electricity. While grid power has a longer lifespan, it is environmentally unsustainable.

Figure 1: LCOE of PV and other comparable power generation sources



Source: Ugulu (2016)

6.4 A framework for PV adoption decision-making and for faster diffusion of PV modules

To create a useful tool that can aid PV promotion, various key variables obtained from the questionnaire, the interview findings and the policy analyses were examined, and the most significant ones applied to the model (based on Ugulu, 2016). The selected variables include power outages (levels of grid-supply received), alternative sources (fossil and green power), including inverter use, electricity costs/kWh, income, awareness, PV sizes for different household groups, communal PV, financing, environmental consciousness, energy conservation and education, while annual/monthly solar PV yield was estimated using RETScreen data. The LCOE calculated from a 24-year PV lifespan (N29.78/kWh) was used to compare it with that of existing power sources. Using these measures, it was possible to draw up the model for rapid PV diffusion in the form of a verified framework for PV adoption and promotion. This model places no distinction on a specific group. It can be used by the Nigerian Government, by policymakers, and by PV designers. It can also be used by SMEs and directly by householders for PV adoption decision-making.

6.5 Applying the verified PV promotion model

In addition to assisting with creating more awareness of cleaner energy sources, the PV adoption and promotion decision-making framework is designed to allow the policymaker or user to choose an appropriately-sized PV module for electricity generation by factoring in relevant considerations such as the hours of daily grid-distributed electricity received, alternative electricity sources in use (such as inverters), energy consumption per month, income per month, and emissions concerns.⁴ For example, a household that says that they receive less than the average 6 hours per day of electricity in Lagos who seeks alternative energy sources could be taken through the steps on the left or right of the framework, depending on their answers to these questions. If for instance, they agree that they use less than 653kWh/month and spend over N29.78k/kWh for electricity received from the grid or using own-power generators, they can be offered PV as a better alternative. For the higher income earners on the N150,000-450,000/month wage, they should

⁴ The synopsis of the verified model framework can be received by the readers from the editors. Please send them an e-mail. It was too large to be reprinted here. The framework is useful for decision-making purposes. With Yes-No-Answers the decision-maker can proceed by selecting on various steps of decision-making. The framework is based on: Ugulu, A.I. (2016): The determinants of decentralized photovoltaic (PV) adoption in urban Nigeria and a verified model for rapid diffusion, Doctoral Theses, Heriot-Watt University, UK.

be shown a demonstration of how a 5kWp PV module is a more stable, cleaner, and cheaper alternative to diesel generators and grid-supplied electricity. For those who are not interested in outright purchase of the modules, they can be offered credit facilities in the form of low-cost loans with long repayment periods. For those on the lowest income band of N75,000 or less/month, they should be presented with support in the form of community PV systems via leasing schemes where they are charged on a pay as you go (PAYG) basis. Of necessity, it will be necessary to educate the potential adopters of the limits of PV power and why they need to shed non-critical loads (when not in use) for the optimal operation of the system.

6.6 Summary of results and analysis

In the designed PV adoption model, an estimate had to be used based on various parameters, but with a small margin for error. In the above model, the PV side (right) is analogous to the fossil-fuel side (left). This framework can be modelled using a computer programme to draw up an algorithm that will allow users to enter data such as costs of their existing electricity, income, and household size. It will then generate a suitable PV module for the potential adopter. In this way, anyone can find the model easy to apply. To ensure that the model operates in the intended manner, it was considered necessary to ‘test’ it. A total of 14 households from Nigeria participated in the trial. Of this number, 12 found it straightforward and easy to understand and to apply, while 1 household needed help occasionally, and the remainder did not understand it. Most of the households who participated in the ‘test’ have a university degree. It is interesting to find that a 5kWp PV system can meet almost all energy needs of many households. However, of necessity, the module needs to be properly designed, installed, and operated. Also, as an integral part of the PV installation, a competent but inexpensive load manager can schedule the appliances to come ON and OFF as required to manage the load requirement at any given time ensuring it fits into the 5KW window.

This report is proof that instigating rapid PV diffusion will require a “radical” approach, entirely different from paths previously followed. Regular and reliable electricity will enable households to move out of “light poverty” and “energy poverty” and to engage in economically useful and socially productive activities, as they live in cleaner environments. Aside providing fiscal incentives to make PV more appealing, there will be need for better regulation so that highly qualified technicians, high-quality materials, and high-quality installations will be the norm. Also, more consumer awareness needs to be created to increase PV uptake and to help positively change energy generation and consumption behaviour. This verified model will be mainly useful for non-liberalised electricity markets where public services are still centrally provided.

7 Conclusions and some policy recommendations

Promoting and investing in modern energy technologies would be necessary to eliminate the need for many people in rural locations to rely on fuelwood for cooking while lowering the rate of deforestation from wood felling. There is evidence that trees act as sinks for carbon emissions helping to remove them from the atmosphere. Aside the environmental risks of using primary energy sources such as fuelwood, there is also the health element as constant exposure to smoke and fumes from fuelwood burning, kerosene lamps and candles can cause ill-health, preventing citizens from making meaningful contribution to society.

From an economic perspective, the poor access to energy resources like stable electricity increases the costs of engaging in business, making industries less competitive. Some smaller businesses would be easily priced out of the market by the dominant ones who are more able to sustain their business using private power generators. An unfavourable business environment undermines economic growth and impacts employment. Regular electricity does not only create employment but also sustains it. This is more the case when that electricity is generated from novel sources like solar as SDG 7 targets that by the year 2030 a significant share of the energy portfolio comes from modern renewables.

As the SDG 7 targets that by 2030 more LDCs and developing countries should have embraced cleaner, more reliable energy sources, renewable, low-carbon, decentralised solar PV is one of the best modern power technologies to consider, especially for tropical countries with high solar intensity like Nigeria. Promoting PV by following the proposed strategy holds promise for Nigerian households irrespective of their earning power, when appropriate supportive regulatory and fiscal policies are introduced, implemented, and effectively monitored. Similarly, to encourage cooperation at the international levels as targeted in SDG 7, it would also be useful to seek collaboration with leading PV countries like Germany and China who have contributed greatly to lowering the costs of PV modules as well as to improve cell efficiencies over the course of few years.

The Nigerian policymakers can also learn from Kenya and Tanzania whose governments support led to the expansion of their PV market, making them leaders in the industry. In relation to SDG 9 which targets an increase in innovative small-scale enterprises by the year 2030, lending institutions would play a key role in the increased uptake and diffusion of decentralised PV in Lagos, Nigeria. Liaising in this manner would enable a faster upgrade of the energy infrastructure and related retrofit industries in the built environment which would stimulate better attitudes to resource use efficiency before the year 2030.

In addition to the subsidies that the government should apply to PV products and installation materials, the availability of low-interest credit

facilities would encourage households to install these electricity and energy systems knowing that they can easily repay without being put under pressure from the creditors. Investors (local and international ones) would also benefit by following the PV leasing schemes, generally referred to as part-worth utilities. Unlike the self-financing model, the leasing schemes are simply situations whereby the PV systems are owned by a third party or an independent investor who now installs and supplies electricity to residents and charges them for this in the same way as electricity from the grid is designed. But this time, the payments go to the suppliers who are the lease scheme operators. The advantage of this model is that the capital cost of installation is borne by the investor, allowing payment by instalments from the energy consumers/end-users. For donor agencies looking to support developing countries or LDCs, results-based financing or aid can be considered. This system rewards nations or regions when a set of predetermined results are achieved as part of the contractual agreement upon which the lending or aid is given. Adopting the above strategy would offer an enabling platform for clean energy resources to become more regular, reliable and affordable for the many households who struggle with energy poverty.

PV costs have significantly reduced due to global uptake and technological learning. Cities would be crucial in the transition to low carbon futures. Promoting PV technologies in cities will save expenditure on governments' subsidies and reduce energy infrastructure investments. Property developers and the house-building sector would be a key part of the transformation. This is how Japan grew its photovoltaic (PV) industry in the 2000s by allowing building designers and developers to liaise with PV installation businesses. Proper regulatory frameworks and enhanced administrative procedures would be needed to reduce bureaucratic hindrances. Likewise, improved tax administration systems are needed to encourage firms to invest and to pay their taxes. Political risks and uncertainty can be a hindrance to large scale investments, innovative measures, and long-term investment in the manufacturing sector, and so minimising this risk would be important to assure investors.

As the Nigerian and African governments seek to improve electricity supply to households, decentralised PV presents huge opportunities. Energy policy regulations and climate action plans, that take into consideration the building construction sector, would help to alleviate the burdens placed on the undersized national grid infrastructure. Unsuccessful grid expansion initiatives of the past three decades should be a constant reminder that efforts to raise electricity output through a defective system will always fail. Regarding the widespread household generator use, the Nigerian government can consider a "generator amnesty" where households who install PV and return the generators are rewarded. Finally, findings from this study should serve to encourage government agencies, the private sector and energy end-users to invest in PV instead of continuing to purchase expensive,

noisy and heavily polluting generators. While results are specific to Lagos, Nigeria, it would readily find application in similar cities in Nigeria and in African cities with comparable national power sector challenge.

References

- Adhekpukoli, E. (2018): The Democratization of Electricity in Nigeria. In: *Electricity Journal*. Access: <https://doi.org/10.1016/j.tej.2018.02.007>.
- Ahlborg, H. & Hammar, L. (2014): Drivers and barriers to rural electrification in Tanzania and Mozambique—Grid-extension, off-grid, and renewable energy technologies. In: *Renewable Energy*, 61, pp. 117-124.
- Ajzen, I. (1991): The theory of planned behavior. In: *Organizational behavior and human decision processes*, 50(2), pp. 179-211.
- Aliyu A.S, Dada J.O and Adam I.K. (2015): Current status and future prospects of renewable energy in Nigeria, *Renewable and Sustainable Energy Reviews*, 48, 336-346 <https://doi.org/10.1016/j.rser.2015.03.098>
- Branker, K., Pathak, M. and Pearce, J. (2011): A review of solar photovoltaic levelized cost of electricity, In: *Renewable and Sustainable Energy Reviews*, 15(9), pp. 4470-4482.
- Chidebell-Emordi, C. (2015): The African Electricity Deficit: Computing the Minimum Energy Poverty Line Using Field Research in Urban Nigeria. In: *Energy Research & Social Science*, 5, pp. 9–19.
- Claudy, M., Michelsen, C. and O'Driscoll, A. (2011): The diffusion of microgeneration technologies—assessing the influence of perceived product characteristics on homeowners' willingness to pay, in: *Energy Policy*, 39(3), 1459-1469.
- Collier, P., and Venables, A. (2012): Greening Africa? Technologies, endowments and the latecomer effect, *Energy Economics*, 34 (1), pp S75-S84. DOI <https://doi.org/10.1016/j.eneco.2012.08.035>
- Crossland, A., Anuta, O. and Wade, N. (2015): A socio-technical approach to increasing the battery lifetime of off-grid photovoltaic systems applied to a case study in Rwanda. In: *Renewable Energy*, 83, pp. 30-40.
- EIA/US Energy Information Administration, (2014). U.S imports from Nigeria of crude oil and petroleum products. URL: <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MTTI-MUSNI1&f=M> [Accessed 30/12/2015].
- ESMAP/Energy Sector Management Assistance Program (2013): Assessing low-carbon development in Nigeria: An analysis of four sectors. Edited by Cervigni, R; Rogers, J; Dvorak, I. A. A World Bank Study, URL: <http://documents.worldbank.org/curated/en/2013/01/17977719/assessing-low-carbon-development-nigeria-analysis-four-sectors#> [Accessed 01/02/2013].
- Fadare, D. (2009): Modelling of solar energy potential in Nigeria using an artificial neural network model, In: *Applied Energy*, 86(9), pp. 1410-1422.

- Financial Times (FT), (2018), Nigerian economy: Why Lagos works. Available at: <https://www.ft.com/content/ff0595e4-26de-11e8-b27e-cc62a39d57a0> [Accessed 10/03/2019].
- Foxon, T. and Pearson, P. (2008): Overcoming barriers to innovation and diffusion of cleaner technologies: some features of a sustainable innovation policy regime, In: *Journal of cleaner production*, 16(1), S148-S161.
- Gujba, H., Thorne, S., Mulugetta, Y., Rai, K. and Sokona, Y. (2012): Financing low carbon energy access in Africa, In: *Energy Policy*, 47, pp. 71-78.
- Guo, X., Liu, H., Mao, X., Jin, J., Chen, D., & Cheng, S. (2014): Willingness to pay for renewable electricity: A contingent valuation study in Beijing, China, In: *Energy Policy*, 68, pp. 340-347.
- IEA, (2014), *Technology roadmap: Solar PV energy*. IEA Publication, 2014.
- Jacobson, A. (2007): Connective power: solar electrification and social change in Kenya, In: *World Development*, 35(1), pp. 144-162.
- Jenny, A., López, J. and Mosler, H. (2006): Household energy use patterns and social organisation for optimal energy management in a multi-user solar energy system, In: *Progress in Photovoltaics: Research and Applications*, 14(4), pp. 353-362.
- Jung, J., & Tyner, W. E. (2014): Economic and policy analysis for solar PV systems in Indiana. *Energy Policy*, 74, 123-133
- Kaenzig, J., Heinzle, S., & Wüstenhagen, R. (2013): Whatever the customer wants, the customer gets? Exploring the gap between consumer preferences and default electricity products in Germany, In: *Energy Policy*, 53, pp. 311-322.
- Karekezi, S. and Kithyoma, W. (2002): Renewable energy strategies for rural Africa: is a PV-led renewable energy strategy the right approach for providing modern energy to the rural poor of sub-Saharan Africa? In: *Energy Policy*, 30(11), pp. 1071-1086.
- Krugman, P. R. and Obstfeld, M. (2003): *International Economics – Theory and Policy*, 6th edition, Boston et al.: Addison-Wesley.
- Lagos State Government, Nigeria. (2014): About Lagos, Available at: <https://lagosstate.gov.ng/about-lagos/> [Accessed 17/04/2019].
- Leenheer, J., De Nooij, M. & Sheikh, O. (2011): Own power: Motives of having electricity without the energy company, in: *Energy Policy*, 39(9), pp. 5621-5629.
- Lüthi, S. (2010): Effective deployment of photovoltaics in the Mediterranean countries: Balancing policy risks and return, In: *Solar Energy*, 64, pp. 1059-1079.
- Makdissi, P. and Wodon, Q. (2006): Fuel poverty and access to electricity: comparing households when they differ in needs, In: *Applied Economics*, 38(9), pp. 1071-1078.
- Monyei, C. G., Adewumi, A. O., Obolo, M. O. and Sajou, B. (2018): Nigeria's energy poverty: Insights and implications for smart policies and framework towards a smart Nigeria electricity network, In: *Renewable and Sustainable Energy Reviews*, 81(1), pp. 1582-1601.
- NBS/Nigerian Bureau of Statistics (2012): *Socio-economic statistics: Household survey*. Available at: <http://www.nigerianstat.gov.ng/nbslibrary/social-economic-statistics/household-survey> [Accessed 15/04/2012].

- NBS/Nigerian Bureau of Statistics (2014): Nigerian Construction Sector Summary Report 2010-2012, Available at: <https://nigerianstat.gov.ng/elibrary> [Accessed 17/07/2019].
- NBS/Nigerian Bureau of Statistics (2015): Nigerian Manufacturing Sector Summary Report 2010-2012, Available at: <https://nigerianstat.gov.ng/elibrary> [Accessed 17/07/2019].
- Ozoegwu C. G., Mgbemene C. A., and Ozor, P. A. (2017): The status of solar energy integration and policy in Nigeria. In: *Renewable and Sustainable Energy Reviews*, 70, pp. 457-471.
- PHCN/Power Holding Company of Nigeria (2015): Nigeria Electric Privatisation: Background. URL: http://www.nigeriaelectricityprivatisation.com/?page_id=2 [Accessed 10/01/2015].
- Reuters News (2019), Nigeria plans special economic zones to double manufacturing by 2025. Available at: <https://af.reuters.com/article/nigeriaNews/idAFL8N21S686> [Accessed 02/04/2019].
- Santamouris, M., Paravantis, J. A., Founda, D., Kolokotsa, D., Michalakakou, P., Papadopoulos, A. and Servou, E. (2013): Financial crisis and energy consumption: A household survey in Greece, In: *Energy and Buildings*, 65, pp. 477-487.
- Sanusi, Y. A. and Owoyele, G. S. (2016): Energy poverty and its spatial differences in Nigeria: Reversing the trend, in: *Energy Procedia*, 93, pp. 53-60.
- Sardianou, E. and Genoudi, P. (2013): Which factors affect the willingness of consumers to adopt renewable energies? In: *Renewable Energy*, 57, pp. 1-4.
- Soon, J. and Ahmad, S. (2015): Willingly or grudgingly? A meta-analysis on the willingness-to-pay for renewable energy use, in: *Renewable and Sustainable Energy Reviews*, 44, pp. 877-887.
- Sovacool, B. (2009): Rejecting renewables: The socio-technical impediments to renewable electricity in the United States, In: *Energy Policy*, 37(11), pp. 4500-4513.
- Sovacool, B. (2016): How long will it take? Conceptualizing the temporal dynamics of energy transitions. In: *Energy Research and Social Science*, 13, pp. 202-215.
- Sovacool, B., D'Agostino, A. and Bambawale, M. (2011): The socio-technical barriers to Solar Home Systems (SHS) in Papua New Guinea: Choosing pigs, prostitutes, and poker chips over panels, In: *Energy Policy*, 39(3), pp. 1532-1542.
- Talavera, D. L., Pérez-Higueras, P., Ruíz-Arias, J. A., & Fernández, E. F. (2015): Levelised cost of electricity in high concentrated photovoltaic grid connected systems: spatial analysis of Spain. *Applied energy*, 151, 49-59.
- Tillmans, A. and Schweizer-Ries, P. (2011): Knowledge communication regarding solar home systems in Uganda: the consumers' perspective. In: *Energy for Sustainable Development*, 15(3), pp. 337-346.
- Ueckerdt, F., Hirth, L., Luderer, G., Edenhofer, O (2013), Systems LCOE: What are the costs of variable renewables? In: *Energy*, Vol. 63, Pages 61-75.
- Ugulu, A.I. (2016): The determinants of decentralised photovoltaic (PV) adoption in urban Nigeria and a verified model for rapid diffusion, Doctoral Theses, Heriot-Watt University, UK.

- UN/United Nations (2018): Sustainable Development Goals: Knowledge Platform. Available at: <http://sustainabledevelopment.un.org/>. [Accessed: 22/12/ 2018].
- Unruh, G. (2000): Understanding carbon lock-in, In: *Energy policy*, 28(12), pp. 817-830.
- World Bank (2011): Country case study-Lagos State, Nigeria: Public Investment Management (PIM), Investment in infrastructure for a modern megacity. URL: <http://documents.worldbank.org/curated/en/799671468125679524/Lagos-State-Nigeria-PIM-investment-in-infrastructure-for-a-modern-megacity>, [Accessed 15/03/2019].
- World Bank (2015), Population in the largest city (% of urban population). URL: <http://data.worldbank.org/indicator/EN.URB.LCTY.UR.ZS/countries/1W-NG?display=graph> [Accessed 05/07/2015].
- World Bank (2019): Electric power consumption per capita, Available at: <https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=GB&view=chart>, [Accessed 17/02/2019].
- World Bank Report (2016): An assessment of the investment climate in Nigeria: The challenges of Nigeria's private sector, Available at: <http://documents.worldbank.org/curated/en/641551481520950285/Main-report>, [Accessed 10/02/ 2019].

Renewable energy consumption and economic growth in Cameroon

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1 Introduction

Cameroon is a developing country located in central Africa with a total population of 25 million. A huge proportion of this population is still suffering from energy poverty, because access to electricity in the country is rated at 61.4% (WDI, World Bank, 2019). In order to become an emergent country by 2035, the government of Cameroon has designed its strategy in “Vision 35”⁴, a document that forecasts the total GDP and the GDP per capita of Cameroon. In this document, the GDP is expected to grow at a rate of 9% between 2010 and 2035. Apart from the year 2015 when Cameroon registered a GDP growth rate of 5,6%, the economic performance of the three years 2016 - 2018 has been declining at the following rates: 4.5%, 3.5% and 3.8% (WDI, World Bank, 2019), which is far from the target of 9%. Besides, in the Intended Nationally Determined Contribution (INDC) which Cameroon has submitted to the United Nations (UN), its determination was to reduce greenhouse gas (GHG) emissions by 32% compared to the 2035 reference scenario, and this by supplying 25% of the total electricity generated (TEG) in the country from renewable energy (RE).

Energy is at the centre of nearly every major challenge and opportunity in the world today. Energy enhances investment, innovation and new industries which can create jobs and encourage growth in most economies of the world. Mitigating climate change and achieving sustainable development without sentencing the poor globally to perpetual poverty is the prime challenge of energy policy today (Harjanne and Korhonen, 2019). To achieve sustainable development and alleviate poverty in the world by 2030, the United Nations Organization (UNO) has put in place seventeen Sustainable Development Goals (SDGs). Whereas goal number 7

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⁴ See on Vision 2035 for Cameroon: [extwprlegs1.fao.org › docs › pdf › cmr145894](http://extwprlegs1.fao.org/docs/pdf/cmr145894)

is promoting clean and affordable energy, goal number 9 relies on building resilient infrastructure, promoting sustainable industrialization and fostering innovation. These goals are essential to developing countries like Cameroon because investment in infrastructure is crucial to achieving economic growth (Aschauer, 1989a and 1989b; Barro, 1990); it is therefore important to lay emphasis on SDG number 9 and its targets. About energy infrastructure and industrialisation, investment in public infrastructure sets the cornerstone for economic growth and development. So, we know: "Countries that invest more in public infrastructure have a competitive advantage for attracting economic activity" (Halstead and Deller, 1997; Palei, 2015). Infrastructure, industrialisation and innovation remain a great challenge for the development of African countries in the sense that businesses as the engines of economic growth and development use public infrastructure in their production processes in much the same way as labour or private capital. If the existing infrastructure is insufficient, business production will be hindered, thereby hindering economic growth and development. Energy as a central pillar in economic activities also needs to follow the process of innovation, being an element of SDG 9 too.

The entire world nowadays is facing global warming. This is mainly attributed to non-renewable energy consumption in the industrial and transport sectors, due to the significant release of greenhouse gases (GHGs). Since we cannot do without energy, renewable energy appears to be a solution. Renewable energy plays an important role in meeting the needs of a country in terms of sustainable development (Da Silva et al, 2018). The expansion and proper use of renewable energy should be given priority for sustainable development. Today, about one billion people still live without electricity, while hundreds of million people live with insufficient or unreliable access to it. At the same time, nearly 3 billion people cook or heat their homes with polluting fuels like wood or other biomass, resulting in indoor and outdoor air pollution which causes widespread health hazards (World Bank, 2018).

Regarding infrastructure, industrialisation and innovation, Cameroon is putting strategies in place to become an emergent country by 2035. The energy sector is an essential instrument for Cameroon's public authorities to meet this challenge. The country has great energy potentials for the development of renewable energies, such as wind, biomass, solar and hydro power, all of which exist in abundance. These resources make Cameroon an attractive place for renewable energy's investors. In fact, smart energy systems (SESSs) are founded on the idea of basing future energy systems on variable renewable energy sources (Lund, 2014). This means that production of energy from wind turbines, photovoltaic, solar thermal, etc. is the main source of energy in the system (Djorup et al., 2018). It is important to note that Cameroon is still facing energy poverty, given that it is one of those developing countries with a very low access rate to electricity. With a population of 25.22 million people in 2018, up from 17.46 million people in 2005 (INDC,

2015), the country has an average annual rate of population growth of 2.6%. As part of the 2035 Vision, the government of Cameroon aims to improve the access to electricity for people and for industries by quadrupling the generation capacity by 2035 to 6 GW; to increase the use of renewable energy in electricity production, especially in areas with difficult grid connections; and to make energy efficiency a national priority. This can only be made possible through investment in energy infrastructure and industrialisation, a reason why emphasis should be laid on SDG 9.

In view of the above, knowing the key Flagship Programmes which can boost Cameroon's economic growth and development, leading to the rapid transformation in accordance with Agenda 2063 of the African Union (AU)⁵, the objective of this empirical work is to study the causal relationship between renewable energy consumption and GDP growth in Cameroon. More precisely, the long-term and the short-term causality relation between renewable energy consumption and GDP growth in Cameroon during the period 1971 to 2014 is of interest, in order to show that investment in renewable energy infrastructure is at the heart of Cameroon's take-off. To achieve this objective, we will use the VECM (Vector Error Correction Model) modelling approach. The next section 2 presents the literature review on the energy and economic growth nexus. Section 3 embodies the specificities of energy development in Cameroon. The section 4 provides the overall methodology employing the VECM approach in the econometrics analysis which is followed in section 5 by the discussion of the results and findings of the research. Section 6 discusses policy recommendations, and section 7 gives the conclusions of the study.

2 Literature review

The economic theory on energy developments nowadays is mainly focused on energy transition, clean energy, the energy mix, and on energy and sustainable development (Azevedo et al., 2019; Markovska et al., 2016). To address the problem of sustainability and alleviating poverty in the world, the United Nations (UN) adopted 17 Sustainable Development Goals (SDG) to be reached over the period 2015-2030. Energy is related to many of these SDGs, not only to SDG 7 on affordable and sustainable Energy for All and to SDG 9 on innovation, infrastructure and industrial development, as the SDGs 7 and 9 relate also to such goals as decent jobs and income growth, combatting pollution and protecting ecosystems, making it central to many of the challenges and opportunities the world is facing (Büyükközan et al., 2018). Countries are unable to power up their development

⁵ See on the Agenda 2063 of the African Union: <https://au.int/en/agenda2063>

without a reliable supply of energy. The use of more renewable energy would similarly reduce Africa's economic vulnerability to the adjustable and rising prices of imported fuels. This is the reason why Aliyu et al. (2017) argue that energy efficiency and access to renewable energy for off-grid, small scale applications are key to a successful resolution of the energy crisis, for sustainable development, and for fighting climate change and alleviating poverty.

Energy security is a key factor in alleviating poverty (OECD/IEA, 2010), and that is the reason why access to renewable energy for off-grid and small-scale applications is debated now in developing countries. The objective of the United Nations Sustainable Energy for All initiative (SE4All)⁶ is to provide electricity by 2030 to the 1.1 billion people in developing countries who hitherto lack access. Knowing that it is mainly in the rural areas that access to energy is still very low, mini-grids play a crucial role in accomplishing the SE4All's goal, because access to electricity brings benefits to households (Peters et al., 2019) and because the cost per connection is high in grid roll-out programmes, especially in sparsely populated areas (IEA, 2010; Bos et al., 2018). And, mini grids, because of the distributed nature of wind and solar energy installations, enable local communities to become energy providers, disrupting the power of centralized major power utilities and providing a source of local income (as highlighted by Harjanne and Korhonen, 2019). All this means that a good energy policy needs to be at the heart of every nation for its development; this is a major reason why developing economies should pay great attention to SDG 7 and to SDG 9.

Addressing the fundamental problems of renewable energy expansion in the market, it has been proven that renewable energy consumption is suitable for sustainability (Aliyu et al., 2017) and creates more job opportunities than conventional energy production. However, renewable energies need to be subsidized for some time to compete with non-renewable energies (Lund, 1999). For the last fifteen years, the costs of producing electricity from renewable sources have decreased by at least 50 per cent. Yet, renewable energies are still expensive when compared to fossil fuels that have long been existing and that have the advantage that the costs of their installed infrastructures have been amortised. So far, the introduction of renewable energy has to a large extent been provided through feed-in tariffs and other comparable schemes (Djørup et al., 2018). These schemes are often referred to as subsidies, implying that they are temporal necessities until renewable energy technologies mature (what is already the case in developed and emerging economies). Furthermore, Djørup et al. (2018) argue that the feed-in tariffs currently fill the gap between long term production costs and market prices which are derived from short term marginal costs. This gap seems to be a lasting condition at least while the transition proceeds over the next 3-4 decades.

⁶ See on the United Nations Sustainable Energy for All initiative: [tps://www.seforall.org/](https://www.seforall.org/)

On the other hand, some studies have examined the interaction of renewable energies expansion and oil price developments. The findings of these studies show that with high hydrocarbon prices there is an improved position of renewable energy sources (Bird et al., 2005; Van Ruijven and Van Vuuren, 2009; Reboredo, 2015), whereas low oil prices have the opposite effect. In addition, Da Silva et al. (2018) pointed out that the wealth of a country plays a significant role in determining the use of renewables. A higher level of income means a higher potential or more resources to foster renewable energy (RE) growth. Larger income allows countries to handle the costs of developing RE technologies and is guaranteeing higher support for the costs of public policies in promoting and regulating renewables. That is the reason why Aliyu et al. (2017) concluded that energy efficiency and access to renewable energy for off-grid, small scale applications are the key to a successful resolution of the energy crisis, to sustainable development, and for fighting climate change.

The central role of energy in the production process is now known in the economic theory. Basically, classical and neo-classical economists do not directly integrate energy as a factor of production in the production process (Alam, 2006). These authors focus mainly on labour and capital. Adam Smith, for instance, stated that the value of a good depends only on the amount of work needed to produce it. It is in 1865, due to the work of Stanley Jevons on the impact of coal depletion on the industrial development in the United Kingdom (UK), that energy is considered as a main factor in the production process (Stern and Cleveland, 2004; Missemmer, 2012). Following the 1973 oil crisis and its consequences on the world economies, interest in energy as a factor of production became more relevant in economic research (Jaffe and Stavins, 1995; Milliman and Prince, 1989). Various studies therefore integrate the effects of energy consumption, such as oil and gas, into analyses of factors determining the generation of economic activities (Behname, 2012). Stern (1999), on the other hand, divides factors of production into two groups, namely reproducible factors, like labour and capital, and unreproducible factors, like energy. Still, in that wake, Berndt and Wood (1975, 1979) have argued that energy and capital are complementary, while Griffin and Gregory (1976) have obtained a conflicting result that energy and capital are substitutes (Özatalay et al., 1979). But this opposition in views about factors of production has led to the conclusion that economic growth depends on the quantity of factors of production and on technical progress (Percebois, 1989). From this time on, the causal relationship between energy and economic growth was developed, what is done now here for Cameroon.

It has been demonstrated that there is a clear causal relationship between economic growth and energy consumption. Kraft and Kraft (1978), with their pioneering study of the causal relationship between energy consumption and economic growth, show that a growth of income in the USA leads to more energy consumption. The study was done over the period 1947-1974 and was based on

strong statistical tests which were developed by Sim (1972). Because the first oil price shock falls within that period, Akarca and Long (1980) criticized the results of Kraft and Kraft (1978). But using the same techniques and reducing the period of study to 18 years (1950–1968), Akarca and Long (1980) found no causal relationship between energy consumption and economic growth. This result was later confirmed by Yu and Hwang (1984) in the USA. Besides, Jumbe (2004) points out that energy consumption, particularly electricity, is essential for economic development because it facilitates reaching the efficiency of inputs of production. To achieve this result, he used the Granger causality and error correction model (Granger, 1988) over the period 1970–1999 in Malawi.

After these pioneering works on the causal relationship between energy and economic growth, many other empirical studies were done with different methods and which resulted in different findings, which Adams et al. (2016) categorized into four main groups, namely the conservation, growth, neutrality, and feedback hypotheses. The *energy conservation hypothesis* is based on the idea that economic growth is likely to result in an increase in energy consumption. In supporting this hypothesis, Omri and Kahouli (2014) and Esso (2010) are using the Generalized Method of Moments (GMM) estimation technique and the Bounds Testing Approach (BTA) to Cointegration, confirming that economic growth positively affects energy consumption.

The *growth hypothesis* relies on the idea that energy consumption is the main driver of economic growth. Behname (2012), with the same variables used by Apergis and Payne (2010a), and by using the co-integration test, the Hausman test and the Granger causality test over the period 1995–2010, showed that, in Western Europe, there is a long and short run causal relationship from renewable energy consumption to economic growth. The Granger causality test indicated that the relationship was bidirectional. Whereas, the same author (Behname, 2013) in a similar study for northern Europe showed that the causality was rather unidirectional, by assuming that energy positively affects GDP growth. Besides, Menyah and Wolde-Rufael (2010) examined the relationship for South Africa over the period 1965–2006 and reported a unidirectional causality leading from energy consumption to economic growth. In addition, Wandji (2013) did a similar work for Cameroon over the period 1971–2009 and reported that a 1% increase in energy consumption leads to a 1.1% increase in economic growth. Moreover, Silva et al. (2012), using the Unit Root Tests and the VAR (vector auto-regressive) method, studied the impact of renewable energy consumption on economic growth and CO₂ (carbon dioxide) emissions in a panel of 4 countries (USA, Denmark, Portugal, and Spain). They concluded that renewable energy has a non-significant effect on growth in the short run (except in the USA), but exponentially reduces the emissions of CO₂. For the Italian economy, Magnani and Vaona (2011) tested the spillover effects of renewable energy generation, applying panel co-integration and Granger non-causality within the framework of GMM systems. Their results

showed that renewable energy generation promotes economic growth; thus, policies promoting renewable energy should be encouraged.

The *feedback hypothesis* stands for a bi-directional causality between energy and economic growth, meaning that an increase of energy consumption leads to an increase of economic growth and vice versa. Here, Apergis and Payne (2010b) are using the following variables: capital formation, GDP, labour and renewable energy consumption, showing that there is a bi-directional causality between economic growth and renewable energy consumption in Eurasia. They had the same results for OECD countries in 2010 (Apergis and Payne, 2010a). The same empirical exercise was undertaken by Apergis and Payne (2011) to find the causal relationship between renewable energy consumption and economic growth by using the data of Central American countries over the period of 1980–2006. The estimated results revealed a bi-directional causality between the two variables, which also confirms the feedback hypothesis.

According to Adams et al. (2016), the *neutrality hypothesis* explains a situation where there is no correlation between energy consumption and economic growth. Notwithstanding the empirical work of Ankara and Long (1980), various studies have resulted in that finding. For instance, Tang and Abosedra (2014) argue that energy conservation policies or energy crises will not have a significant impact on economic growth. This is so because energy consumption represents a very small percentage of the GDP, and therefore it is not expected that energy consumption has a significant effect on the growth rate (Yu and Choi, 1985). Similarly, Soytaş et al. (2007) studied the cases of USA and Turkey and reported that there is no significant relationship between energy consumption and economic growth.

In view of the above, we support the *growth hypothesis* stating that an increase of energy consumption leads to more economic growth. From our findings in section 5, we will confirm or reject this hypothesis. Before testing this hypothesis, let us analyse the renewable energy background and the economic performance of Cameroon.

3 Renewable energy situation, accessibility and infrastructure in Cameroon

According to Cameroon's Vision 2035 that forecasts the total GDP and the GDP per capita of Cameroon, the GDP is expected to grow at a Compound Annual Growth Rate (CAGR) of 6.5% between 2010 and 2035, taking into consideration the SDGs as stated in the Intended Nationally Determined Contribution (INDC), while the population is expected to increase at a CAGR of 2.3% during the same period. Supplying energy to meet the growth of the economy and the needs of the population in the future is a challenge that Cameroon faces.

3.1 Access to energy and economic performance in Cameroon

Along with technological advancements, the response from various nations to climate change is expected to stimulate the deployment of RE globally, this to reduce the GHG emissions. The Paris Agreement was enacted in December 2015, with the unanimous consent of the 196 member countries, signalling the beginning of a new regime for climate change. The International Energy Agency (IEA) has called for higher energy efficiency, for a phasing out and termination of constructing coal-fired power plants, for increased investment into RE, for a gradual phasing out of fossil fuel subsidies, and for the reduction of emissions of methane gases from the extraction of oil and natural gas. However, RE is regarded as the most significant contributor to the reduction of GHG emissions, along with improvements in energy efficiency. In other words, RE is the key option to achieve SDG 7, targets of SDG 9 and the INDC target. Accordingly, the market and the industry for RE technologies is expected to show substantial growth in the future. In this context, reaching price competitiveness could facilitate significant contributions from RE technologies and could help to solve environmental issues in both developed and in developing countries. This is important also for countries like Cameroon. In terms of price competitiveness, the International Renewable Energy Agency (IRENA) predicts that the levelized cost of energy of solar PV will decrease from 0.13 USD/kWh in 2015 to 0.06 USD/kWh in 2025 (IRENA, 2016). The greater the improvement in price competitiveness, the higher will be the access rate to energy in Cameroon, especially in the off-grid zones like the rural areas; these successes will help to achieve the SDG 7, but also targets of SDG 9.

Cameroon still suffers from serious energy shortages, and the imbalance between energy supply and energy demand is enormous. The population of Cameroon is 25.216 million, up from 22.682 million in 2014 and 17.734 million in 2005, with a compound annual growth rate (CAGR) of 2.6% (WDI, World Bank, 2019). This huge increase in the population suggests a great deal of energy demand and a demand for better access to electricity. The fourth Cameroonian Household Consumption Survey (CHCS/ECAM 4, 2014) of 2014 estimated the active population's poverty rate at 37.5%, being 2.4 points lower than that of 2007 (which stood at 39.9%)⁷. Poverty is concentrated in the rural areas; the high concentration of the poor people in the rural areas is detrimental to the access to basic energy services, such as electricity and cooking gas. Indeed, in the rural areas in 2017 only 21.3% of the population had access to electricity, against 93.2% in the urban area (WDI, World Bank, 2019). However, this situation is common to all central African countries and even to many of the sub-Saharan Africa's countries, where nearly 80% of those lacking access to electricity across the region are living in rural areas

⁷ Concerning data on poverty in Cameroon, 2014 is the most recent year with data available (refer to WDI, 2019).

(Prasad, 2011). The situation is even more alarming when we consider that the energy consumption of the average African in the early 2000s was less than what an average British citizen used more than a hundred years ago (Adams et al., 2016). The low access rate to energy in sub-Saharan African countries in general and specifically in Cameroon negatively affects the economic performance.

Concerning economic performance, Cameroon has long been resilient to shocks, but its economy is showing early signs of a slowdown. GDP growth has been steady since 2010, averaging 5.8% from 2013 to 2015 before falling to 4.7% in 2016 and to 3.8% in 2018 (AEO/African Economic Outlook, 2018). To sustain such growth, both in population and economic development, a stable supply of energy from various sources is necessary. Cameroon is the leading economy in the Central African sub-region whose energy policy is mainly focused on increasing electricity supply in order to meet the demand. For instance, Cameroon's electricity-generating capacity in 2018 was 1,442 MW (MINEE, 2018) against 1,329.08 MW in 2014 and 900 MW in 2011 (ARSEL/ESRA, 2014), while Gabon's own electricity supply was 452 MW in 2016, increasing from 350 MW in 2012 (Observ'ER, 2013). That supply of the other countries of the Central African region, like the Central African Republic (CAR), is less.

3.2 Renewable energy situation in Cameroon

Electricity in Cameroon is supplied by hydropower plants of more than 5 MW, thermal power plants, and power plants fuelled by renewable energy sources such as sun, wind and small-scale hydro (≤ 5 MW), which generated a total of 7,980.78 GWh in 2015 against 7,722.01 GWh in 2014, what is an equivalent of a 3.35% increase. Hydropower and fossil fuel thermal power plants generate 4,358.7 GWh and 3,580.48 GWh respectively, whereas renewable sources provide only 41.6 GWh. With a total generation capacity of 7,980.78 GWh in 2015, hydroelectricity dominates with a share of 54.62%, followed by public thermal generation (22.86%), while half of fossil fuel thermal power is provided by self-generation through businesses and households (22.003%); the remaining generation capacity is from other renewable sources (EBSC, Cameroon Energy Balance 2016). The share of renewable energy, such as solar, wind, and biomass), is still marginal as presented in the tables 1-3 below.

Despite of the fact that Cameroon has a huge potential of renewable energy sources, we notice from the tables 1-3 below that there is only a marginal share of renewable energy supplies, such as solar, wind, biomass, and small hydro in the overall energy supply in Cameroon. Among the RE generation capacity, the solar energy generation capacity is the highest (2.45 MW), followed by small hydro-power generation (0.094 MW). This marginal share of renewable energy (RE) in the energy mix of Cameroon is due to a certain number of factors, as highlighted by Suberu et al. (2013): a limited capital investment, lack of technological

knowledge in renewable energy development, unreliable equipment, low rate of electrification, and high transmission losses. All these factors lead to Cameroon's severe energy deficit and explain its correlation with the high poverty rate. It is therefore important to seize the opportunity offered by renewable energies, not only to reduce Cameroon's energy deficit (in the context of the targets of SDG 7), but also to achieve sustainable development (SD) through low-carbon growth. The following sub-sections present overviews of the various sources of renewable energy (RE) in Cameroon.

Table 1: Status of installed capacity for generation by source in 2014 (unit: MW)

Public						
Hydro		thermal		Subtotal public		
732.2		621.6		1,353.8		
Private						
Thermal	Renewable	Solar	wind	Small hydro	Bio-mass	Subtotal Private
971.1	2.5484	2.4500	0.0044	0.0940	-	973.6
Total generation capacity						
2,327.4						

Source: Authors from MINEE data (2015, pp. 48)

Table 2: Renewable energy capacity in 2018 (unit: MW)

Hydro-power	Solar	Marine energy	Wind	Bioenergy	Total renewable energy capacity
732	14	-	-	-	746

Source: Authors from IRENA data (2019, pp. 2)

Table 3: Renewable energy production of Cameroon in 2017 (unit: GWh)

Hydro-power	Solar	Marine energy	Wind	Bioenergy	Total renewable energy
5,090	16	-	-	-	5,106

Source: Authors from IRENA data (2019, PP. 3)

3.3 Renewable energy and its infrastructure in Cameroon

The development of renewable energy (RE) in Cameroon is by itself an industrialisation and innovation strategy, because the construction of renewable energy infrastructure is (a form of) industrialisation, and the transition from fossil fuels to renewable energy is (a form of) innovation. From the above tables we notice a marginal contribution of renewable energies, such as solar, wind power, and geothermal power in the energy supply of Cameroon, whereas the potential of those

sources is enormous, also for industry development and innovation capacity. Let us analyse the potential of each source.

3.3.1 Hydropower infrastructures

The good economic performance which Cameroon has achieved from 2010 to 2016 was due to public investment programmes in major infrastructure projects, designed to make Cameroon an upper-middle-income country (UMIC) under the implementation of the Cameroon "Vision 2035" since 2010. Among these infrastructures, the Lom Pangar storage dam construction project of 7 billion m³, the construction of the Natchigal hydro-electric dam of 330 MW, and the construction of the Memve'ele hydro-electric dam (with 120 MW - 201 MW) have significantly increased the energy supply of Cameroon. Several other important energy infrastructure projects are planned for the medium and long term in the Growth and Employment Strategic Paper (GESP) of Cameroon⁸.

Table 4: List of hydropower infrastructure projects to be built in the medium and long term (Vision 2035)

Hydro-power plant	Song Mbengé	Kikot	Njock	Ngodi	Song Ndong	Nyan-zom	Bayo-men
Capacity (MW)	950	350-550	270	475	250-300	375	470
Hydro-power plant	Mouila-Mogué	Bagangté	Bini at Warak	Co-lomines	Cholet	Grand Eweng	Petit Eweng
Capacity (MW)	350	90	50	12	400	386	230
Hydro-power plant	Noun-Wouri	Mandou-rou	Mbinjal	Lan-crenon	Vogzom	Munaya	Kpaf
Capacity (MW)	1200	67	66	34	33	200	300
Hydro-power plant	Ment-chum	Total					
Capacity (MW)	15-35	6,573 MW					

Source: Authors from GESP (2010, pp. 59-60) data.

⁸ See on the GESP of Cameroon: <https://tradestrategymap.org/document/33daf25e-9de2-4523-b3d6-06c736825c86/growth-and-employment-strategy-paper>

Table 4 shows the list of hydropower infrastructure projects to be constructed in Cameroon within the period of the “Vision 2035”. The total generation capacity as planned is 6,573 MW; it is nine times higher than the existing capacity from hydropower (732 MW). This implies that, if Cameroon policy makers resolutely adopt SDG 9 and SDG 7, Cameroon will have abundant energy to fuel its economy and to achieve its goal of becoming an upper-middle-income country (UMIC) in 2035. Such an expansion of energy infrastructures can become a driver of growth in Cameroon.

3.3.2 Small hydropower

About 407 watercourse sites have been identified as potential sources for small hydro-electricity generation throughout the national territory. Apart from the Far North Region, these sites are found in the nine other regions of Cameroon. Installed capacities range from 0.005 to 1028 kilowatts (PDER, 2015). Besides, the Ministry of Water Resources and Energy (MINEE) has identified 19 sites in 5 regions with a total capacity of 127.65 MW, and 260 other sites with a total capacity of 340 MW (MINEE, 2016a). In addition, Cameroon is known as the second African country after the Democratic Republic of Congo (DRC) for having the greatest hydraulic potential. Regardless of the large hydro projects that are extremely expensive, deploying small hydropower installations can be adopted as a contribution to the solution of the national energy-shortage problems; the installation of small hydropower projects will also help to achieve SDG 7 and some targets of SDG 9. A problem is that there are good plans and proposals, but not yet information on the implementation of such projects.

3.3.3 Solar energy

IRENA (2014) has estimated the Technical Potential of Solar Energy in Cameroon at 10,105 TWh/year (equivalent 1 billion KWh). With such a potential, energy poverty can be alleviated both in the rural and the urban areas of Cameroon. Besides, solar radiation on the entire national territory changes in intensity from the coastal areas, particularly in the South-West and Littoral Regions (less than 1,300 to 1,600 KWh/m²/year), through the South, East, Centre, West and North-West Regions (1,700 to 2,000 KWh/m²/year), to the North regions (Adamawa, North and Far North), with temperatures ranging from 2,100 to more than 2,300 KWh/m²/year. Average radiation in the northern part stands at 5.8 KWh/m²/day and in the southern part at 4.3 KWh/m²/day. In Cameroon, telecommunication companies such as ORANGE-Cameroon, CAMTEL and MTN are pioneers in solar energy consumption to power their antennas and equipment in electricity off-grid zones. Solar energy is also used in urban regions for streetlights and for household solar PV generation systems. Distributed generation sources from solar PV generators are used in isolated rural villages, which are in the off-grid zone. Solar energy has been utilized in public organizations, such as airports, railways, and by

the defence sector, for a long time. Full advantage is taken of the natural light through large glass windows that reflect the sunlight. Consequently, in accordance with SDG 7 & SDG 9, advantages are enjoyed such as solving the problem of insufficient power supply, reducing electricity bills, and stabilizing the power supply. There is a huge unexploited potential for industrial development and innovation.

3.3.4 Wind power

Wind speed is relatively low on the entire national territory. According to the National Energy Plan (Plan Energie National/PEN), the wind speeds are varying from 2.53 m/s to 4.2 m/s which have been identified in the localities of Kaele and Kousseri in the North and Far North Regions. Wind power potential has also been identified in the Bamboutos Mountains and in Gobo. However, wind power infrastructure development is still at the stage of project studies (MINEE, 2016a).

3.3.5 Biomass and Biodigester Installations

The organic and plant residues resulting from animals and vegetation cover constitute the biomass. This potential energy forms part of the renewable energy sources. Wood, biogas and biofuels are the constituent elements of this type of energy. There are protected areas, where all forms of exploitation are prohibited. In terms of statistics, total power output is 1,050 GWh/year, and power capacity to grid connection is 700 GWh/year (MINEE, 2016a). KEEI (2017) assessed the potential by sector: Forest: 4.6 TWh/year, Agriculture: 1.3 TWh/year, and Livestock: 0.6 TWh/year. Again, no data on implementation are available.

Nearly 343 biodigester installations are identified throughout the national territory. The numbers are unequally distributed in the regions. The Adamawa Region has the highest number of biodigesters (182), while there are only five (5) in the Centre. The East and South-West Regions do not yet have biodigesters.

3.3.6 Major stakeholders regarding RE in Cameroon

The Ministry of Water Resources and Energy (MINEE) is charged with establishing and implementing government policies related to production, transportation, and the supply of water resources and energy, as well as promoting RE. The other stakeholders are mentioned in table 5 below.

All the organisations presented in table 5 are government stakeholders which are involved in the expansion of RE in Cameroon. Besides, ENEO-Cameroon⁹,

⁹ ENEO-Cameroon is the company in charge of electricity in Cameroon. It is the only private company in the electricity sector in Cameroon. ENEO replaced AES-SONEL in 2015, an American corporation that took over the public company SONEL which was privatised in 2001. See: <https://www.eneocameroon.cm/index.php/en/>

the electricity company of Cameroon, is one of the main actors in the energy sector.

Table 5: Organizations being relevant to RE deployment in Cameroon

Organization	Function
Ministry of Water Resources and Energy	<ul style="list-style-type: none"> • Establishes and implements policies related to RE. • Surveys and researches on RE resource potentials. • Environmental impact management for large-scale projects. • Promotion of RE in conjunction with the Ministry of Science (Energy Research Laboratory).
Ministry of Environment, Nature Protection and Sustainable Development	<ul style="list-style-type: none"> • Production of sustainable energy, such as solar and biogas (with environmental considerations).
Rural Electrification Agency	<ul style="list-style-type: none"> • Technical and financial support for businesses/users. • To supply electricity to rural areas by using the RE generation as much as possible.
Electricity Sector Regulatory Agency/ ARSEL/ESRA	<ul style="list-style-type: none"> • Regulations related to energy.
EMC/Energy Management Committee	<ul style="list-style-type: none"> • Energy crisis management, and planning, support, and supervision of national energy planning strategies. • Supervision of the Cameroon Solar Project 2020*, and AER projects approval
Cameroon Committee/CC of the World Energy Council/WEC	<ul style="list-style-type: none"> • Analyses, surveys, case studies, and strategy studies on all types of energy
ANAFOR/National Forestry Development Agency	<ul style="list-style-type: none"> • Development of <i>Prunus africana</i>, an Afromontane hardwood tree, for timber, fuelwood, and medicine uses. • Guidance for the National <i>Prunus Africana</i> Management Plan Cameroon

Source: KEEI (2016), World Energy Market Insight No.16-19. **Note:** ANAFOR stands for the National Forestry Development Agency; ARSEL/ESRA stands for Electricity Sector Regulatory Agency; EMC stands for Energy Management Committee; and CC of WEC stands for Cameroon Committee of the World Energy Council.

The company is active in the production, the transportation, the supply, and the sale of electricity in Cameroon. However, a new state company, SONATREL that

was created in 2015, will henceforth be responsible for electricity transportation. Concerning funds in the energy sector, the government receives some funds from NGOs through forms of public-private cooperation. The World Bank (WB), the International Monetary Fund (IMF), and the Exim Bank of China are some of the funding partners in the energy sector of Cameroon (SPGE, 2010). In addition, the Ministry of Forestry and Wildlife (MINFOW) and the Ministry of Livestock, Fisheries and Animal Industries (MINEPIA) are also major actors in the renewable energy sector of Cameroon. They are, respectively, in charge of forest biomass and organic biomass affairs. Despite of the great number of responsible institutions from the government side, there is a gap on the side of private enterprises to get involved in the development and production of such RE technologies.

Concerning the private sector involvement in the domain of renewable energy in Cameroon, it is important to highlight that the electricity sector is characterised by a natural monopoly. Initially we had a state company (SONEL), but then, after privatisation in July 2000, we had a private corporation (AES-SONEL), an American company that operated for fourteen years in Cameroon. In 2014, AES-SONEL became ENEO, when the British group ACTIS bought the shares of the American group (SIRROCO). In regard of renewable energy, ENEO as the main company in the electricity sector in Cameroon is charged with developing the renewable energy infrastructure for power generation. Besides, there are a few companies operating in the renewable energy sector. For instance, the agri-business sector generates electric power from biomass by burning their waste; examples are the Cameroon sugar company (SOSUCAM), the palm oil company (SOCAPALM), and many others. Apart from biomass, the private sector is also very active in solar and wind equipment trading. Examples are: ENERGIE RENOUVELABLE DU CAMEROUN S.A.; KRIBI POWER DEVELOPEMENT COMPANY; RIO TINTO ALCAN CAMEROUN; SCHNEIDER ELECTRIC CAMEROUN; SOLAR CAMEROON; GROUPE HUMBERLEC; HOMELEX LTD SARL; INSTRUMELEC CAMEROUN; MICROPRISE SARL; SAF – SOLAIRE AFRIC SARL; SOOLARTEK; THE CATALYST GROUP; THERMOMECANIC ENERGY CAMEROON (TEC SARL); GENERAL ELECTRIC; 2L Technologies SARL; DISTEC SARL. These companies also facilitate the installation of solar and wind energy equipment through their expertise in the domain.

4 Methodological approach of the study

This section discusses the estimation techniques and the data collection procedures that were employed to find the causal relationship between renewable energy consumption and economic growth. It is divided into two sub-sections. Data are presented in the first sub-section and details of the estimation strategy are presented in the second sub-section.

4.1 Data of the study

We use annual data for Cameroon spanning 44 years from 1971 to 2014¹⁰. Because the VAR (Vector Auto-Regressive) modelling technique requires time series of at least 30 years in order to obtain authentic results, the time span of 44 years is appropriate. That period was chosen according to the data available. Our data were obtained from the World Bank's World Development Indicators data basis (WDI).¹¹ Following Apergis and Payne (2010a), our variables are as follows: The first variable is GDP growth in % (GDP-Growth); we have chosen this variable to stand for economic growth, making it the depended variable in our equation. The second variable is Renewable energy consumption (logRE-Con); it consists of renewable fuels, waste, biomass, and large and small hydro power in percentage of total energy used. The third variable is Gross capital formation (logGCF) in % of GDP; we have chosen this variable as a control variable (see table 6 for details of the variables). It stands for investment and it helps to consolidate economic growth because the economic growth of a country is generated by a good number of aggregates. RE consumption and Gross Capital Formation will be converted into log for statistical reasons, such as to avoid Heteroskedasticity. Other variables, such as CO2 emissions and labour, have been used in the literature but due to lack of data we could not use them.

Table 6: Variables' definition and descriptive statistics

Variable's name	GDP-Growth	RE-Con	GCF
Definition	The growth rate of the Gross domestic product (%)	Renewable energy consumption (%) in percent of total energy used	Gross fixed capital formation (%)
Source	World Bank Development Indicators data basis (WDI)	World Bank Development Indicators data basis (WDI)	World Bank Development Indicators data basis (WDI)
Observations	44	44	44
Mean	3.995093	75.84522	21.90425
Median	4.326552	76.17165	21.64247
Minimum	-7.932067	61.10592	14.30539
Maximum	22.00300	87.65528	31.24881
Std. Dev.	5.972411	7.262546	3.610007

Source: Computed from EViews 8 with WDI data. See on EViews:
<https://www.eviews.com/home.html>

¹⁰ Concerning data for renewable energy, the year 2014 is the most recent year for Cameroon in (WDI, 2019).

¹¹ See: <http://datatopics.worldbank.org/world-development-indicators/>

Over a period of 44 years, GDP in Cameroon has had an average growth rate of 3.99% against a share of 21.9% of investment, whereas in the same period the average rate of renewable energy consumption was 75.8% of total energy. The lowest GDP growth rate in our period of study is -7.932%. This lowest rate was obtained in the year 1993 and that year falls within the period of the economic crisis of the 1990s in central Africa, when the crisis had led to the devaluation of the national currency (the CFA Franc) in 1994. The lowest rate of investment (14.30%) is also registered within the same crisis period (1992). But in overall terms, the means of our variables of interest are all positive. The dispersion of the series in relation to the mean is marginal (5.9% for GDP and 7.2% for RE consumption). This descriptive statistics shows a positive relationship between renewable energy consumption and GDP growth, but it does not tell us anything about the nature of the relationship; it is not clear whether it is a short or long term relationship, and this is the reason why we are going to use the econometrics method for more information. Thus, the next sub-section relies on the methodical approach of our model.

4.2 Methodological approach

The objective of this sub-section is to present and to describe the econometric model that is used here as a tool to solve our problem. In general, studies involving many countries in a region are made in panels. In time-series regression, ARDL (Auto-Regressive Distributed Lag Model), VAR (Vector Auto-Regressive Model) or VECM (Vector Error Correction Model) modelling techniques are suitable for studies based on causal relationship findings. Each of these models has its specificity, but most empirical studies on the causal relationship between energy and growth use ARDL modelling, simply because this model does not require that the series should all be integrated in the same order. However, macroeconomic series of different order of integration are frequently encountered (Nelson and Plosser, 1982). The VAR modelling technique requires that all the series be stationary, whereas the VECM model requires that all the series be integrated in the same order. Because all our series are $I(1)$, the VECM modelling technique is therefore suitable in our case. This approach has been used by many other studies in the literature (Silva et al., 2012; Altinay and Karagol, 2005).

4.2.1 Presentation of the model

The initial equation linking our variables is presented in equation (1) as follows:

$$X_t = A_0 + A_1X_{t-1} + A_2X_{t-2} + \dots + A_pX_{t-p} + \varepsilon_t \quad (1)$$

Where X_t is a $n \times 1$ vector of explanatory variables, A denotes the vector of coefficients and the subscript refers to its lag, ε_t is a $n \times 1$ vector of error terms. The error terms are assumed to be normally distributed. The appropriate lag length in a time-

series depends on the number of observations. There are several criteria for choosing the optimal lag length such as the Akaike information criterion (AIC), the Bayesian/Schwartz information criterion (BIC), and the Hannan-Quinn criterion (HQ). In our case, we use the AIC, and the lower the AIC value, the better will be the model.

After studying the stationarity of the series, if the variables of vector X_t are found to be cointegrated, the model estimated has the form of a VECM model (equation (2))

$$D(Y_t) = A_0 + \sum_{i=1}^p \alpha_i \Delta Y_{t-i} + \sum_{j=0}^q b_j \Delta X_{t-j} + c[Y_{t-1} - \beta X_{t-1}] + \varepsilon_t \quad (2)$$

Where $D(Y_t)$ is the vector of our three variables in first deference, $[Y_{t-1} - \beta X_{t-1}]$ is the error correction term (ECT), and c is its coefficient. This coefficient c is the speed of adjustment towards long run equilibrium; however, it must be significant, and its sign must be negative.

The VECM model gives information about the short and the long run adjustment to changes in Y_t , via the estimated parameters α_i , b_i , and c respectively. Because we have 44 time-series data, we use EViews software to estimate these parameters. Since we have a vector of 3 variables, our VECM model is as follows:

$$D(GDPgrowth) = a_{10} + \sum_{i=1}^p a_{1i} * D(GDPgrowth_{t-i}) + \sum_{i=1}^p b_{1i} * D(logREcon_{t-i}) + \sum_{i=1}^p c_{1i} * D(logGFCF_{t-i}) + d_1 ECT_{t-1} + \varepsilon_{1t} \quad (3)$$

$$D(logREcon) = a_{20} + \sum_{i=1}^p a_{2i} * D(logREcon_{t-i}) + \sum_{i=1}^p b_{2i} * D(GDPgrowth_{t-i}) + \sum_{i=1}^p c_{2i} * D(logGFCF_{t-i}) + d_2 ECT_{t-1} + \varepsilon_{2t} \quad (4)$$

$$D(logGFCF) = a_{30} + \sum_{i=1}^p a_{3i} * D(logGFCF_{t-i}) + \sum_{i=1}^p b_{3i} * D(GDPgrowth_{t-i}) + \sum_{i=1}^p c_{3i} * D(logREcon_{t-i}) + d_3 ECT_{t-1} + \varepsilon_{3t} \quad (5)$$

ECT is the error correction term, and it measures the long-run correlation between the sets of variables. The estimation of the model requires the following procedure: first, we study the stationarity of the series by doing a stationarity test. This is to make sure that the series evolve around a long-term equilibrium. Then we study the cointegration of series, and finally the model specification is presented. If a series is stationary without any differencing, then it is designated as $I(0)$, or integrated of the order 0. On the other hand, a series that has stationary first differences then it is designated as $I(1)$, or as integrated of order one (1). An augmented Dickey-Fuller test as suggested by Dickey and Fuller (1979) has been used to test the stationarity of the variables (the result of the test will be discussed in section 5). If the set of variables is integrated of the same order, we proceed by analysing the cointegration. If a set of variables is found to have one or more cointegrating vectors, then the suitable estimation technique is a VECM (Vector Error Correction Model) which adjusts to both short run changes in variables and to deviations from equilibrium.

4.2.2 Cointegration of series

Tests for cointegration¹² identify stable, long-run relationships between sets of variables. Three of the most popular tests are: Engle-Granger, Phillips-Ouliaris, and the Johansen cointegration test. In this study, the last test will be used because it can detect multiple cointegrating vectors.

We apply the Johansen-Juselius maximum likelihood method of cointegration to obtain the number of co-integrating vectors. The model is given as follows:

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-1} + \varepsilon_t \quad (6)$$

Where X_t is the 3x1 vector (GDPgrowth, logRE_Con, logGFCF) respectively, Δ is the symbol of the difference operator, ε_t is a 3x1 vector of residuals, while ΠX_{t-1} denotes the error correction term. If at least one cointegration equation is found, meaning that the variables have a long run relationship, we proceed with the Vector Error Correction Model (VECM).

4.2.3 Model specification

In order to make sure that our VECM model is a good regression model, we need to verify that the model does not have any serial correlation, any ARCH effect, and that the residuals are normally distributed. So, we do a heteroskedasticity test, an autocorrelation test, and a normality test. For the first two tests, we use the Breusch-Pagan and the Godfrey test. As for the normality test, we can use the Jarque-Bera test or even that of Shapiro-Wilk. The results of these tests will be discussed in detail in the next section.

5 Results and discussion

In this section, we estimate the model using EViews software, and we discuss the results. Thus, as required by the model, we start with the Unit root test, then the cointegration test, and finally we move to the VECM specification.

5.1 Stationarity test

Since most of the variables or series are non-stationary, unit root tests are useful to determine the order of integration of variables. For stationarity tests, we use the Augmented Dickey-Fuller (ADF) test which assumes as a null hypothesis that

¹² Two sets of variables are cointegrated if a linear combination of those variables has a lower order of integration. In other words, if we have two non-stationary time series X and Y that become stationary when differenced such that some linear combination of X and Y is stationary, then we say that X and Y are cointegrated.

each variable has a unit root. After running the ADF test, we compare its P-value with the acceptability threshold (level: 5%); if the P-value is greater than 5%, we reject the null hypothesis if we do not accept it. Table 7 presents the results of the test for the levels, and table 8 shows the results for the first differences.

Table 7: ADF Stationarity tests of the variables

Variables	Test	Level	P-value	Null Hypothesis H_0	Decision
GDPgrowth	ADF	5%	0.3577	Has a unit root	Reject H_0
logREcon	ADF	5%	0.9630	Has a unit root	Reject H_0
logGCF	ADF	5%	0.486	Has a unit root	Reject H_0

Source: Computed from EViews WS8 with WDI data.

Table 8: Stationarity Tests of first differences of the variables

Variables	Test	Level	P-value	Null Hypothesis H_0	Decision
D(GDPgrowth)	ADF	5%	0.000	Has a unit root	Accept H_0
D(logREcon)	ADF	5%	0.000	Has a unit root	Accept H_0
D(logGCF)	ADF	5%	0.000	Has a unit root	Accept H_0

Source: Computed from EViews 8 with WDI data.

Regarding the results of table 7, all the three variables are non-stationary because their P-values are greater than 5%. However, looking to the same test in first differences (table 8), the first differences of the variables are stationary because their P-values are 0.000, which is less than 5%. The conclusion is that the variables used in the model are all integrated of the same order I(1), meaning that our series evolve around a long term equilibrium, which is a key requirement for the estimation of a VECM.

5.2 Cointegration

Since our variables are all integrated of the same order, we continue our analyses with the cointegration test in order to check if the variables have a long or short run relationship.

Table 9: Results of Johansen Cointegration test

Tests	Null hypothesis H_0	Level	P-value	Decision	Model
Trace	No cointegration Eq	5%	0.0103	Reject H_0	VECM
Maximum Eigenvalue	No cointegration Eq	5%	0.0074	Reject H_0	VECM

Source: Computed from EViews

Results of the Johansen cointegration test show that our variables are cointegrated meaning that there exists a long-run causality relationship among our variables. Regarding table 9, the P-values of the trace and Maximum Eigen value tests (respectively 0.0103 and 0.0074) are less than 5%. This leads us to reject the null hypothesis, meaning that our model has at least one cointegrating equation. In other words, Renewable energy consumption and GDP growth have a causal relationship in the long run. It is now possible for us to run the VECM estimation because the series are I(1) and cointegrated.

5.3 VECM specification

The linear equation of the relationship between energy consumption and GDP growth in Cameroon is as follows:

$$GDPgrowth_t = \alpha_0 + \alpha_1 logRECon_t + \alpha_2 logGCF_t + \varepsilon_t \quad (7)$$

where α_0, α_1 and α_2 are paramters and ε_t the error term

The models to estimate are the following (equations (3) and (4) see sub-section 4.2.1):

$$\begin{aligned} D(GDPgrowth) &= a_{10} \\ &+ \sum_{i=1}^p a_{1i} * D(GDPgrowth) \\ &+ \sum_{i=1}^p b_{1i} * D(logRECon_{t-i}) \\ &+ \sum_{i=1}^p c_{1i} * D(logGCF_{t-i}) + d_1 ECT_{t-1} + \varepsilon_{1t} \\ D(logREcon) &= a_{20} \\ &+ \sum_{i=1}^p a_{2i} * D(logREcon_{t-i}) \\ &+ \sum_{i=1}^p b_{2i} * D(GDPgrowth_{t-i}) \\ &+ \sum_{i=1}^p c_{2i} * D(logGCF_{t-i}) + d_2 ECT_{t-1} + \varepsilon_{2t} \end{aligned}$$

After estimation with EViews 8, the result is:

$$\begin{aligned} D(GDPgrowth) &= c_1 \\ &* (GDPgrowth_{t-1} - 16,23logRECon_{t-1} - 22,03logGCF_{t-1} \\ &+ 134,05) + c_2 * D(GDPgrowth_{t-1}) + c_3 \\ &* D(logRECon_{t-1}) + c_4 * D(logGCF_{t-1}) + c_5 \quad (8) \end{aligned}$$

$$D(\log RECon) = c_6 * (GDPgrowth_{t-1} - 16,23\log RECon_{t-1} - 22,03\log GCF_{t-1} + 134,05) + c_7 * D(GDPgrowth_{t-1}) + c_8 * D(\log RECon_{t-1}) + c_9 * D(\log GCF_{t-1}) + c_{10} \tag{9}$$

Where: $(GDPgrowth_{t-1} - 16,23\log RECon_{t-1} - 22,03\log GCF_{t-1} + 134,05)$ in equation (8) is the cointegrating equation that was indicated in the cointegration test, and it is also called ECT; c_1 and c_6 are the coefficients of the ECT, and they stand for the speed of adjustment towards long run equilibrium, but they must be significant and their sign must be negative. c_1 helps us to know if there is a long run causality from the independent variable such as RE consumption to GDP growth, as well as c_6 helps to know if there is a long run causality from GDP growth to RE consumption. On the other hand, the coefficients c_3 and c_7 help us to know more about short-run causality. For short-run causal relationship, c_3 and c_7 need to be significant and statistically non-zero. We run the Ordinary Least Square (OLS) test to check the sign and the significance of these coefficients as presented in the table 10 below.

Table 10: coefficient significance test (Ordinary Least Square test)

Coefficient	value	Null hypothesis H_0	Level	P-value	decision
c_1	-0.997830	The coefficient is significant	5%	0.0013	Accept H_0
c_3	-20.42376	The coefficient is significant	5%	0.5111	Reject H_0
c_6	0.000507	The coefficient is significant	5%	0.7507	Reject H_0
c_7	-0.000234	The coefficient is significant	5%	0.8415	Reject H_0

Source: Authors with Eviews8 software

The result from the OLS (table 10) indicates that the coefficient c_1 is negative (-0.997830) and significant because its P-value (0.0013) is less than 0.05. This result implies that there is a long run causality from RE consumption to GDP growth, meaning that RE consumption has an influence on GDP growth in the long run. But there is no causality in the short run because c_3 is not significant (its P-value 0.5111 is greater than 0.05). Meaning that Renewable energy consumption has no influence on GDP growth in the short run. On the other hand, there is no causality running from GDP growth to RE consumption both in the long run and the short

run because the coefficient c_6 is neither significant¹³ nor negative, as well as the coefficient c_7 is not significant and it is not non-zero. This is meaning that in the case of Cameroon, GDP growth has no influence on renewable energy (RE) both in the short and long run. This result verifies the growth hypothesis that we have chosen as the main hypothesis in section 2, stating that renewable energy consumption drives economic growth.

5.4 Model efficiency

The previous results indicate that there is a long-run causality running from Renewable Energy (RE) consumption to the GDP growth rate. In order to make sure that our model provides suitable results, we need to verify that the model does not have any serial correlation, any ARCH effect, and that residuals are normally and independently distributed. The normality test, the heteroskedasticity test, and the serial correction test are done as shown in the table 11 below.

Table 11: Normality, Heteroskedasticity and serial correlation tests

Tests	Null hypothesis H_0	Level	P-value	Decision
Normality test (Jaque-Bera)	The residuals are normally distributed	5%	0.590458	Accept H_0
Heteroskedasticity Test (Breusch-Pagan-Godfrey)	There is no ARCH effect	5%	0.160	Accept H_0
Breusch-Godfrey Serial Correlation LM Test	There is no serial correlation	5%	0.249	Accept H_0

Source: Authors computation with EViews 8 software

Regarding the results in table 11, the residuals are normally distributed (because of the P-value being $0.590458 > 5\%$), the model does not have any ARCH effect (because of the P-value $> 5\%$), nor is there any serial correlation (because the P-value $> 5\%$); we therefore approve the result of the estimation although the R^2 of the model is low and the P-value of the F-statistic is good (because 0.009975 is less than 5%).

The objective of this sub-section is to test the efficiency of our model. Thus, with regards to the fact that our model does not have any serial correlation nor any ARCH effect, and that residuals are normally distributed, we approve our findings.

¹³ The P-value of c_6 (0.7507) is greater than 0.05 and its sign is not negative (0.000507); also, with 0.8415 the P-value of c_7 is greater than 0.05.

From the descriptive statistics above, we found that there was a positive relationship between RE consumption and GDP growth, but the VECM modelling has gone deeper by revealing the nature of the relationship. The major findings of this model are that there is an impact of RE consumption on economic growth in the long term, but there is no causality in the short term. In other words, this finding indicates that RE consumption leads to the increase of GDP in the long run in Cameroon.

The energy situation of Cameroon shows abundant energy resources in the country, but the population is still suffering from energy poverty, and Cameroon remains a less developed country. From the above study, we found no impact of RE consumption on economic growth in the short run, but an impact in the long run. This is partly so because appropriate investments have not been done. We therefore give the following recommendations based on SDG 9 (and SDG 7). RE sources in Cameroon are not only relevant for climate protection, but also for growth acceleration (and with it for employment creation and poverty reduction).

5 Policy recommendations

The main factors boosting renewable energy growth can be split into three groups: political factors, socio-economic factors, and country specific factors. Before giving policy advice with respect to these factors, let us first present an energy scheme involving the government and the private sector, capable of making the energy sector dynamic in Cameroon in order to achieve inclusive growth.

5.1 Public-private partnership for an optimal investment scheme in local power mini-grids

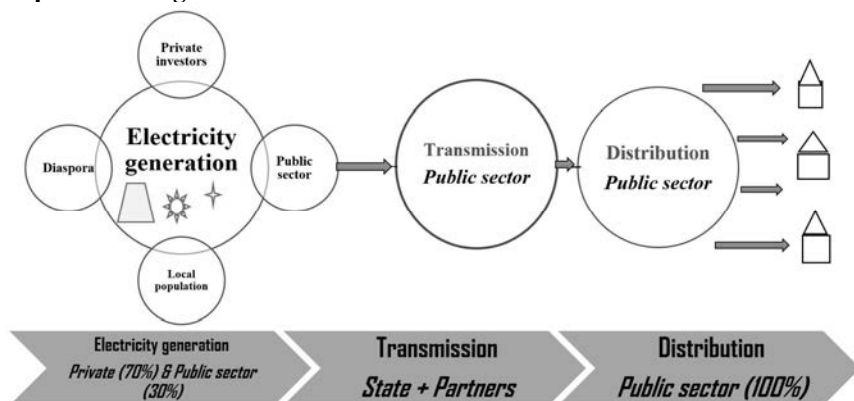
From the above results, investment in energy infrastructure is necessary in order to achieve SDG 9 and to boost structural change and economic growth in Cameroon. Thus, we suggest the development of local power mini-grids through public-private partnership in off-grid zones, based on the circular and solidarity economy involving the State, the Diaspora, Technical and Financial Partners and the Local Population (as shown in the chart 1 below), where tasks are allocated as follows:

Investment in the power generation should be done by the private sector at 70% and by the public sector at 30%. Investment in the power transmission and distribution should exclusively be done (100%) by the government and its partners. Many localities in Cameroon, both in semi-urban and in rural areas, still lack access to energy because they are in off-grid zones. In view of the abundant resources of renewable energy being available in the country, especially hydro, solar

and biomass, it is possible to develop local mini-grids with these resources provided there in the form of a public-private partnership. The government needs to stimulate the private sector to invest in the renewable energy projects.

The energy sector in Cameroon consists of ENEO, the main company in charge of electricity generation and transmission in the national territory, and two Independent Private Producers (IPPs), namely the Kribi Power Development Corporation (KPDC) and the Dibamba Power Development Corporation (DPDC). These IPPs only generate electricity and sell it to ENEO, but they do not supply it directly to households nor enterprises. ENEO, like every private company, is seeking to maximise its profit, and so it tends to neglect the rural areas. It is therefore left for the government to create enabling conditions in such areas in order to attract private investors. Since the electricity price is a uniform one (not differentiated) in the national territory, the potential private investors might be reluctant to invest in off-grid zones because they cannot supply energy at the existing uniform price like ENEO, even if they receive subsidies from the government. Thus, the government needs to partake by operating in the transmission and distribution of energy, while the private sector operates the generation of electricity in such a way that as the national Interconnected Power Network (IPN) is expanding. When mini grids are developed, the producers already in place become IPPs. Funds in this scheme are obtained through own funds, loans and subsidies. The Internal Rate of Return (IRR) can be estimated at more than 10% for own funds. This scheme is likely to improve the energy system in Cameroon and boosts economic growth. The scheme is as follows in chart 1.

Chart 1: Public-private partnership for an optimal investment scheme in local power mini-grids



By making effective such a scheme, SDG 7 (Ensure access to affordable, reliable, sustainable and modern energy for all) will be achieved by the government. In order to boost investments, infrastructure, industry and innovation in the energy/RE sector in Cameroon (according to SDG 9), let us analyse the other key factors.

5.2 Political Factors

Political motivations are the most relevant aspects to the promotion of renewable energy in Cameroon. One of the political factors is public policies. It has been demonstrated that renewable energy (RE) technology is still expensive, so the RE cannot easily compete with traditional energies (fossil fuel) in the context of developing countries. Therefore, public policies are important, such as targeted subsidies, quota policies, direct investment, research & development funds, and even feed-in tariffs (FITs); all these public policies can encourage renewable energy (RE) growth in Cameroon if applied in a coherent way. For instance, Cameroon intends to reduce the carbon footprint of its development path by 32% up to 2035, compared with the year 2010. This target is a commitment taken by Cameroon's government during the Paris conference on climate change in 2015. To achieve this goal, one of the measures taken is the quota of 25% of renewable energy in the total energy consumption by 2035. These initiatives are good ones but there is still more to be done for the growth of renewable energy (RE) in Cameroon and in the Central African sub-region concerning political factors.

In developed countries, carbon tax is used as an instrument to commit enterprises into reducing GHG emissions and to increase the share of electricity produced from renewables, but in developing countries like Cameroon it will be more relevant to subsidize in a coherent framework renewable energies or to apply feed-in tariffs (FITs)¹⁴ rather than to apply a carbon tax, and this for two main reasons: firstly, Cameroon has abundant natural resources being suitable for renewable energies; thus the government can devise policies to subsidise the prices of renewable energy equipment and technology. Secondly, the carbon tax indeed generates income but might instead have a negative impact on the economic activities in the sense that economic operators will have to consider not only the internal costs related to the production of a good, but also the external cost from a carbon tax to set the final prices of goods, and this might make enterprises less competitive in terms of prices. Whatever the government is doing, a coherent approach is important, meaning that policy initiatives should not contradict each other. Also, the strategy should consider rural and urban areas, main economic sectors, and the size of enterprises as small and medium enterprises should be promoted.

¹⁴ See on the feed-in-tariffs (FITs): [https://energypedia.info/wiki/Feed-in_Tariffs_\(FIT\)](https://energypedia.info/wiki/Feed-in_Tariffs_(FIT))

5.3 Socioeconomic factors

Energy infrastructure consists of nation-wide projects, meaning that it is difficult for individuals and enterprises to commit themselves in their development. Therefore, the energy transmission infrastructure is the task for government rather than that for a private venture. Governments need to present policy guaranties to induce RE development because venture capital investments exhibit policy risk aversion in that they tend to avoid renewable energies investment opportunities if regulatory exposure is perceived to be high.

The projection of the International Energy Agency (IEA, 2015) indicated that energy demand is expected to increase considerably in the coming years as a result of population growth and economic development, driven primarily by Asian and African countries. The annual growth rate of the population in Cameroon is 2.6% and the access rate to electricity is less than 30% in rural areas. This implies that the energy demand will also increase in Cameroon as indicated by the IEA. Presently, the energy generated by the electricity industry in Cameroon is insufficient for the entire population to meet up with its growth rate and the increase of energy demand. We suggest the construction of solar power stations in isolated villages of Cameroon that are not connected to the Interconnected Power Network (IPN) as described in the above scheme (chart 1).

To achieve the SDG 9 goal and its targets in Cameroon, building a resilient energy infrastructure is essential. Cameroon has the second largest watershed in Africa after the Democratic Republic of Congo. There is an abundance of rivers and streams throughout the country. Apart from large hydroelectric dams which require a huge financial mobilization, we can develop a system of mini power grids in villages, meaning the exploitation of small rivers available to generate energy of less than 5 MW in remote areas. This is important because these mini power off grid projects will reduce not only energy poverty. but will also reduce economic poverty in rural areas in Cameroon.

5.4 Country-specific factors

Cameroon has a natural endowment with renewable energy (RE) resources such as solar radiation, waterfalls. or strong winds. It would therefore be important for governments to invest in each region in the type of renewable energy which can rapidly be developed in that locality. For example, solar power stations could be supported in northern Cameroon because of the high solar radiation in these regions, while wind power could be developed in regions with strong winds such as in west and north-west Cameroon. Investment can be done in small-scale applications in isolated areas while waiting for the national grid to reach the areas in question.

5.5 Research and Development and Technology Diffusion

The RE technology is still expensive in Cameroon. As a developing country, Cameroon is not at the top of that technology, and so the government needs to finance research & development to achieve higher levels of this technology. With respect to target N°5 of SDG 9, the government needs to support local technology development and innovation. For instance, it is essential to finance research in the universities and to train staff and technicians in that domain; so, scholarships can be granted to students to study abroad and to come back afterwards to practice in Cameroon. Moreover, courses related to RE can be created in our universities and institutions in order to train more specialists. Patents need to be awarded to young researchers for their discoveries.

5.6 Synopsis: Agenda for Action

Energy is one of the main factors of economic growth. In the case of a developing country like Cameroon, energy supply is not yet optimally organized. Given that ENEO Cameroon is the main energy supplier in the country, its services do not reach out to most of the people, and especially those in the rural areas are bypassed. Consequently, if renewable energy can be adequately developed and extended, this will help to encourage the activities of small and medium size enterprises. For instance, small businesses like metal and welding workshops, hair dressing and barbing salons, retail shops, and many more small businesses and workshops will go operational in rural areas of Cameroon based on adequate energy supplies. With the expansion of renewable energies, living standards will improve as small businesses will be able to employ workers and to make profits for further investment. If such small and medium size enterprises are flourishing, the level of poverty in the country will drastically drop in accordance with the targets of SDG 9. This can be achieved through public-private partnerships in terms of investment and contracts for infrastructure development to the benefit of the private sector. Public-private partnerships can be the base for an optimal investment scheme in local power mini-grids in Cameroon.

Indeed, energy is one of the main drivers of economic growth. Thus, energy policy becomes a tool to achieve SDG 9 and its targets. To build resilient infrastructure and to promote inclusive and sustainable industrialisation, resilient energy infrastructure is a precondition. In order to become an emerging country by 2035, Cameroon needs to lay emphasis on its energy sector which will activate and boost all the other sectors of the economy. This is so because energy makes a country attractive for foreign direct investment. Thus, the following goals are set by the policymakers in the energy sector:

- Ensure sustainability of the state's energy infrastructure fabric.
- Extend energy infrastructure.

- Strengthen industry, private sector, governance and human resources of the energy infrastructure sector.
- Promote decentralized rural electrification.
- Promote energy independence of households through an alternative energy system between national grids and solar home installation in urban areas.

The following targets are derived from these goals:

- Construction of energy and hydraulic infrastructure (dams).
- Construction of small hydro dams for local power mini-grids and solar power stations in off-grid localities.
- Rehabilitation of energy and hydraulic infrastructure.
- Maintenance of energy and hydraulic infrastructure.

Expected results by 2030:

- Increasing the rate of access to electricity to 80% in rural areas in Cameroon.
- Energy infrastructure will effectively contribute to the economic development of Cameroon.
- Increasing the access of small-scale industrial and other enterprises to energy.
- Increasing the access to internet, information and communication in rural areas of Cameroon via better access to energy.
- With the increase of access to energy, promoting inclusive and sustainable industrialisation, especially in rural areas where factors of production like labour and land are cheaper.

The implementation of this action programme will contribute to inclusive and sustainable growth in Cameroon, and the government ambition of increasing the share of renewable energy to 25% in the overall energy mix of Cameroon by 2035 will have a chance to be achieved.

6 Conclusion

In this paper we investigated the causal relationship between renewable energy consumption and economic growth in Cameroon for the period 1971–2014 by using the VECM modelling. The energy situation of Cameroon shows that the country has abundant resources for developing renewable energy, such as wind, biomass, solar and hydropower being available in many parts of the country and so making it an attractive place for RE investors. But, the population of Cameroon is still suffering from energy poverty and a low rate of access to energy, despite of the fact that the country is endowed with a lot of natural energy resources. On the other hand, we found that renewable energy consumption has a positive impact on GDP growth in the long run but no impact in the short run. Thus, based on the

SDG 9 goal and its targets, appropriate investment needs to be done in the energy sector of Cameroon. The development of small-scale industries and of other enterprises (according to target 3 of SDG 9) relies on a dynamic energy sector as well as on economic growth and the well-being of the population. A dynamic energy sector with a high RE component relies on the private business sector and its innovation capacity. In order to improve investment and innovation in the energy sector in Cameroon, it is necessary to aim at inclusive economic growth as required by the SDGs. We suggest the development of local power mini-grids through public-private partnership in off-grid zones, based on a circular and solidarity economy involving the State, the Diaspora, Technical and Financial Partners and the Local Population. In addition, we suggest the following actions to be carried out: feed-in-tariffs and targeted subsidies, direct investments by the Diaspora, encouraging scientific research and development, and ensuring industrial diversification for the energy transition in developing countries such as Cameroon. Finally, SDG 9 and its targets need to be considered as a springboard for achieving inclusive economic growth in developing countries such as Cameroon.

References

- Adams, S., Kwame, E., Klobodu, M., Evans, E., Opoku, O. (2016), Energy consumption, political regime and economic growth in sub-Saharan Africa. *Energy Policy*, 96, pages 36-44.
- AEO (2018), African Economic Outlook. African Development Bank.
- Akarca, A. T., Long, T. V. (1980). On the relationship between energy and GNP: a re-examination. In: *Journal of Energy and Development* 5, pages 326-331.
- Alam, M. S. (2006). Economic Growth with Energy. MPRA/ Munich Personal RePEc (Research Papers in Economics) Archive Paper No. 1260
- Aliyu, A. K., Modu B., Tan C. W. (2017). A review of renewable energy development in Africa: A focus on South Africa, Egypt and Nigeria. *Renewable and Sustainable Energy Reviews*, <http://dx.doi.org/10.1016/j.rser.2017.06.055>
- Altınay, G., Karagöl, E. (2005). Electricity consumption and economic growth: Evidence from Turkey. *Energy Economics*, 27, pages 849-856.
- Apergis, N., Payne, J. E. (2010a). Renewable energy consumption and economic growth: evidence from a panel of OECD countries. *Energy Policy* 38, pages 656-660.
- Apergis, N., Payne, J. E. (2010b). Renewable energy consumption and growth in Eurasia. *Energy Economics* 32, pages 1392-1397.
- Apergis, N., Payne, J. E. (2011). The renewable energy consumption-growth nexus in Central America. *Applied Energy* 88, pages 343-347.
- Apergis, N., Payne, J. E. (2012a). The electricity consumption-growth nexus: renewable versus non-renewable electricity in Central America. *Energy Sources, Part B: Economics, Planning, and Policy*, 7, pages 423-431.

- Apergis, N., Payne, J. E. (2012b). Renewable and non-renewable energy consumption-growth nexus: evidence from a panel error correction model. *Energy Economics* 34, pages 733–738.
- ARSEL/Agence de Régulation du Secteur de l'Electricité/ESRA/Electricity Sector Regulatory Agency (2014). Statistiques des activités dans le secteur de l'électricité du Cameroun
- Aschauer, D. A. (1989a). Is public expenditure productive? In: *Journal of Monetary Economics*, volume 23, issue 2, pages 177–200.
- Aschauer, D. A. (1989b). Does public capital 'crowd out' private capital? In: *Journal of Monetary Economics*, volume 24, issue 2, pages 171–188.
- Azevedo, S. G., Sequeira, T., Santos, M., Mendes, L. (2019). Biomass-Related Sustainability: A review of the Literature and Interpretive Structural Modelling. *Energy Journal*, doi:10.1016/j.energy.2019.01.068
- Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, 98, pages 103–125.
- Baumol, W. J., Oates, W. E. (1988), *The Theory of Environmental Policy*, 2nd Edition, Cambridge University Press.
- Behname, M., (2012). La Consommation d'Energie Renouvelable et la croissance économique dans l'Europe de l'Ouest. *The Romanian Journal of Economics*, 35, pages 160–171.
- Behname, M., (2013). La consommation d'Energie Renouvelable et le PIB dans l'Europe du Nord. *The Romanian Journal of Economics* 38, pages 154–166
- Berndt, E. R., Wood, D. O., (1975). Technology, prices and the derived demand for energy. *Review of Economics and Statistics* 57, pages 259–268.
- Berndt, E. R., Wood, D. O. (1979). Engineering and econometric interpretations of energy capital complementarity. *American Economic Review* 69, pages 342–354.
- Best, R., & Burke, P. J. (2018). Electricity availability: A precondition for faster economic growth? *Eneeco* (2018), doi:10.1016/j.eneco.2018.06.018
- Bird, L., Bolinger, M., Gagliano, T., Wiser, R., Brown, M., Parsons, B. (2005). Policies and market factors driving wind power development in the United States. In: *Energy Policy* 33, pages 1397–1407.
- Bos, K., Chaplin, D., Mamun, A. (2018). Benefits and challenges of expanding grid electricity in Africa: A review of rigorous evidence on household impacts in developing countries. In: *Energy for Sustainable Development*, 44, pages 64–77.
- Bowden, N., Payne, J. E. (2010). Sectorial analysis of the causal relationship between renewable and non-renewable energy consumption and real output in the US. *Energy Sources, Part B: Economics, Planning and Policy* 5, pages 400–408.
- Büyükoçkan, G., Karabulut, Y., Mukul, E. (2018). A Novel Renewable Energy Selection Model for United Nations' Sustainable Development Goals. *Energy Journal*, doi: 10.1016/j.energy.2018.08.215

- Costantini, V., Martini, C. (2010). The causality between energy consumption and economic growth: a multi-sectoral analysis using non-stationary cointegrated panel data. *Energy Economics* 32, pages 591–603.
- Da Silva P. P., Cerqueira P. A., Ogbe W. (2018). Determinants of Renewable Energy Growth in Sub-Saharan Africa: Evidence from Panel ARDL (Auto-Regressive Distributed Lag). In: *Energy* 156, pages 45-54. doi: 10.1016/j.energy.2018.05.068
- Dickey, D., Fuller, W. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association* 74, pages 427-437
- Djørup, S. Ø., Thellufsen, J. Z., Sorknæs, P. (2018). The electricity market in a renewable energy system, *Energy Journal*, doi: 10.1016/j.energy.2018.07.100.
- ECAM/Enquête Camerounaise Auprès des Ménages 4 (2014), Quatrième Enquête Camerounaise Auprès des Ménages. Institut National de la Statistique. <http://www.statistics-cameroon.org>
- EBSC/Energy Balance Sheet of Cameroon (2016), Energy Balance Sheet of Cameroon. Ministry of Water and Energy.
- Engle, R. F., Granger, C. W. J. (1987). Cointegration and error correction: representation, estimation and testing. *Econometrica*, 55, pages 251-276.
- Esso, L. J. (2010). Threshold cointegration and causality relationship between energy use and growth in seven African countries. In: *Energy Economics*, 32, pages 1383–1391.
- Foray, D. (1989). Les modèles de compétitions technologiques : une revue de la littérature. *Revue d'Economie Industrielle* 48, pages 16-34.
- Granger, C. W. J. (1988). Causality, cointegration and control. *Journal of Economic Dynamics and Control* 12, pages 551–559.
- Griffin J. M., Gregory P. R. (1976). An Intercountry Translog Model of Energy Substitution Responses. *American Economic Review* 66, pages 845-847.
- Halstead, J. M., Deller, S. C. (1997). Public infrastructure in economic development and growth: evidence from rural manufacturers. *Journal of the Community Development Society*. Volume 28, Issue 2, pages 149–169.
- Hamilton, J. D. (1994): *Time Series Analysis*. Princeton University Press, 1994.
- Hamilton, J. D. (1983). Oil and the macroeconomy since world war-II. *Journal of Political Economy* 91, pages 228–248.
- Harjanne, A., Korhonen, J. M. (2019), Abandoning the concept of renewable energy. *Energy Policy*, 127, pages 330–340.
- IEA/ International Energy Agency (2010), *World Energy Outlook*, International Energy Agency, Paris.
- IEA/ International Energy Agency (2015). *World Energy Outlook 2015*. International Energy Agency, Paris.
- INDC/ Intended Nationally Determined Contribution (2015). *Intended Nationally Determined Contribution, Cameroon*. <https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Cameroon/1/CPDN%20CMR%20Final.pdf>

- IRENA/International Renewable Energy Agency (2014). Estimating the Renewable Energy Potential in Africa: A GIS (geographic information system)-based approach. International Renewable Energy Agency, Abu Dhabi, United Arab Emirates
- IRENA (2016). The Power to Change: Solar and Wind Cost Reduction Potential to 2025, International Renewable Energy Agency, Abu Dhabi, United Arab Emirates
- Jaffe, A. B., Stavins, R. N. (1995). Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion. In: *Journal of Environmental Economics and Management*, Volume 29, Issue 3, pages S43–S63.
- Johansen S. (1998). Statistical Analysis of Cointegration Vector. *Journal of Economic Dynamics and control* 12, pages 231-254
- Johansen S. (1991). Estimation and Hypothesis testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Economica* 59, pages 1551-1580
- Jumbe, C. (2004). Cointegration and causality between electricity consumption and GDP: empirical evidence from Malawi. *Energy Economics* 26, pages 61-68.
- KEEI/ Korea Energy Economics Institute, (2017): A Study for Establishment of the Master Plan of Renewable Energy in Cameroon.
- KEEI/ Korea Energy Economics Institute (2016), World Energy Market Insight No.16-19
- Kraft J., Kraft A., (1978). On the relationship between energy and GNP. *Journal of Energy and Development* 3, pages 401-403
- Lund H. (2014): Renewable energy systems: A smart energy systems approach to the choice and modelling of 100% renewable solutions. 2nd ed. Waltham (MA): Academic Press; 2014
- Lund, P. D. (1999). Effects of energy policies on industry expansion in renewable energy, *Renewable Energy* 34, pages 53–64
- Magnani, N., Vaona, A. (2011). Regional spillover effects of renewable energy generation in Italy. Working Papers 12/2011. Dipartimento di Scienzeeconomiche, Università di Verona.
- Markovska, N., Duić, N., Mathiesen, B. V., Guzović, Z., Piacentino, A., Schlör, H., Lund, H. (2016). Addressing the main challenges of energy security in the twenty-first century-Contributions of the conferences on Sustainable Development of Energy, Water and Environment Systems. In: *Energy*, Volume 115, Part 3, pages 1504-1512, <http://dx.doi.org/10.1016/j.energy.2016.10.086>.
- Marques, C., Fuinhas, J. A., Manso, J. (2010). Motivations driving RE in European countries: A panel data approach. *Energy Policy* 38, pages 6877-6885.
- Marques, A. C., Fuinhas, J. A. (2012). Are public policies towards RE successful? Evidence from European countries. *Renewable Energy* 44, pages 109-118.
- Maurel F. (1989). Modèles à correction d'erreur : l'apport de la théorie de la cointegration. *Economie et Prévision* 88, pages 105-125
- Menegaki A. N. (2011). Growth and renewable energy in Europe: a random effect model with evidence for neutrality hypothesis. *Energy Economics* 33, pages 257–263

- Menyah, K., Wolde-Rufael, Y. (2010). CO2 emissions, nuclear energy, renewable energy and economic growth in the US. *Energy Policy* 38, pages 2911–2915.
- Milliman, S. R., Prince, R. (1989). Firm incentives to promote technological change in pollution control. In: *Journal of Environmental Economics and Management*, Volume 17, pages 247–265.
- MINEPAT/Ministère De L'Economie, De La Planification Et De L'Aménagement Du Territoire (2009). *Cameroun Vision 2035*
- MINEPAT/Ministère De L'Economie, De La Planification Et De L'Aménagement Du Territoire, (2010). *Growth and Employment Strategy Paper*
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2012). *Situation Énergétique du Cameroun, Rapport 2011*.
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2014a). *Statistical Yearbook of Water and Energy*.
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2014b). *Projet de développement du Secteur de l'Energie (PDSEN), Mise à Jour du Plan de Développement du Secteur de l'Electricité à l'Horizon 2030 (PDSE 2030)*.
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2014c). *Status of the regulatory framework of renewable energy sector in Cameroon*.
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2015). *Energy Situation in Cameroon*.
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2016a). *Rural Electrification Master Plan of Cameroon*.
- MINEE/Ministère de l'Eau et de l'Energie/Ministry of Water Resources and Energy (2016b). *Environmental and Social Strategic Assessment of the Energy Sector in Cameroon*.
- Missermer A. (2012). William Stanley Jevons' The Coal Question (1865), Beyond the Rebound Effect. *Ecological Economics* 82, pages 97–103.
- Nelson, R., Winter, S. G. (1977). In search of useful theory of innovation. *Research Policy* 6, pages 36–76. doi:10.1016/0048-7333(77)90029-4
- Nelson, R., Winter, S. (1982): *An evolutionary theory of economic change*. The Belknap Press of Harvard University Press, Cambridge.
- Nelson C. R., Plosser C. R. (1982). Trends and random walks in macroeconomic time series: some evidence and implications. *Journal of Monetary Economics*, 10, pages 139–162
- Observ'ER (2013). *La production d'électricité d'origine renouvelable : détails par région et par pays, 15e-inventaire-Chap03-3.10.5-Gabon*. Observ'ER.
- Özatalay S., Grubaugh S., and Veatch T. L., (1979). *Energy Substitution and National Energy Policy*. *American Economic Review*, 69, pages 369–371
- Palei, T. (2015). *Assessing the Impact of Infrastructure on Economic Growth and Global Competitiveness*. *Procedia Economics and Finance*, 23, pages 168–175.

- PDER/ Plan Directeur d'Electrification Rurale (2015), Plan Directeur d'Electrification Rurale du Cameroun. Ministère de l'Eau et de l'Energie, Cameroun.
- Percebois J. (1989): *Economie de l'Energie*. Ed. Economica (689 p.)
- Peters, J., Sievert M., Toman M. A. (2019). Rural Electrification through Mini-Grids: Challenges Ahead. In: *Energy Policy*, 132, pages 27-31.
- Prasad, G. (2011). Improving access to energy in sub-Saharan Africa. *Current Opinion in Environmental Sustainability*, 3, pages 248–253.
- Reboredo, J. C. (2015). Is there dependence and systemic risk between oil and renewable energy stock prices? In: *Energy Economics*, 48, pages 32–45.
- Sadorsky, P. (2009). Renewable energy consumption and income in emerging economies. *Energy Policy* 37, pages 4021–4028.
- Silva, S., Soares, I., Pinho, C., (2012). The impact of renewable energy sources on economic growth and CO2 emissions - a SVAR (structural vector autoregressive) approach, *European Research Studies*, 15, 2012
- Sims, C. A. (1972). Money, Income, and Causality. In: *American Economic Review*, Volume 62, pages 540-552.
- Stern, D. I. (1999), Is energy cost an accurate indicator of natural resource quality? *Ecological Economics* 31: pages 381-394.
- Stern, D. I., Cleveland, C. J. (2004). Energy and Economic Growth. Rensselaer Working Papers in Economics No. 0410, Rensselaer Polytechnic Institute, USA.
- Soytas, U., Sari, R. (2007). The relationship between energy and production: evidence from Turkish manufacturing industry. *Energy Economics* 29, pages 1151–1165.
- Soytas, U., Sari, R., Ewing, B. T. (2007). Energy consumption, income, and carbon emissions in the United States. *Ecological Economics* 62, pages 482–489.
- Suberu, M. Y., Mustafa, M. W., Bashir, N., Muhamad, N. A., & Mokhtar, A. S. (2013). Power sector renewable energy integration for expanding access to electricity in sub-Saharan Africa. *Renewable and Sustainable Energy Reviews*, 25, pages 630–642. doi:10.1016/j.rser.2013.04.033
- Tang, C. F., Abosedra, S. (2014). The impacts of tourism, energy consumption and political instability on economic growth in the MENA countries. In: *Energy Policy*, Volume 68, pages 458–464.
- Van Ruijven, B., Van Vuuren, D. P. (2009). Oil and natural gas prices and greenhouse gas emission mitigation. *Energy Policy*, 37, pages 4797–4808.
- Wandji, F. Y. D., (2013). Energy consumption and economic growth: Evidence from Cameroon. In: *Energy Policy*, Volume 61, pages 1295–1304.
- Wolde-Rufael, Y. (2006). Electricity consumption and economic growth: a time series experience for 17 African countries. *Energy Policy* 34, pages 1106-1114.
- WDI/World Development Indicators/World Bank (2019), World Development Indicators, <https://databank.worldbank.org/source/world-development-indicators>
- World Bank (2018), Overview Energy, <https://www.worldbank.org/en/topic/energy/overview> Last Updated: Oct 11, 2019.

World Bank (1994), World Development Report, Washington, D. C., 1994.

The Roads System in Sudan: Importance for Sustainable Development and Inclusive Growth

Hassan Ali Gadkarim*

1 Introduction

According to the Goal 9 of the Sustainable Development Goals it is necessary to build resilient infrastructure, to promote inclusive and sustainable industrialization, and to foster innovation. This broad goal can be divided into two distinctive goals, one for building a resilient infrastructure, which is comprehensive, and the other for industrialization and its major development driver, innovation.

The main sectors of infrastructure, it could be argued, are energy/electricity, water/sanitation, and the transport sectors. Considering developing countries, of which Sudan is one, infrastructure, especially transport, is pivotal for achieving the majority of the other SDGs: end poverty in all its forms everywhere; end hunger, achieve food security and improved nutrition, and promote sustainable agriculture; ensure healthy lives and promote well-being for all ages; ensure inclusive and equitable quality education and promote lifelong learning opportunities for all; ensure availability and sustainable management of water and sanitation for all; ensure access to affordable, reliable, sustainable and modern energy for all; and promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Other SDGs could be added to this list. In fact, for Sudan infrastructure is at present more related to the development of the agricultural sector and to agribusiness than to industrialization. But innovation is key for agricultural development and for agro-industrialization too. Box 1 gives the targets of SDG 9, and we see that there is a certain number of targets to be fulfilled to realize SDG 9, and some of these targets relate directly to infrastructure development. It is obvious in the case of Sudan that the country needs a dynamic development of its road infrastructure to develop and to link markets, to industri-

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alize also peripheral regions, to allow for the processing of agricultural commodities, to broaden the impact of R&D, and to develop the base for skills and technological capabilities.

BOX 1: SDG 9 Targets

- Develop quality, reliable, sustainable, and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking actions in accordance with their respective capabilities.
- Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.
- Increase the access of small-scale industrial and other enterprises, especially in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.
- Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, especially of developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.
- Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and Small Island developing States.
- Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.
- Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

Source: United Nations (2015), *Transforming Our World, The 2030 Agenda for Sustainable Development*, New York: United Nations, General Assembly

Indicators mentioned for SDG 9 also relate to infrastructure (see box 2); specifically, they refer to the proportion of the rural population who live within two kilometres of an all-season road. This is central for the Sudanese case as most of the population lives in rural areas, and road transport is central to the socio-economic development. Also, other indicators are important to measure the extent of market

integration which is supported by the roads system. In the essay such indicators are provided as evidence for dynamic changes.

BOX 2: Indicators SDG 9

- Proportion of the rural population who live within 2 km of an all-season road.
- Passenger and freight volumes, by mode of transport.
- Total official international support to infrastructure.
- Manufacturing value added as a proportion of GDP and per capita.
- Manufacturing employment as a proportion of total employment.
- Proportion of small-scale industries in total industry value added.
- Proportion of small-scale industries with a loan or line of credit.
- CO2 emission per unit of value added.
- Research and development expenditure as a proportion of GDP.
- Researchers (in full-time equivalent) per million inhabitants.
- Proportion of population covered by a mobile network, by communication technology.
- Proportion of medium- and high-tech industry value added in total value added.

Source: United Nations (accessed 2019), Official List: SDG Indicators; access: <https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf>

That been said, and for the scope of this paper, focus will be directed to the transport sector in Sudan. Within the transport sector, which could be divided into road, rail, air, sea and river sub-sectors, emphasis will be on the roads sector. The structure of the study is as follows. After section 1 with the Introduction follows section 2 with a focus on the transport sector. Section 3 discusses the importance of the roads sector for conflict prevention and sustainable development in Darfur. Section 4 is on the performance and the achievement of the roads sector in Sudan. Section 5 gives the Conclusions and the Policy Recommendations.

The author of this study did field work in Darfur, studying the role of the roads system for conflict prevention and sustainable development.¹ This is the base for the arguments about the developmental role of the roads sector in Sudan.

¹ The author has been in Darfur during February - March 2019 as part of a team assessing the viability/importance of construction/rehabilitation/improvement of ten feeder roads in Darfur (see: Ashraf and Salah Company, 2019).

2 The Transport Sector in Sudan

Sudan has experienced movements of people and commodities within the country and with neighbouring countries since early periods. Land as well as sea and river transport were important and popular. Many factors do affect the preference of people for diverse means of transport. Cost, the time element, safety reasons, and the comfort seem to be the most influential considerations followed by others, such as accessibility and cleanness.

Having that in mind, table 1 below shows the volume of goods carried by the different means of transport in Sudan for selected years during the period 2001 – 2016. The dominance of land transport is obvious, with a general rising trend observable but for some years also witnessing declines of volumes. These occurrences could be explained by exceptionally bad years on the part of agricultural production and/or foreign trade (caused by weather or by civil war and violence).

The rising trend is however also partly due to the declining contribution of the railways in carrying goods which dropped by 50% during the period alluded to. However, railways still occupy the second place, although there is a declining trend. Sudan Airways - the national air carrier – and river transport have a minimal role, while that of the Sudan Shipping Line - which is supposed to move the bulk of Sudan's foreign trade - is humble but shows an increase since 2013.

Table 1: Goods Carried by Different Means of Transport (in 000 tons) for the years 2001-2016

	2001	2003	2005	2007	2009	2011	2013	2015	2016
Sudan Railways	1,249	1,278	1,137	1,091	907	994	1,102	718	618
Land Transport	3,972	4,385	9,222	5,556	5,736	10,325	8,683	13,684	14,086
Sudan Airways	8	18	8	12	10	31	17	33	30
River Transport	40	50	73	71	69	97	2	25	na
Sudan Shipping Line	221	199	57	169	33	0	323	1,820	na

Source: Computed from CBOS/Central Bank of Sudan, Annual Reports, various issues. **Note:** na: not available

The picture changes slightly when passenger movements are examined. Table 2, which presents the number of passengers carried by the same different means of transport during similar years, depict a somewhat different story. Though land transport takes the lead, its performance is unstable and varies – sometimes dramatically – from year to year which makes the task of assuming a regular tendency

or trend rather unattainable. Sudan Railways' greatest yearly contribution to transporting people is less than one per cent of those transported by land. River and sea transport by the Sudan Shipping Line are negligible. Sudan Airways' performance, as far as passengers are concerned, seems to be better than that of goods and commodities.

Table 2: Passengers Carried by Different Means of Transport (in 000's)

	2001	2003	2005	2007	2009	2011	2013	2016
Sudan Railways	180	144	55	51	87	0	13	210
Land Transport	26125	28853	15256	22400	26150	29990	47000	25703
Sudan Airways	526	494	442	476	497	2580	2061	2927
River Transport	7.4	8	19	143	5	34	0	na
Sudan Shipping Line	80	42	0	0	0	0	21	na

Source: Computed from CBOS/Central Bank of Sudan, Annual Reports, various issues; na: not available

Historically, Sudan was linked with his neighbours since ages ago. The North was linked mainly by Darab Alarbeen which stretches from Egypt to the Northern Sudan and reaches to the Western region. Camel convoys travelled along this road for centuries carrying commodities and people. As well, it was an extension to the routes from western African countries. The Red sea was also crossed by passengers and goods creating a long-lived relationship with Saudi Arabia and the Gulf countries. Sudan was usually crossed by pilgrimages from Western African countries on their way to Holly Mekah. Land routes were also used between Sudan and the Horn of Africa, especially Ethiopia. Journeys were tough and used to take weeks, and many foreign travellers settled in Sudan during their journeys.

Nile travel was known but not widely used because of the cataracts which disrupt journeys. Railways have followed land and Sea/Nile means of transport. It started at the end of the nineteenth century with the invasion of the British forces, 1897. The initial purpose was to move the army to the capital, since Nile sailing, for the army, was slow and dangerous and endangered the whole purpose of defeating Omdurman which lies far away from the Southern Egyptian border. Moving by land, on animals, was slow and exhausting and was surrounded by the danger of erupting the continuous supply process for such an army. In the words of W. Churchill (Churchill, 1902/2009 edition): "Fighting the Dervishes was primarily a matter of transport. The Khalifa was conquered on the railway"² This supports the argument that transport benefits are not only limited to the known economic/social ones.

² Churchill (2009/1902 edition), p. 128; access: <https://www.gutenberg.org/files/4943/4943-h/4943-h.htm>

2.1 Sudan Railways

However, the railways network was, later, developed to satisfy the economic purposes of the colonial power in the first place, by facilitating the foreign trade which serves the colonizers by exporting primary commodities (especially cotton) and by importing manufactured/processed goods and commodities. Therefore, the network of railways meets these ends (see map 1).

Map 1: Railway Lines



Source: Sudan Railways, Wikimedia Commons; access: https://upload.wikimedia.org/wikipedia/commons/thumb/5/5b/Railways_in_Sudan.svg/1200px-Railways_in_Sudan.svg.png

According to the Sudan Railways Strategic Plan (second edition)³, the Corporation runs about 4,180 km of a single line of 1067 mm gauge (narrow gauge). Main routes include: Khartoum – Port Sudan, passing by Atbara; Alternate route linking the Port with Sennar via Haiya and Kassala, which is not at service in the meantime; the line from Khartoum to Atbara has branch lines to both Karima in the Northern region and to Wadi Halfa at the borders with Egypt. From Sennar

³ See about the Sudan Railways Corporation (SRC): https://www.ide.go.jp/English/Data/Africa_file/Company/sudan05.html

there exist links southward to El Damazin, which is not in service, and westwards to El Obeid and Nyala, etc. Most of the lines were built before 1930, and no new lines in the main network were reported since the 1960s. Few short extensions were constructed to fulfil specific purposes, e.g. to link refineries, cement and sugar factories, power plants, free areas, food silos, and petroleum storage areas to nearby passing main lines. This reflects more the demand of the oil industry which is exporting since 1999.

The Sudan Railways Corporation (SRC), which runs the network, is one of the units of the Ministry of Transport, Roads and Bridges. Its main offices and workshops are in Atbara which is the center for managing the Northern region of the corporation as well. The other regions - Eastern, Central, Southern, and Western - are run from Port Sudan, Khartoum, Kosti, and Babanusa, respectively. Though the purpose for this decentralization was to weaken Atbara (which was strong in terms of trade unions and the political influence of workers), it could also reflect the relatively wide area covered by railways and its role in linking production areas with local and external markets.

It should be mentioned that the Sudan Railways Corporation (SRC) had faced a severe blow during Numeiri's regime. The Railways Workers Union (RWU), with its bulk membership in Atbara, was strong and composed a solid opposition to the regime, and its strikes had frequently shaken the regime. That led to the decentralization of the corporation by Numeiri. Not only that, but one of the main purposes of developing the roads network was to weaken the railways workers' position. In fact, many roads were built parallel to existing railway lines, intentionally to compete and to ruin the railways. Not only that, but railways were also hit by privatization endeavours. Such a government policy was expensive and led to disastrous neglect of both means of transport (railways and roads).

It might be logical for African countries in view of its geography, Sudan included, to prefer a combination of roads and railways transport. However, the high cost of investment capital for establishing railways as well as the cost of rolling stock needed as compared to investment for roads might offset the balance against railways, but some other factors for the decline of the railways system lie on the side of railways. Railways are cheaper in use than road transport. In countries like Sudan, railways are savers since transported goods/commodities/luggage etc. are put in carriages that keep them away from sun, rain, wind and uneven roads as well as thieves. Trains are supposed to be more punctual and more comfortable for passengers but may be slower and less flexible. Moreover, railway stations are usually equipped with convenient storage facilities.

As a general proposition, both transport means can exist side by side. Railways can serve in moving bulky commodities and production from production areas to markets and ports as well as passengers in need of more convenient and comfortable transport means. Roads could be used for those contractors and persons in need of speed and flexibility. In Sudan, a vast agricultural country, there is

high demand/need for both means of transport. They can be complements at some occasions and substitutes at some others. For example, road transport becomes scarce and expensive when there is a shortage in petrol supplies, which is not unusual in Sudan. The public railways' needs of petrol are less and can be secured easier than in the case of the private owners of vehicles using roads.

For railways to regain its position, which is not the same as starting as a new sector, rehabilitation and modernization are needed. Sudan has some railways infrastructure, which may need renewal/repair, and the country has as well an accumulated experience related to operating this kind of service.

2.2 The Destruction of Sudan Airways, of the Sudan Shipping Line, and of River Transport

Not only railways, but the whole transport sector had suffered during the Salvation Regime (1989 – 2019), although the times before were not so good for the Sudanese transport sector. Some sub-sectors suffered more than others, but it could be argued that the main reasons were political rather than factors relating to the transport industry, political reasons which were also the main cause of problems in the railways subsector.

One main service provider, Sudan Airways, had faced difficulties for long time, but the most rapid deterioration and collapse took place during the Salvation Regime. At the early years of the Regime, It is stated: "In mid-1991, scheduled domestic air services were provided by Sudan Airways, a government-owned enterprise operated by the Sudan Airways Company (SAC). The company began its operations in 1947 as a government department. It has been operating commercially since the late 1960s, holding in effect a monopoly on domestic services. In 1991 Sudan Airways had scheduled flights from Khartoum to twenty other domestic airports, although it did not always adhere to its schedules. It also provided international services to several European countries, including Britain, Germany, Greece, and Italy. Regional flights were scheduled to North Africa and the Middle East as well as to Chad, Ethiopia, Kenya, Nigeria, and Uganda. The Sudan Airways fleet in 1991 consisted of thirteen aircraft, including five Boeing 707s which were used in international flights, two Boeing 737s, two Boeing 727s which were employed in domestic and regional services, and four Fokker F-27s used for domestic flights."⁴

⁴ Sultan, Maysoon A., Mohammed H. Mudawi, and Afra H. Abdellatif (2016): Past, Present & Future of Airlines Domestic Services in Sudan. In: IOSR (International Organization of Scientific Research) Journal of Mathematics. Volume 12, Issue 3 (May - June 2016); access: www.iosrjournals.org

The Sudan Airways company, due to its huge debt on government, political appointments, mismanagement and corruption was unable to keep most of its international flights and government started in the early 2000s to pour funds into the enterprise, not to rescue the national carrier but to prepare it for privatization. The scandalous sale of 49% of its shares to a foreign company and of 20% to Sudanese investors, who were in fact part of the foreign company, left the Sudanese side with less than 30% of shares. The new owner's unprofessional practices, such as selling aircrafts at cheap prices and renting them at unusual high ones by any standards, had led to the collapse of the company and had assisted other companies to take over. The corruption involved in selling the Sudan Airways slots (lines) was openly criminalised by the legal authorities. The agreement with the foreign company, under great public pressure, was terminated and the company, in addition to what it had taken away, had a profitable split-up.⁵ The company, like most of the national projects, is in line for government support to regain its position as the national carrier.

The Sudan Shipping Line (SSL) was liquidated in June 2016 and its story was not very different from the rest of the national projects which were dismantled because of mismanagement/corruption etc. and were prepared to facilitate unfair competition in front of allied private (foreign and local) firms being interested in parts of the corporation.

The national merchant marine, the corporation Sudan Shipping Line (SSL), was established in 1962 as a joint venture between the government and Yugoslavia. In 1967, it became wholly government owned. From the initial two Yugoslav-built cargo vessels, the line had grown by the mid-1970s to seven ships, totalling about 52,340 deadweight tons. During the years 1979 to early 1980, eight more ships were added, including six which were built in Yugoslavia and two which were built in Denmark. In 1990, the merchant marine consisted of ten ships of 122,200 deadweight tons in total. The Yugoslav vessels were all-multi-purpose and included container transport features. The Danish ships were equipped with roll-on-roll-off facilities. Sailings, which had been mainly between Red Sea ports and northern Europe, were expanded in the late 1980s to several Mediterranean ports.⁶ That up to the 1980s, the Sudan Shipping Line (SSL) was expanding, before it was pulled to pieces and all its ships sold, in the usually suspicious manners of the overthrown regime. All this was called privatization policy, but it was corruption at highest political levels (to finance the party, the family, the security forces, the loyal media and the loyal officials).

⁵ Please see: Assayha Newspaper (2019): The Assassination of Sudan Airways: The Complete Crime. Five reports published during 11-25 September 2019 for details

⁶ See Transport in Sudan, by Wikipedia; accessed in 2019: https://en.wikipedia.org/wiki/Transport_in_Sudan

Transport via inland waterways, river transport, was not more fortunate. Due to a multiple of factors utilizing the abundance of watercourses for transport was modest. These factors include cataracts, shallowness of the streams at some places, dams, and the spread of the water hyacinth, which all hinder navigation. However, there were two main routes, Karima – Dongola on the Nile in the North and Kosti – Juba on the White Nile in the South, which were functioning. Needless to mention their seasonality because of the impacts on the levels of water. The Northern line stopped because of its seasonality and the development of a speedy road system. The more prominent route in the South was abandoned due to the civil war and the secession of South Sudan in 2011. It is a huge task for the new government to revitalize these means of transport and to provide for a balanced provision of all these transport modes.

2.3 Sudan Road Transport

The Africa Infrastructure Country Diagnostic (AICD)⁷ states that despite the road network's expansion since the advent of the oil industry, Sudan's performance in the roads sector still lags the regional aggregates. Between 2000 and 2008, the report (World Bank, 2008, Ranganathan/Briceño-Garmendia/AICD, 2011) says, the length of roads almost doubled from 3,400 km to over 6,200 km. The network expansion involved major arterial routes that connect Khartoum with Port Sudan and onward to Egypt. While these north-south links are developed and in relatively good condition, east-west connectivity lags considerably. Sudan has extremely low road densities and poor paving rates; a significant segment of the road network is in poor conditions. The classified road network in Sudan is around 30 percent the size of what is prevalent in low-income countries and in resource-rich countries, and traffic volumes are extremely low.⁸

Sudan has made some progress, as far as roads are concerned, especially during the period 2000-2010 when regional roads were expanded mainly from Khartoum to the North. But it is estimated that Sudan needs at least 2,900 km of roads more to meet regional connectivity standards (linking Khartoum to international frontiers); 5,300 km more to meet national connectivity standards (linking all provincial capitals to the regional network); and a further 34,201 km more to meet rural connectivity standards (linking land which is responsible for 80 percent of the existing agricultural production value to the national network as well as linking

⁷ See World Bank, 2008; access: <https://www.icafrica.org/en/knowledge-hub/article/africa-infrastructure-a-time-for-transformation-9/>

⁸ Rupa Ranganathan and Cecilia Briceño-Garmendia/AICD (2011): Sudan's Infrastructure: A Continental Perspective, Africa Infrastructure Country Diagnostic (AICD), The International Bank for Reconstruction and Development / The World Bank, p. 14

land with the capability of producing 50 percent of the non-realized agricultural value). In addition, the urban connectivity standards assume an extension of the paved road network to within 500 meters of the population.⁹ All this means that Sudan has huge gaps in terms of roads infrastructure.

The long table in the Appendix with the list of roads is important in its coverage of three main patterns of paved roads, namely: local roads, i.e. in cities and towns; regional roads, which connect destinations within the same region; and interregional roads, which connect regions and also the neighbouring countries. These three patterns overlap since local and regional roads are usually stretched to adjacent regions. The table gives insight on the distribution of roads among the different regions. If the area is used in relation to the length of roads in the region, the biased distribution will be obvious. Kordofan (11.01%) and Darfur (7.63%), which have together less than 20% of the length of roads within the regions, occupy more than half the area of the whole country. The fact that these two regions comprise eight states does not weaken the argument, but give it more strength when it is noticed that the Northern state, which occupies about 17% of the area of Sudan, has more than 30% of these roads, and the Red Sea state, which occupies more than 10% of the land area, has about 14% of the length of the roads in Sudan. River Nile state stretches over more than 6% of the country area and enjoys more than 9% of these roads. The other states, Gezira, Kassala, and White Nile, which have more than 6% of the roads of Sudan each, have an area of less than 2% each. Interregional roads distribution also shows the dominance of the central and northern regions.

The map 2 below - of the different states of Sudan - can be employed to illustrate the vast regions of Darfur (states 11, 12, 13, 14 and 15 in the map) and Kordofan (states 16, 17 and 18 in the map). That reaffirms the unjustified marginalization of these regions, especially so of Darfur.

The analysis clearly demonstrates the unequal distribution of land roads, which may be taken as a norm of the past distribution of investments, services, and infrastructure. Table 3 below gives a detailed presentation of the roads network of Sudan (more detailed is the table in the Appendix). The unequal living standards/wellbeing of the people follow this pattern, which resulted, among other factors, in armed conflicts/struggles in what are called the marginalized regions. South Sudan, it should be mentioned, scored the lowest indicators of development, which among other factors provoked a long history of civil war, which culminated into secession.

⁹ Ranganathan/Briceño-Garmendia/AICD (2011), p. 16

Map 2: The States of Sudan

Source: Developed by the author. **Note:** 1- Khartoum; 2- Northern; 3- River Nile; 4- Red Sea; 5- Kassala; 6- Gezira; 7- El Gedaref; 8- White Nile; 9- Sennar; 10- Blue Nile; 11- North Darfur; 12- West Darfur; 13- Central Darfur; 14- South Darfur; 15- East Darfur; 16- North Kordofan; 17- West Kordofan; 18- South Kordofan.

Moreover, and based on the World Bank analysis of the poverty situation in Northern Sudan (according to the Sudan National Baseline Household Survey/NBHS of 2009), the poverty headcount by state, i.e. the percentage of population with consumption below the poverty line, was as follows: Northern Darfur (69%), South Darfur (61%), South Kordofan (60%), North Kordofan (58%), Red Sea (58%), Blue Nile (57%), West Darfur (56%), White Nile (56%), Al Gedarif (50%), Sennar (44%), Gezira (38%), Kassala (36%), Northern (36%), River Nile (32%), and Khartoum (26%). Therefore, any plans to develop the country in general and the transport (roads) sector must have in mind the importance of amending this skewed situation and to pursue a balanced route. To further illustrate the importance of such intentions and objectives, the case of the roads system in Darfur is examined below.

Table 3: Distribution of Roads in Sudan (Interregional, Regional, Local)

Destinations	Region/States	Km
Wadi Saydina – AL Hogna	Khartoum-Nile	63
Khartoum - Medani	Khartoum - Gezira	187
Medani – Gedarif	Gezira - Gedarif	228
Gedarif – Kassala	Gedarif – Kassala	220
Kassala – Haya	Kassala –Red Sea	351
Atbara – Haya	Nile – Red Sea	279
Gaili – Shendi	Khartoum – Nile	129
Atbara - Merawi	Nile - Northern	226
Omdurman – Al Multaqa (Joint)	Khartoum – Northern	311
Khartoum North – Kataranj – Abu Haraz	Khartoum - Gezira	191
Sinja - Damazin	Sennar – Blue Nile	167
Medani – Sennar - Kosti	Gezira – Sennar –White Nile	220
Jebel Awlia – Eddueim	Khartoum – White Nile	158
Tendelti – Obeid	White Nile –North Kordofan	191
Jebelain – Renk (Tariq Alsalam)	White Nile – South Sudan (int.)	97
Omdurman – Bara	Khartoum - North Kordofan	110
Dibaibat – Dillinj – Kadogli	North & South Kordofan	188
Um Rawaba – Ubu Jubaiha (Partial)	North & South Kordofan	50
Um Rawaba – Al Abasia	North & South Kordofan	50
Um Kadada – Nihud	North & South Darfur	221
Total Interregional Roads		3,637
	Khartoum	107
	Nile	477.25
	Northern	1,563.6
	EL Gedarif	205
	Kassala	359.5
	Red Sea	721.5
	Gezira	308.5
	White Nile	350
	Sennar	95
	Kordofan	567
	Darfur	393
Total Regional Roads		5,147.35
Total Local Roads		1,079.75
TOTAL		9,864.1

Source: See Appendix (Full Table)

3 The Importance of the Roads Sector for Conflict Prevention and Sustainable Development in Darfur¹⁰

Darfur is a region in the western part of Sudan as the above map 2 shows. It comprises, according to the map, five states with West Darfur/12, Central Darfur/13, South Darfur/14, East Darfur/15, and North Darfur/11. The region is rich in natural resources. Both the land and the climate are suitable for growing a multiple of agricultural products, which include millet, sorghum, sesame, groundnuts, various species of beans and seeds, as well as vegetables and fruits. It is also rich of livestock, and the number was estimated at 30,613,962 (7% in North Darfur, 44% West Darfur, and 49% in South Darfur). As well, it is reported to be endowed with minerals and other resources. However, all this potential could not be utilized in the direction of improving the living standards and conditions of the population of the region. Darfur and some other regions has faced unequal central government treatment, with the outcome of backward regions in a country which is already classified as a least developed country. Consequently, Darfur is characterized by underdevelopment in all aspects of its economy and society. Social services are lacking/scarce or very underdeveloped and insufficient. Health and education indicators as well as other human resources development indicators are very low. Water and electricity are scarce, and water provision was the main concern of regional governments at the time of preparing this paper. Electricity is a luxury which had not been fully attended to yet.

Though Darfur was facing this backward situation even since independence, the armed conflict which erupted in 2003 (mainly because of that situation) has worsened the conditions further to reach disastrous levels. The conflict has eroded the already weak infrastructure and the basic services. Modes of living have been destroyed and about a quarter of the populations live in camps after fleeing their destroyed / burned settlements. The disaster resulted in a situation that virtually the entire population of Darfur - an estimated 8 million - is affected by the conflict. Apart from the 2 million that are still displaced, including the refugees (80% of whom lost everything they owned), every community is affected. Whether the people in the communities are sedentary rural farmers, nomadic pastoralists, public sector workers or urban dwellers, all of them have seen their livelihoods disintegrated and their freedom of movement and personal security severely threatened

¹⁰The author has been in Darfur during February-March 2019 as part of a team assessing the viability/importance of construction/rehabilitation/improvement of ten feeder roads in Darfur (see: Ashraf and Salah Company, 2019).

or compromised.¹¹ This resulted in the internal displacement of an estimated 1.7 million people, as well as a flood of 280,000 people from Western Darfur into Chad as refugees.

Peace efforts such as the signing of the Doha Document for Peace in Darfur (UNAMID et al., 2011)¹² have contained some of the major fighting parties, and the situation has improved considerably with many factions joining peace or lessening confrontation. The situation seemed to be calm but there is a need for a cautious approach. Arms, it is said, are not completely collected but hidden to encounter any surprises. The lost trust among tribes, between the government and a respectable section of the population, not only the armed opposition, needs some time to be regained. Among the actions needed, the continuation and the success of the ongoing efforts to return and to resettle internally displaced persons (IDPs) are crucial. However, this issue of return and resettling is a complicated and multifaceted one and not a direct forward one. The success of efforts to secure a voluntary return of IDPs necessitates, among others, solving land problems, rebuilding demolished villages, providing inputs for agricultural and other production activities, and providing necessary services and infrastructure (roads included). Such measures are of high priority in the years to come, but there is no master plan for this task and support is lacking. It is time to develop further the Developing Darfur Strategy (DDS) concept towards coherent action.

The region, it has to be stated, needs fast and huge recovery and reconstruction efforts. At the time of the visit to Darfur, it could be argued that the region, which depends on federal transfers and foreign assistance, was not experiencing a post-conflict development era. Development efforts were/are concentrated on providing water, an endeavour which is far bigger than what the government's deteriorating economic, financial and administrative situation would allow to handle, leaving aside other vital tasks. Darfur regional governments are occupied with frequent gasoline shortages, affecting transport and mobility, but also market development and market integration. The historically weak volume of fiscal transfers from the centre in Khartoum, which was among the major causes of the conflict, did not experience any substantial quantitative changes since the Doha Agreement. Handling the critical economic situation is crucial at this junction of circumstances. Stability in the more deprived regions like Darfur is largely dependent on the actions to come in the next time.

¹¹ DRA/Darfur Regional Authority et al., 2012; 2013-2019 Developing Darfur: A Recovery & Reconstruction Strategy (DDS); 2012; access: [www.undp.org > content > dam > sudan > docs > DDS English](http://www.undp.org/content/dam/sudan/docs/DDS_English)

¹² Doha Document for Peace in Darfur (DDPD), 2011; access: <https://reliefweb.int/report/sudan/doha-document-peace-darfur-ddpd>

3.1 Roads Situation in Darfur

The AICD¹³ report points out the fact that Sudan's transport infrastructure is unevenly developed. This means that, despite a few road corridors, a large part of Sudan is unconnected or lacks paved roads; the road density in Sudan is among the lowest in Africa and the world. The existing road arteries in Sudan are centred on Khartoum as the hub. One artery connects Khartoum with the coastal gateway of Port Sudan, a second one connects Sudan with Egypt and North Africa, a third one connects Khartoum with the Eritrean border, a fourth one connects Kordofan with Khartoum, and a fifth one leads to Ethiopia. Connections to other parts of Sudan, including Darfur, are fragmented resulting in little traffic overall.

For Darfur, the situation is aggravated by the conflict. It is stated: "In the case of Darfur, the infrastructure has been completely destroyed during the war, making the sector one of the top priority areas to address"¹⁴. This sentence clearly illustrates the need to work on the conditions of roads but also of the infrastructure at large. Regarding the actual conditions of the roads network, in a list documented by the National Highway Authority (NHA), the Darfur region registers some of the most extensive network of bad roads (AfDBG, 2016; MoT/Ministry of Transport, 2014). For instance, the El Nuhud to Nyala via Babanousa and Ed Da'ein road sections, a major inter-state link representing some 436 kilometres, are un-paved and hardly passable. The road section from El Fasher to El Geneina, some 328 km long, is virtually impossible to navigate or to drive. Likewise, the road from Zalingei to El Geneina, some 175 km long, is in a severe state of disrepair, restricting movement, so that the conduct of basic economic activity and of inter-state trade between the two states of West Darfur and Central Darfur is impossible.

The road systems in Darfur are, therefore, in a dilapidated state of repair and require major rehabilitation or reconstruction. The situation is impaired by the fact that the National Highway Authority (NHA), responsible for development and management of the national highway network, and the Darfur State Governments, responsible for intra-state roads, are faced with severe financial, human and technical capacity constraints. Furthermore, the private sector is not yet fully developed to take on the road construction and maintenance tasks. The prevailing insecurity had further complicated matters.

The Situational Analysis and Results Framework undertaken in November 2012 to work on a Developing Darfur Strategy (DDS 2012) indicated that the road network in the Darfur region covers over 12,000 km. However, only 200 km are

¹³ Ranganathan/Briceño-Garmendia/AICD (2011)

¹⁴ AfDBG/African Development Bank Group, Country Office (2016): Sudan: Darfur Infrastructure Development Report, p. 2

asphalted and only 100km of the network are gravelled, while over 10,000 km remain in a state of disrepair, and some only existing as tracks, which become virtually unusable during the rainy seasons. This is a sad situation and shows that only 1.7% of the roads network in Darfur is paved; about 1% is gravelled, while tracks comprise 97.3 % of the whole network.¹⁵

The proportion of paved and unpaved roads in the former three Darfur States further illustrates this; in North, South and West Darfur, prior to the creation of two new states, 96%, 97.6% and 100% of the roads were not paved. The portions paved were about 4%, 2.4% and 0%, respectively. The National Highway Authority (NHA) list of unpaved priority national highways in the Darfur region includes En Nuhud - Babanousa Ed Daein - Nyala, El Fasher - El Geneina, Zalingei - El Geneina, Nyala - El Fasher, Nyala - Buram and Kutum - El Fasher.¹⁶

The construction and upgrading of the El Fasher to Kutum (110 km) road to the asphalt standard was reported to have started some years ago with central government funding, based on measured contract performance. This implies that after the down payment, the contractor only receives payment based on measurement of the work done. It was noted that progress on the El Fasher - Kutum road was minimal, as the contractor had only been able to undertake the base construction of 13 km of the road from El Fasher. The target completion date of 2014 was not met. Government officials attributed the delay mainly to the prevailing insecurity; however, escalation of costs of building materials, cash flow problems, fluctuating exchange rates, and a limited budget were also cited among the major problems. The Government has only budgeted SDG (Sudanese Pound) 5.4 million for the rehabilitation of the road from El Fasher through Kutum to El Tina, a road which has a length of 360 km. This amount of funding would not even be adequate to fully gravel the section between El Fasher and Kutum, which would require at least US\$ 25.2 million at an estimated cost of US\$ 240,000 per km¹⁷.

An upgrading to the bitumen standard of the road from Zalingei in Central Darfur to El Geneina in West Darfur, with a length of 175 km, is also underway. This road was fully completed in 2014. The road link from En Nuhud in Northern Kordofan to El Fasher, through Um Kadada in North Darfur, with a length of 389 km, was under construction for upgrading to the asphalt standard and was completed in 2014. Although the Nyala - Kass - Zalingei road was asphalted in 1983, it has since deteriorated. Rehabilitation of the section between Nyala and Kass (86 km) has recently been completed, leaving the section Kass-Nertiti-Zalingei (112

¹⁵ See: AfDBG (2016), pp. 8-9

¹⁶ African Development Bank Group (AfDBG), (2016), pp. 8-9

¹⁷ African Development Bank Group (AfDBG), (2016), pp. 8-9

km) in need of urgent rehabilitation.¹⁸ Whereas Darfur appears to have an extensive road network, most of it is in a worn-out state and virtually impassable. All this means that achievements are possible in Darfur, but it is necessary to analyse, to plan and to implement in a rigorous manner.

However, some governmental studies give a rather optimistic picture of the achievements in the roads sector as well as in other infrastructure sectors. This is understandable, especially in arenas for attracting foreign support. A report¹⁹ claimed that 33% of the network of roads in 2011 was added during the period 2011-2018, bringing the total roads length to paved 10,595 km. The distribution of the new roads, it is claimed, gave due consideration to the regional balance where several roads were completed or are near completion in Darfur. It is stated that Darfur enjoyed 1,125 km, this being about 32%, of the total completed roads in that period.

The report includes, within Darfur's 1,125 km, a total of 212 km for the Nyala – Kass - Zalingej road. This road was in fact under rehabilitation. The Kass - Nyala road (about 80 km) was truly paved and could be described as one of the best roads in Darfur and may be in Sudan. The rest of the road, the Kass-Zalingei part, is in poor condition and impassable and vehicles prefer to go off road by taking longer roads.²⁰ It should be mentioned that the President had a scheduled visit to Kass from Nyala which he reached by air. The Nyala-Kass segment was taken care off, primarily because the President was going to Kass.

In this regard, some points need to be spelled out to understand the real/the ignored context of the alluded to achievements in the roads sector. First, the Salvation regime ruled the Sudan for thirty years, almost half its life since independence. Thus, its attainments should be related to its long period of rein. Second, major roads such as the arteries of the Northern and the Western Sudan roads have been constructed from compulsory donations. Special taxes were levied to finance these roads, and the Sudanese working abroad were obliged to pay specific sums annually, to assist in constructing these roads. In addition, these roads were linked to widely circulated stories of corruption. In fact, the people financed both the roads and the corruption of top authorities/persons in the regime. Finally, but not the least, the constructed roads are not up to the normal standards and require reconstruction/rehabilitation in short time.

¹⁸ National Highway Authority (NHA) information, cited in: AfDBG (2016); see also MoT/Ministry of Transport (2018), and National Roads and Bridges Corporation (2019)

¹⁹ See: Republic Of The Sudan (2019): Ministry of Finance and Economic Planning (2019): Implementation of Istanbul Plan of Action for Least Developed countries (IPoA) 2011-2020.

²⁰ Our group of researchers went through this experience and travelled for about six hours from Zalingei to Nyala during February 2019.

3.2 The Prominence of the Roads Sector: Darfur as an Illustration

In Sudan, transport and roads are multidimensional in importance and this infrastructure cuts across the economic, social, cultural and security fundamentals of the society. Emphasis, however, differs from one location to the other depending on the characteristics of each area and the current situation there. For example, the eminence of the transport sector in Darfur, at this time, is highly related to what is called the voluntary return of the internally displaced persons (IDPs) and the refugees. Movements of IDPs have taken direction not only within different states in Sudan but also between them. For example, it is reported that more than 23,000 IDPs have flown from Central Darfur to North Darfur. Roads will assist in facilitating/encouraging voluntary return of IDPs, especially from camps in/near towns to villages and to rural areas. Many villages have been rebuilt for a voluntary return, most of which are located near feeder roads while camps are located mostly around state capitals and relatively large settlement locations (towns, big villages, and/or near army units).

In some places that were disturbed by serious conflict(s) and intensive migration(s) to other places, voluntary return processes for seasonal agricultural practices started some years ago, before - recently, during the past two or more years - a permanent settlement tendency took place in some areas. In other areas, still only a seasonal return is practiced. Roads are supposed to play a great role, among other measures, in enhancing the efforts for a voluntary return. The improvement of roads will assist the efforts towards promoting the voluntary return of IDPs to their home villages and lands and towards finally encouraging permanent settlement. Efforts for building returnee villages are great. In one administrative unit²¹, for example, they reached thirteen villages in addition to another one in the process of being established for a group of returnees.

Needless to emphasize the security enhancement factor as one of the important benefits of roads for encouraging the on-going voluntary return of both refugees, mainly from Chad, and of internally displaced people which were previously relocated in camps around towns and other villages as well as near stations of security forces. It could be argued that good roads are reassuring factors by spreading the feeling of security among the returnees because of the proximity of security forces and the expectation that a swift reaction to any trouble will follow, may it be of tribal origin or related to natural resources and other calamities. As well, there are sometimes massive burglary and theft incidents, which are fostered/aided by the forces that usually deal with such instances. Better roads will expedite the dealing with such lawless cases. In addition, some tribal or other conflicts, not uncommon in the region, will be faced with a necessary prompt action.

²¹ A state is divided into small local administrative units.

Security is very crucial in that region, especially for settling disputes, which may erupt in the area at any time. The time factor, it is reported, is vital for containing such disputes and any other security hazards. A security committee has been formed in each village to resolve conflicts. They may refer cases to the state's security committee if it is proved to be too difficult for the local ones. It is understood that the efficiency of such mechanisms depends on the time element which is a derivative of the efficiency of roads as well as of communication means. Security and improved roads are envisaged as interrelated factors encouraging returning and settling in old but devastated villages. Ease of movement helps displaced persons and refugees in frequency visiting their home areas to assess the situation as well as to practice some of their old activities from pre-conflict times, especially agriculture during the cultivation seasons. Of course, ease of movement is a driving factor which is enhancing the process of returning home.

These, and other factors, of promoting returning and enhancing security are not only related to the existence of roads, but also to their state of maintenance and an all-seasons-roads-usability, as most of the people are cut off during the rainy season when these roads become impassable and highly risky for crossing. This factor, easy access in all seasons, is a necessary one but it needs complementary action for sustaining a voluntary return of the IDPs. Other factors may include the availing of resources for rebuilding their old accommodations and other facilities, the provision of services (health, education, water, etc.), the feasibility of reengaging in their old agricultural activities/livestock rearing or in other (off-farm) activities, and the settlement of land and other disputes. Not only the availability of roads but also the condition of roads is of extremely great importance. The difficulty of movement in the rainy seasons has destructive consequences for the people, as development, peace and reconstruction are endangered (see below the box 3).

A common bitter complaint is the difficulty of transferring patients, especially of serious ones, and complicated delivery cases for women. Such situations get worse during the rainy seasons, endangering many lives. In rainy seasons, people stick to their places; people prefer not to move away because of difficulties to move. When they move to their land to practice agriculture, they stay at their cultivated land mainly because of transport problems. People are reluctant to move, worried of being cut off from transport facilities and unable to return. If they take the risk of moving during the rainy season, this may result in delays, on the road, for some days, leading to serious problems.

Box 3: Disturbing Cut-Offs

The stoppage/difficulty of movement in the rainy season has led to disastrous instances. Complications in a woman's delivery course made it inevitable to transfer her to the capital's hospital. The ambulance driver took high risk in driving during the rainy season but still it was impossible for him to cross one

of the wadis because of the high and strong stream of water. He tried more than once but failed to cross. People tried to carry her on a stretch/bed to the other bank of the wadi to be moved from there by another car, but their trials were in vain. Time passed, her condition worsened, and at last, she died on the bank of the running wadi. This is only a case in point which her town still mourns with great grieves. In that area, wadis drifted/killed at least twelve people during the past few years. Foreign forces lost some soldiers as well. More women are said to have been lost because of the difficulty to reach hospital(s). However, it is unfortunate and unacceptable to be delayed for 5-7 days to travel from capitals to villages/towns or vice versa. Emergency cases and certain complicated situations cannot endure delays that usually lead to disasters.

Source: Author from reported cases

The relatively large number of people living in localities/villages in Darfur is an argument for providing an all-seasons reliable roads network. Darfur localities are not so thinly populated that one may argue against providing such vital services/infrastructure. The existence of schools and governmental units (local administrative offices, police, and taxes/zakat units, etc.) in the localities/districts show that such road networks are justified by social, administrative, and economic reasons. But also, for private sector development such a roads network is important.

Other shortcomings, which are related to the conditions of roads, include their roughness. Their harshness condition discourages travel except for obligatory or emergency circumstances. It should be mentioned that the conditions of roads are such that using four-wheel drive vehicles is necessary. This leads to raising the cost of transport and at the same time squeezing passengers, commodities, and goods. It is not uncommon to see passengers packed on the top of vehicles. Lorries, trucks, and large vehicles are rare on feeder roads and may operate in towns and their neighbouring areas during the Souq (market) days. This alarming situation also prevails during the (better) conditions of the dry season. It gets worse in the rainy season, with long durations, sometimes extending to a week or so, of immobility and isolation. All these situations can be changed with an all-seasons-road network. Referring to SDG 9, all the eight targets can be realized when such a roads network is existing, and all the measured indicators will show a positive trend.

In Darfur, agriculture is practised, and people cultivate all kinds of plants, including sorghum, groundnuts, beans, millet, watermelon, sugar cane, vegetables and fruits, etc. Most products are exportable to markets within and outside the region. Consumer goods are imported from other parts of the country, especially from Khartoum State and via Port Sudan. Trade is also practiced between Sudan, Chad, and Central Africa where commodities, goods and livestock are exchanged. Roads can be considered not only as feeder roads within Sudan but also as roads serving and encouraging foreign trade with West Africa. Developing vast and all-

seasons accessible roads would consolidate the road network of Darfur and would contribute to the national road network of the country in general.

As far as production and trade are concerned, it could be argued that the severity of the roads' situation is a discouraging factor by raising the cost of both transporting products as well as people. Not only that, but the incentive for producing goods and services for neighbouring markets is restricted, especially so for perishables because of the risk of damage and getting rotten. Production of mangoes, guava, bananas and many other fruits and vegetables, in which the area has a comparative advantage, is negatively affected. The production and the sales of such products to other parts of the country are discouraged, mainly because of the transportation problem. Farmers claim that their surplus production is sold at very low prices or even left to spoil during the harvest season. And, processing of fruits and vegetables is not taking place because of weak agribusiness value chains. Thus, most farmers are trapped in the small-scale subsistence production.

Regarding agriculture, it should be mentioned that some farmers resort to the Agricultural Bank in near towns for financing their activities. Others depend on other local means of finance, for example loans sharing, etc. As such, roads are envisaged to encourage access to modern forms of finance by easing access to near towns. This is emphasized when elaborating on the impact of the road(s) in encouraging trade and even stimulating production. The anticipated easiness of production activities and the cheaper transport made possible act as incentives to produce for the market. The production composition may also tend to change and depends on the market mechanisms instead of subsistence production-limited calculations by farmers.

Transport difficulties and problems are deterrent factors in the face of economic and social development: agricultural production and trade are reduced, social mobility is affected negatively, providing security and supporting peace building are hindered. Improved roads are envisioned to greatly influence the returnee and settlement rates; to improve health conditions with better access to health services; to ease the movement between towns and villages, especially for daily commuting to work, trade and other activities; and to encourage agricultural production for near and far away markets. Production for the market and utilizing the value-added potential of processing local products may also provide employment opportunities if infrastructure and other services are improved. As well, improved all-seasons-roads will encourage taking off-farm occupations in near towns. People/officials may prefer to work in near towns and to commute to their homes if transport is improved, and so are students becoming mobile in their training and education options.

Adjacent villages along the roads are usually linked in various ways, but the most important linkages become visible during market days. Market days differ from a village to the other, and so the people are moving from one market to the other, may be for the whole week. The purpose is to get the best products in price

and quality and to offer their own supplies profitably to a wider market. Social visits are also common among people of neighbouring villages, especially for social occasions like marriage and mourning traditions. People claim that telecommunication has linked them with other parts of the region, but that they need to be physically linked as well through a good and reliable road system.

The above case of Darfur illustrates the significant role of an efficient roads system/network in achieving and maintaining peace that is vital for Sudan's present and future life. The case also elucidates how production and trade could flourish depending, among other things, on a functioning roads system; but the role of a high-quality roads system and its impact on health, education and social relations should also be emphasized. Above all, it consolidates the feeling of unity in such a vast country.

3.3 The Roads Construction Industry and the Potential Role of the Stakeholders

In order to envisage a role for each layer of the government in Sudan, not only the past deterioration but also the current situation and the aspirations, after the December 2019 revolution, should be taken in perspective. Local governments were in no position to financially assist in any developmental or infrastructural/roads endeavours. In Darfur, the devastated countryside is incapable, due to the damage inflicted upon its potential for production for the market, to raise revenues. The population is in a transitional phase trying to restore their living modes. This is exacerbated by the large number of displaced people living in camps. However, other states, which are not directly influenced by the conflict, were/are also in a depression state and dependent on federal transfers. The economy, at large, was and is facing difficulties and the government is striving to provide the necessities.

That is to say, the situation is not better at the state's level. In addition to the fragile peace conditions and the catastrophic economic situation, governments of the states are faced with acute shortages in petroleum products, power and above all water supplies for their populations. Financially, the three levels of government, the local/state/federal levels, are under great stress to provide the necessary goods and services for the population. The governments failed to provide the necessary goods (such as petrol and bread) and services (electricity, water, etc.). As such, the government/public sector is not able to finance the development of the roads sector, which needs huge resources.

The private sector, it could be argued, will also not be able to invest in the next time into the roads sector. Great parts of the Sudanese private sector had been crippled by the Salvation Regime and were replaced by the politically dominating/state and party capturing new businesses. These new private businesses were in fact affiliates of the security agencies and of other public bodies, of the party leaders and of the many groups of opportunists. As well, if the country takes steps

in the right direction, there will be more profitable opportunities for the private sector than financing roads construction and maintaining the roads system.

However, it could be argued that Sudan has some positive factors that could attribute to developing this sector:

First, Sudan has a capable institutional setup. The National Authority for Roads and Bridges constitutes, together with that for Railways, the core of the Ministry of Transport in Sudan. This Authority has a long history of evolution from a small department at the Ministry of Works to a full-fledged authority capable of initiating, studying, constructing (or contracting construction), and of monitoring the development of roads network(s). The Authority, which is the only entity being responsible for this sector, has a trained work force as well as specialized laboratories for raw materials quality examination and for research. Bridges are indispensable elements in almost all rural as well as urban roads in Sudan. As has been mentioned earlier, wadis/seasonal streams in Darfur (and in other parts of the country) diminish any road to a seasonal (not all weather all year round) road.

The awareness and the believe in this complementarity add to the suitability of this authority to take a great part in developing this sector. Nevertheless, this should not ignore the fact that the sector, like all other sectors of the state, had witnessed mismanagement and corruption that is manifested in the conditions of many of the roads, which were constructed/rehabilitated during the ousted regime. Concerning ten major national roads, the situation is however different with regard of maintenance (see Zumrawi/Margani 2017). Institutional reforms and thorough revisions are necessary for the different government entities to carry their responsibilities in a proper manner. The public sector acquired experience in employing the private sector in the construction phase of this industry. Many companies had worked as contractors and sub-contractors.

Second, the importance of an efficient roads system has maintained a high priority ranking among different parts of the population. Some people find that roads will bring accidents (inflicted on humans and animals), unwelcomed openness and infiltration of new practices and norms. Others are welcoming roads as means for better economic, social, cultural, and security life. This, among other factors, will increase the deep-rooted self-help attitude towards contributions. People, when convinced about the importance of the road(s), will be inclined to assist in its implantation. This may take the form of free/cheap labour to support the construction camps; free or cheap labour services, other services and goods may help the project employees in various ways.

Moreover, and most importantly, is the possibility of appealing to the traditional ways of managing disputes related to the ownership of land when they arise in relation to roads. This and other factors necessitate a participatory approach and involve the stakeholders in all phases of public projects, modalities which were absent or only superficially undertaken during the past regime.

Third, Sudan has the needed raw materials for roads construction. Rocks, gravel, and sand are available and are abundant in countless locations. It is easy to deliver them to other places. There is a long history in supplying such inputs. These are the basic raw materials being used for most of the roads that are earth and gravel feeder roads. With at least two refineries, other materials for the construction of asphalted roads will not be difficult to be provided. Steel as well as cement (necessary for bridges) are among the few surviving industries in Sudan. Roads construction and maintenance can even help to consolidate these industries.

Fourth, the expected lifting of all kinds of sanctions applied on Sudan will enable her to benefit from the assistance of international and regional organizations, such as the World Bank and the African Development Bank, in establishing a capable and efficient roads system. The need of some neighbouring countries for access to a port, like Port Sudan, by crossing the country will also back this direction. The Continental Free Trade Area (CFTA) may support such claims. This, in addition to the increasing awareness of the importance of roads in almost all aspects of the Sudanese live, supports envisaging great efforts to develop this sector.

4 Performance and Achievements: The Development Perspectives of the Roads Sector in Sudan

Measuring the progress regarding SDG 9 is not easy for Sudan, because of data scarcity and lack of reliable statistics. It is necessary to develop relevant indicators to measure the situation and the changes. The content of the box below (box 4) is extracted from Sudan View and summarizes the reasons behind the modest progress in achieving the Millennium Development Goals (MDGs), which preceded the SDGs. Until now, there are no solid grounds to assume a better performance regarding the SDGs. The experiences with the MDGs have great relevance for the expected achievements of SDGs. The same institutions as before are handling now the implementation of the SDGs. SDG 9 is related to three core developmental issues.

BOX 4: MDGs Performance

Comments on Progress:

- Some progress has been made towards several of the MDGs, especially education, infant and child mortality, access to water & sanitation.
- MDG indicators demonstrate huge inequalities with respect to gender, rural-urban, and between and within states.
- Worst performance in the war-affected areas.
- Highest progress on education and worst was on goal 7 & 8.
- Progress in education was quantitative with no regard to quality.

- Progress in health was very much concentrated in towns and especially in Khartoum state.

Reasons for Poor Performance/Indicators:

a. Conceptual Problems:

- MDGs were treated as a non-binding global commitment and hence there was no effort to transform the MDGs from a global commitment to a national ownership.
- Interim reports were targeted to meet dates and in most cases with UN drive rather than monitoring tools to measure progress and to try to meet targets.
- It was not a government-owned programme and largely UN-driven, and hence representation of civil society, of the business community, and of other "major groups" was symbolic; some procedures were modest (e.g. validation, verification).
- Perceived as an isolated project, and it was not integrated in development plans.

b. Technical Problems:

- Late starts (in 2003 were the first UNDP advocacy workshops).
- Poor statistics and inadequate baseline data, especially in the states.
- Lack of MDGs costing or efforts to mobilize resources for implementation
- Absence of monitoring tools or responsibilities, other than the UN-driven reviews (2005, 2010) – seasonality of approach.
- Poor capacities in the states for implementation or monitoring (technical & financial).
- Failure to benefit from global assessments.
- Non-inclusivity, variable attitudes and sometimes conflictive responses (government – low priority; civil society – high ambitions; business – no concern; people – high hopes).

c. Political Problems and Policy Defects:

- Wars and conflicts ongoing.
- Administrative instability and changing administrative units.
- Continuous changes in political positions (instability) which did not allow for adequate appreciation of the MDGs or their follow up.
- Adoption of a federal system characterized by delegation of responsibilities and strong central monopoly of financial and political decisions.
- Highly centralized planning, quick changes and limited follow-up to plans and failure to integrate MDGs in them.
- Poor foreign relations and failure to make use of Goal 8.

Low priority as indicated by assigning MDG responsibility to a ministry that is neither responsible for development planning nor equipped to mobilize the required resources nor is it the hub for the flow of information.

Source: Abdel Ati et al. (2013)

However, the Sustainable Development Goals Centre for Africa²² has estimated for Sudan some SDG 9-related results as follows: Infrastructure has a score of 37.7 (from 100); the Logistic Performance Index (LPI) for measuring the quality of trade and transport-related infrastructure has an index value of 2.2 (1=low to 5=high); Research and Development Expenditure is at 0.3 (% of GDP); and the number of scientific and technical journal articles is 0.0 (per 1000 researchers). These estimates, though unsatisfactory for a real assessment of SDG 9 achievements, may reflect the state of data in Sudan in terms of both availability and sophistication. However, indicators for appraising the performance of the roads sector may be the implementation ratios of the National Authority for Roads and Bridges.

Accomplishments have been below expectations, especially during the post-secession era (since 2011). For example, tables 4a and 4b below clearly depict the low implementation ratios. It should be noticed that work was only done on the already ongoing projects, and no new constructions took place and were started. The planned new roads were just on paper projects.

Table 4a: Only Ongoing Construction Projects

Year	Planned (Km)	Implemented	%
2011	1,271	289.7	22.8
2012	1,499	395.3	26.4
2013	1,525	579.6	38.0
Total	4,295	1,264.6	

Source: Ministry of Transport, National Authority for Roads and Bridges, The Five-Year Programme for Roads and Bridges 2015 – 2019, June 2014.

Table 4b: New and Ongoing Road Construction Projects

Year	Planned (Km)	Implemented	% Performance
2011	2,308	289.7	12.6
2012	2,505	395.3	15.8
2013	2,324	579.6	24.9
Total	7,137	1,264.6	17.7

Source: Ministry of Transport, National Authority for Roads and Bridges, The Five-Year Programme for Roads and Bridges 2015 – 2019, June 2014.

In fact, table 4b (taken from the Five-Year Programme) for the new and ongoing projects shows the same number of kilometres implemented as those for the table

²² The Sustainable Development Goals Centre (SDGC) for Africa and Sustainable Development Solutions Network/SDSN (2018); access: <https://sdgcafrica.org/>; see also the report for 2019: The Sustainable Development Goals Centre for Africa and the Sustainable Development Solutions Network (2019).

with the only ongoing projects. This means that new projects, planned new roads, are incorporated in the plan as a routine exercise without any intensions for implementation, since emphasis/target is laid on completing the already commenced ones. The same applies as far as rehabilitation plans are concerned, concentrating on roads where rehabilitation had already started. Tables 5a and 5b clearly illustrate that. New, here, may mean what was previously planned, for each year, in long-term plans and automatically carried over from one year to the other.

Table 5a: Only Ongoing Rehabilitation Projects

Year	Planned (Km)	Implemented	%
2011	131.2	92.8	70.7
2012	187.5	40.6	21.7
2013	390	53.2	13.6
Total	708.7	186.6	26.3

Source: Ministry of Transport, National Authority for Roads and Bridges, The Five-Year Programme for Roads and Bridges 2015 – 2019, June 2014.

Table 5b: New and Ongoing Rehabilitation Projects

Year	Planned (Km)	Implemented	% Performance
2011	381.9	92.8	24.3
2012	487	40.6	8.3
2013	901	53.2	5.9
Total	1769.9	186.6	10.5

Source: Ministry of Transport, National Authority for Roads and Bridges, The Five-Year Programme for Roads and Bridges 2015 – 2019, June 2014.

Since there was no execution of any new roads or launching of any new rehabilitation endeavours, their implementation rates should be zero. Then, the tables 4a and 5a show the tangible performance and reflect how implementation of the planned on-going construction (completion) and rehabilitation efforts are modest (especially after 2011).²³

The year 2011 witnessed the secession of South Sudan from where most of the oil production originates. The picture has changed dramatically after 2011 and the secession of South Sudan, where the bulk of the oil fields lie, has put huge

²³ A more optimistic view of achievements is presented in Republic of the Sudan (2019, pp. 9-11). It is also stated that Darfur has benefitted from road construction efforts. It is also argued that Sudan has invested heavily and successfully into roads developments in the period 2011-2018 by building key links. Also new links to Chad and to Egypt are mentioned, having impact on border exchange and exports expansion. It is even mentioned that the National Roads and Bridges Corporation (NRBC) started with a large training and research center. Some handicaps are mentioned, but more so as final remarks.

pressure on the economy of Sudan. The economic deterioration, which had already started prior to the separation, was further aggravated by the failure of the conflicting neighbours to reach acceptable agreements, particularly on the value of services for processing, transporting and exporting the oil of the South. Official estimates of the cost of the secession of southern Sudan were at 75% of the oil production, 36% of the budget revenues, more than 65% of foreign exchange revenues, and 80% of the total exports. As a result, the annual growth rate declined from more than 5% in 2010 to about 2.5% in 2011, and the economic growth rate was projected at 1.5% for 2012. Inflation, which fell to single digits during the high growth period, has started to climb at unprecedented rates. It is estimated to have reached 36% in 2012, compared to 13% and 15% in 2010 and 2011 respectively²⁴. Sudan has failed to adjust to the post-secession conditions, and this has severe consequences for the transport sector. The geography of economic development has changed, and the country needs a refocussing of the vital transport links.

In this context, the estimates in the table 6 below (for the years 2014-2019) are not optimistic, but unrealistic. Government local resources were/are short of satisfying the necessary current expenditures, and foreign resources are meagre due not only to the sanctions and the debt and arrears situation, which blocked funds from multilateral finance institutions, but also due to the failure to promote and to expand exports. Official development assistance was and still is limited. Thus, covering the estimated total cost, especially the foreign exchange component, is unachievable. Financing investment projects (from loans, grants, and from funds of the Ministry of Finance) is just unfeasible. In fact, items in the second term (financed from own resources), which could be labelled as current expenditure, are usually poorly executed as the tables above illustrate.

The performance of the economy in general and specifically of the transport sector have been gloomy during the Salvation Regime that was overthrown by the December 2019 Revolution. The new government should give priority to the transport sector and especially to the roads sector what will facilitate structural change and growth.

²⁴ Cited in Abdel Ati et al. (2013), quoted from: the Ministry of Finance and National Economy, "The real sector: current position, challenges and future prospects", a paper presented by the Ministry of Finance at the Economic Forum, Khartoum, 26-27, November 2012 (MoF/Ministry of Finance (2012)).

Table 6: Total Cost of the Five-Year Programme

		YEARS						Total
		2014	2015	2016	2017	2018	2019	
1-Loans, Grants and Ministry of Finance contributions	Cost (SDG million)	1,541	5,394	5,728	5,275	3,940	3,339	25,223
	Cost (million dollars)	254	883	943	865	657	557	4,157
2-Own Resources i-Rehabilitation	Cost (SDG million)		302	376	531	350	283	1,842
	Cost (million dollars)		50	63	89	58	47	307
ii-Maintenance & Emergency	Cost (SDG million)	83	83	83	83	83	83	498
	Cost (million dollars)	14	14	14	14	14	14	83
iii-Institutional & Capacity Building	Cost (SDG million)	10	10	10	10	10	10	61
	Cost (million dollars)	2	2	2	2	2	2	10
Cost (SDG million)		1,634	5,789	6,197	5,899	4,383	3,715	27,624
Cost (million dollars)		270	948	1,021	969	731	619	4,557

Source: Ministry of Transport, National Authority for Roads and Bridges, The Five Year-Programme for Roads and Bridges 2015 – 2019, June 2014.

5 Conclusions and Policy Recommendations

A study by the African Development Bank (AfDBG/African Development Bank Group, 2016) on the potential of a private sector-led economic diversification showed that, to achieve a moderate real GDP growth of about 6% by 2030 up from the current 3.5%, Sudan will need to invest USD 51 billion (at 2012 prices) into infrastructure. The experiences of sub-Saharan African countries suggest that Sudan should sustain its investment in infrastructure up to 8% of GDP. In the recent past, the bulk of public infrastructure funding has been allocated to the power and transport sectors, at ratios of 78% and 22% respectively.²⁵ These estimates, regarding the infrastructure sector alone, clearly illustrate the huge amount of funds needed to halt and U-turn the previous conduit.

²⁵ See on the more recent development trends: AfDBG 2018; AfDBG 2019; African Development Bank (2019); AfDBG 2016 a, and AfDBG 2016 b

However, to address the problems of geographic isolation, access to markets for agricultural produce, access to health facilities and poverty reduction, the roads subsector should be accorded top priority. Roads are also considered vital for effective administration, exchange of information and control. The need for roads could be looked at in the wider perspective as a prerequisite for any serious development efforts. The state so far was unable to achieve this because of shortage of development funds, mismanagement, and the inability to undertake substantial investments in this vital sector. Some funds, small as they are, were also channelled towards other crucial services, such as water and electricity supply. It is thus of importance for other actors, the private sector, and the foreign entities, to try to make a difference at this front.

The same factors will limit the Sudan Government's ability to support recovery and reconstruction in Darfur from its own resources. Both the macro and the regional contexts are cause for concern. The alluded to inequity in government provisions will also need to be addressed by the new regime. However, maintaining peace, working for regional equity (addressing regional biases/disparities), and achieving progress on the socioeconomic development front seem to be dependent, among other things, on efforts to develop an all-season reliable roads network. Also, international contexts matter. The present government hopes that sanctions will be lifted in a near future and that the international community will generously finance the country's way out of its current predicament. Even if this optimistic assumption is realized, it does not per se face/solve the deeply rooted political, economic, and social challenges. However, adjusting external relations may be a necessary condition but more is needed for expecting adequate funds for financing the transport sector in general and specifically the roads sector. Developing and adopting appropriate business models by the public sector (and in cooperation with the private sector) could also be envisaged.

The local private sector contribution through internationally utilized arrangements, such as BOT (Build-Operate-Transfer), could also be visualized. Nevertheless, though Sudan has witnessed a revolution, the course of its future is unclear. That is why it is rather difficult to anticipate the approach to and the trends in achieving the SDGs, comprising the SDG 9 that embraces the roads sector as a vital part of the infrastructure. As mentioned earlier, roads have an important role in linking production areas with consumers (markets); promoting agricultural, manufacturing, tourism and trade activities; reducing costs of living by lessening the cost of inputs as well as the cost of products transport; assisting in avoiding shortages in goods and commodities; contributing to saving time, efforts and resources in general and saving petrol consumption and spare parts of vehicles in particular; advancing social and cultural interaction and merger; and generally fostering political and economic stability. So, roads have an impact not only on achieving the SDG 9 but all the SDGs and are crucial for the development of the economy and the society.

Sudan's potential for development rests largely on her utilization of the rich agricultural (plant and livestock) resources. Industrialization, the second pole for development, will be supported with these resources in mind, and so the base of industry will be its forward and backward linkages with the agricultural sector. This will warrant its inclusiveness and sustainability. This case study of Sudan's roads system reveals the importance of this element of infrastructure, but it is obvious that other parts of the infrastructure may not be neglected to arrive at inclusive growth and sustainable development.

References

- Abdel Ati, Hassan A., Omer A. Egemi, Abdul Hameed Elias, Hassan Gadkarim (2013): Sudan View: Contribution to the Post-2015 Global Development Agenda, Study for the UNDP, Sudan.
- AfDBG/African Development Bank Group (2019): African Economic Outlook 2019. African Development Bank 2019.
- AfDBG/African Development Bank Group (2018): African Economic Outlook 2018, African Development Bank 2018. With Part II: Financing Infrastructure.
- AfDBG/African Development Bank Group (2016a), Sudan Country Office, Private Sector-Led Economic Diversification And Development In Sudan, African Development Bank, Sudan Country Office, 2016; access: <https://www.afdb.org/en/documents/document/private-sector-led-economic-diversification-and-development-in-sudan-95395>
- AfDBG/African Development Bank Group, East Africa Regional Development & Business Delivery Office, Sudan Country Office (2016b): Sudan Darfur: Infrastructure Development Report, African Development Bank, Sudan Country Office 2016.
- Ali Omer, Balla (2017): The Story of Development of the National Roads Network, Diouma Press, 2017 (In Arabic).
- Ashraf and Salah Company (2019): Detailed Assessment and Rehabilitation of Crossing Points on Feeder Roads in the Five States of Darfur, a study sponsored by the United Nations Office for Project Services/UNOPS (December 2018-May 2019). See on ASC: <https://www.facebook.com/pages/Ashraf-Salah-For-Studies-Design-Co-Ltd-ASC-/295516790591192>
- Assayha Newspaper (2019): The Assassination of Sudan Airways: The Complete Crime. Five detailed reports published during 11-25 September 2019 (In Arabic). See on the newspaper: <https://www.behance.net/gallery/15549267/Assayha-Sudanese-News-Paper>
- CBOS/Central Bank of Sudan, Annual Reports, Various; access: <https://cbos.gov.sd/en/publication-type/annual-reports>
- Churchill, Winston S. Churchill (2009): The River War. An Account of the Reconquest of the Sudan. The Project Gutenberg E-Book (1902 edition). Access: <https://www.gutenberg.org/files/4943/4943-h/4943-h.htm>

- DRA/Darfur Regional Authority, Multiple Entities (2012), like UNAMID, The World Bank, UNDP, African Development Bank Group, Government of Qatar, on behalf of the Darfur Regional Authority: 2013-2019 Developing Darfur: A Recovery & Reconstruction Strategy (DDS). Pursuant to Article 31 of the Doha Document for Peace in Darfur (DDPD), Darfur Joint Assessment Mission (JAM). Access: [www.undp.org > content > dam > sudan > docs > DDS English](http://www.undp.org/content/dam/sudan/docs/DDS_English)
- ERF/Economic Research Forum, National Baseline Household Survey/NBHS 2009; access: <http://www.erfdataportal.com/index.php/catalog/65#metadata-identification>
- MoF/Ministry of Finance (2012), Budget Data, Khartoum, Sudan 2012
- MoT/Ministry of Transport, National Authority for Roads and Bridges, The Five-Year Programme for Roads and Bridges 2015 – 2019, Khartoum, Sudan: June 2014.
- MoT/Ministry of Transport, National Authority for Roads and Bridges, The 2019-2030 Draft Strategy. Khartoum, Sudan, 2018
- National Roads and Bridges Corporation (2019), Annual reports, Khartoum, Sudan, 2019; see on recent activities on roads construction in Darfur: <https://constructionreviewonline.com/2018/07/sudan-to-sign-in-a-new-contract-for-the-construction-of-darfur-highway/>
- Ranganathan, Rupa/Cecilia Briceño-Garmendia/AICD (2011): Sudan's Infrastructure: A Continental Perspective, Africa Infrastructure Country Diagnostic (AICD), Africa's Infrastructure, A Time for Transformation, The International Bank for Reconstruction and Development / The World Bank. Access: <https://openknowledge.worldbank.org/handle/10986/27270>
- Republic Of The Sudan (2019), Ministry Of Finance And Economic Planning, Implementation Of Istanbul Plan Of Action For Least Developed Countries (IPoA) 2011-2020, Sudan National Report, Khartoum, October, 2019; Access: UN-OHRLLS/ UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States: <http://unohrlls.org/>
- Sudan Railways Corporation (SRC) (2019), Sudan Railways Strategic Plan, Khartoum, Sudan 2019; access: https://www.ide.go.jp/English/Data/Africa_file/Company/sudan05.html
- Sudan Railways, Wikimedia Commons; access: https://upload.wikimedia.org/wikipedia/commons/thumb/5/5b/Railways_in_Sudan.svg/1200px-Railways_in_Sudan.svg.png
- Sultan, Maysoon A., Mohammed H. Mudawi, and Afra H. Abdellatif (2016): Past, Present & Future of Airlines Domestic Services in Sudan. IOSR/International Organization of Scientific Research/ Journal of Mathematics. Volume 12, Issue 3, Version IV (May - June 2016), pp. 74-85; Access: www.iosrjournals.org.
- The Sustainable Development Goals Centre for Africa and Sustainable Development Solutions Network (2019): 2019 Africa: SDG Index and Dashboards Report. July 2019; Access: <https://sdgcafrica.org/>
- The Sustainable Development Goals Centre for Africa and Sustainable Development Solutions Network (2018): Africa: SDG Index and Dashboards Report 2018. July 2018; Access: <https://sdgcafrica.org/>

The World Bank (2011), Poverty Reduction and Economic Management Unit, Africa Region (May 2011): A Poverty Profile for the Northern States of Sudan. (Based on the 2009 National Baseline Household Survey for Sudan prior to Independence of South Sudan). Washington D.C.: 2011

Transport in Sudan/Wikipedia: https://en.wikipedia.org/wiki/Transport_in_Sudan.

UNAMID/African Union/United Nations Hybrid Operation in Darfur, Government of Qatar and other parties (2011), Doha Document for Peace in Darfur (DDPD). Agreed between the parties: 14 July 2011. Access for the document in English and Arabic: <https://unamid.unmissions.org/doha-document-peace-darfur>; and Progress Report of March 14, 2019 on Darfur Internal Dialogue and Consultations (DIDC): https://www.sd.undp.org/content/sudan/en/home/library/Research_Knowledge_resources/darfur-internal-dialogue-and-consultations.html

United Nations, General Assembly (2015): Resolution adopted by the General Assembly on 25 September 2015, Transforming our world: the 2030 Agenda for Sustainable Development (A/RES/70/1). Access: <https://sustainabledevelopment.un.org/index.php?page=view&type=111&nr=8496&menu=35>

United Nations (accessed 2019), SDG Indicators, Official List: <https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf>.

World Bank (2008), Africa Infrastructure Country Diagnostic, Overhauling the Engine of Growth: Infrastructure in Africa, Draft, Executive Summary, by Vivien Foster, September 2008, Draft; Access to the final study: <https://www.icafrica.org/en/knowledge-hub/article/africas-infrastructure-a-time-for-transformation-9/>

Zumrawi, Magdi M. E./Kamal M. Margani (2017), Improving maintenance practice for road network in Sudan, In: MedCrave Online Journal Engineering, Volume 2, Issue 6, 2017, pages 202-207; Access: <https://medcraveonline.com/MOJCE/improving-maintenance-practice-for-road-network-in-sudan.html>

Appendix: Sudan Roads Distributed According to Regions

Interregional Roads			
	Destinations	Region	Km
1	Wadi Saydina – AL Hogna	Khartoum-Nile	63
2	Khartoum - Medani	Khartoum - Gezira	187
3	Medani – Gedarif	Gezira - Gedarif	228
4	Gedarif – Kassala	Gedarif – Kassala	220
5	Kassala – Haya	Kassala –Red Sea	351
6	Atbara – Haya	Nile – Red Sea	279
7	Gaili – Shendi	Khartoum – Nile	129
8	Atbara - Merawi	Nile - Northern	226
9	Omdurman – Al Multaga (Joint)	Khartoum – Northern	311

10	Khartoum North – Kataranj – Abu Haraz	Khartoum - Gezira	191
11	Sinja - Damazin	Sennar – Blue Nile	167
12	Medani – Sennar - Kosti	Gezira – Sennar –White Nile	220
13	Jebel Awlia – Eddueim	Khartoum – White Nile	158
14	Tendelti – Obeid	White Nile –North Kordofan	191
15	Jebelain – Renk (Tariq Al-salam)	White Nile – South Sudan (int.)	97
16	Omdurman – Bara	Khartoum - North Kordofan	110
17	Dibaibat – Dilinj – Kadogli	North & South Kordofan	188
18	Um Rawaba – Ubu Jubaiha (Partial)	North & South Kordofan	50
19	Um Rawaba – Al Abasia	North & South Kordofan	50
20	Um Kadada – Nihud	North & South Darfur	221
	Total Interregional Roads		3,637
Regional Roads:			
21	Khartoum – Jebel Awlia	Khartoum	40
22	Omdurman – Wadi Saydna	Khartoum	25
23	Khartoum North – Gaili	Khartoum	42
			107
24	Al Matama – Um Altayoor	Nile	10
25	Shendi –Atbara	Nile	114
26	Atbara – Berbar	Nile	36
27	Berbar – Al Ibaidya	Nile	31
28	Al Ibaidya – Abu Hamad	Nile	163
29	Shendi – Hoosh Banaga	Nile	8.25
30	Al Matama – Al Hugna	Nile	100
31	Al Kamar – Al Jalyia	Nile	15
			477.25
32	Al Multaga – Dongola	Northern	190
33	Karima – Al Silaim	Northern	172
34	Merawi – The Dam	Northern	31
35	Al Silaim – Wadi Halfa	Northern	387
36	Karima – The Dam	Northern	27
37	Karima – Nawa	Northern	180
38	Halfa – Gastal	Northern	29.6
39	Al Multaga – Merawi	Northern	97

40	Dongola - Argeen (BOAT)	Northern	450
			1,563.6
41	Al Shwak – Al Hamra	El Gedarif	45
42	Gedarif – Doka – Galabat	EL Gedarif	160
			205
43	Kassala – Maman –Hemesh-Kuraib	Kassala	30
44	Kassala – Dugeen – Wafer	Kassala	48
45	Halfa Al Jadida – The Factory	Kassala	17
46	Doka – Al Frei (Branch)	Kassala	10
47	Wager – Hadalia	Kassala	10
48	Gadamay – Hamashkoraib	Kassala	82.5
49	Kassala – Al Lafa (the turn)	Kassala	62
50	Kassala – Karkoun Bridge (P.)	Kassala	29
51	Kassala – Galsa	Kassala	24
52	Khashm Algirba – Halfa AlJadida	Kassala	47
			359.5
53	Haya – Suwakin –Port Sudan	Red Sea	206
54	Port Sudan – Suwakin (Tawsiaa)	Red Sea	17.5
55	Port Sudan – Saloum	Red Sea	18
56	Port Sudan – Gabanait	Red Sea	280
57	Port Sudan – Arbaat	Red Sea	25
58	Erkawit – Samad	Red Sea	35
59	Old Port Sudan Circular	Red Sea	14
60	Circular Port Suwakin	Red Sea	14
61	Suwakin – Toker	Red Sea	86
62	Alternative Aqabba	Red Sea	26
			721.5
63	Medani – Managil	Gezira	63
64	Rahad Agricultural Project	Gezira	145
65	Al Fadni Rd. & Sarsar Rd.	Gezira	4.5
66	Hasahisa – Al Fraijab	Gezira	70
67	Medani – Hantoub	Gezira	5
68	Medani – Al Hush	Gezira	21
			308.5
69	Al Gezira Aba	White Nile	11
70	Abu Haleef – Al Sofi	White Nile	45
71	Rabak – Jebelain	White Nile	69

72	Kosti – Tendelti	White Nile	116
73	EdDueim – Rabak	White Nile	109
			350
74	Sennar – Sinja	Sennar	70
75	Sinja – Al Dindir	Sennar	25
			95
76	Obeid – Bara	North Kordofan	59
77	Obeid – Al Khoyi	North Kordofan	103
78	Obeid CIRCULAR	North Kordofan	17
79	Al Khoyi – Nihud	North Kordofan	103
80	Obeid – Kazgail Dibaibat	North Kordofan	100
81	Dibaibat – Abu Zabad – Al Fola	West Kordofan	185
			567
82	El Fashir – Kutum	North Darfur	50
83	Um Kadada – El Fashir	North Darfur	168
84	Zalingi – Genainah – Adri (P.)	West Darfur	175
			393
	Total Regional Roads		5,147.35
Local Roads (LR):			
85	LR:Shendi	Nile	12
86	Halfa – Airport	Northern	17
87	LR: Dongola	Northern	30
88	Aroma Road	Kassala	8
89	LR: Kassala	Kassala	14
90	LR: Khashm Al Girba	Kassala	11
91	LR: Halfa Al Jadida	Kassala	28
92	LR: Kassala	Kassala	32
93	LR: Halfa Al Jadida	Kassala	13.5
94	Aroma	Kassala	4
95	LR: Port Sudan	Red Sea	466
96	LR: Suwakin	Red Sea	188
97	LR: Toker	Red Sea	8
98	LR: Sinkat	Red Sea	12
99	LR: Haya	Red Sea	5
100	LR: Halayib	Red Sea	5
101	LR: Al Ganib	Red Sea	55

102	LR: Al Gitaina	White Nile	5
103	LR: Ed Dueim	White Nile	5
104	Fola Entrance	West Kordofan	15
105	LR: Al Nihud	West Kordofan	15
106	LR: Al Diliñj	South Kordofan	10
107	LR: Al Obeid	North Kordofan	25
108	LR: Abu Jibaiha	South Kordofan	10
109	LR: Kadogli	South Kordofan	8.75
110	LR: El Fashir	North Darfur	13.5
111	LR: Ed Dein	East Darfur	16
112	LR: Nyala	South Darfur	13
113	LR: Zalingi	Central Darfur	25
114	LR: Al Jinainah	West Darfur	10
	Total Local Roads		1,079.75
	TOTAL		9,864.1

Source: Balla Ali Omer, The Story of Development of the National Roads Network, Diouma Press, 2017 (In Arabic). **Note:** LR Local Road

Successful Local Initiatives for Infrastructure Development – Impacts on water, sanitation, and school infrastructure in platinum-mining communities in Zimbabwe and South Africa

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1 Introduction

The 2030 Sustainable Development Goals (SDGs) are an internationally endorsed strategy to enhance the quality of human life on earth. The aim of SDG number 9 (SDG 9) is to “build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation” (UN 2015, p. 14; UN 2016, p. 25). Under this aim, the target to “facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing states” is infrastructure-specific (UN 2015, p. 20; UN 2016, p. 26). Even though the indicator for this target is “total official international support (official development assistance plus other official flows) to infrastructure” (UN 2016, p. 26), we argue that ‘local initiatives’ are indispensable to achieving the infrastructure aim and target of SDG 9.

The concept of ‘local initiatives’ is debatable. The moot point is whether an initiative is ‘local’ because of origin of ideas underlying it or because of the ‘actors’ involved. We postulate that most initiatives in Africa are considered ‘local’ if implemented by actors in a specific geographic locality without much consideration of whether the ideas undergirding the initiatives were borrowed or adopted from elsewhere.

In this study, we examined successful local initiatives for infrastructure development and their impacts on water, sanitation, and school infrastructure in platinum-mining communities in Zimbabwe and South Africa. Four research questions guided the study. First, what are local initiatives and how do they contribute to

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infrastructure development in communities? Second, what are the approaches used in local initiatives for infrastructure development? Third, what local initiatives for infrastructure development were successful and what were the indicators for measuring success? Finally, what impacts do successful local initiatives have on community infrastructure development?

Data for this study were gathered as part of a baseline study for interfaith work in platinum-mining communities in South Africa and Zimbabwe. We used qualitative research methods including multi-method ethnographic assessment tools that incorporate community mapping, structured observations, focus group discussions (FGD), and individual in-depth key informant interviews (KII). Among other themes, we collected data on successful local initiatives targeting water, sanitation, and education infrastructure development in communities around platinum-mining areas in Zimbabwe and South Africa.

Our results show that geography, the actors involved, but also consultation and ideas define the local initiatives in South Africa and Zimbabwe. Local initiatives have led to school (classrooms, teachers' accommodation, and latrines), water (boreholes and water points, water purifying plants, and distribution systems), agriculture (dipping tanks), community latrines, community halls, and road infrastructure construction, upgrades and maintenance. We found that South Africa uses a mandatory approach whence the government enforces explicit laws that compel platinum-mining firms to partake in local initiatives for community infrastructure development. Zimbabwe has shifted between non-mandatory (no laws are enforced) to mandatory and back again to non-mandatory approaches in local initiatives for community infrastructure development.

The approaches affect differently the implementation of local initiatives. Whereas in Zimbabwe communities provide locally available resources towards realisation of community infrastructure, in South Africa platinum-mining firms provide all the required resources and funding for community infrastructure development. There is burden-sharing in implementing local initiatives in Zimbabwe making it cheaper for platinum-mining firms, albeit there is a questionable inter-generational continuity and a changing ethos of non-mandatory approaches due to the promulgation of the Indigenisation and Economic Empowerment Act of 2007 [Chapter 14:33]. In South Africa, participation by platinum-mining firms in local initiatives are a relief for the municipal budgets and enhance service delivery, while community ownership and sustainability of the projects realised are compromised.

We found that Zimbabwean platinum-mining communities emphasise participation, ownership, networking, technology and skills transfer, and sustainability as the key indicators for measuring the success of local initiatives. For South African platinum-mining communities, the key indicators for measuring the success of local initiatives include consultation or participation, job creation, technology

and skills transfer, and empowerment. Noteworthy, communities in the two countries did not articulate learning as an indicator for measuring the success of local initiatives. We further found multiple economic and social impacts of local initiatives for infrastructure development in Zimbabwe and South Africa.

Our findings suggest that non-mandatory local initiatives may be cheaper to execute, create a strong sense of community ownership, promote sustainability, but lack intergenerational continuity. In addition, mandatory local initiatives may promote corruption, may be unsustainable, may be expensive to execute, may create dependence, may destroy community-sense of ownership, and may create a sense of entitlement. The non-mandatory approach is effective where state institutions for service delivery and enforcement of rules and regulations are weak, while the mandatory approach demands strong state institutions to be effective because it requires enforcement of the legal statutes.

We conclude that local initiatives have addressed the infrastructure needs of platinum-mining communities in Zimbabwe and South Africa. Hence, local initiatives contribute significantly to local infrastructure development, and partially to the realisation of SDG 9. We recommend an evidence-informed and multi-stakeholder-related review of existing policies to enhance community-centred and inclusive interventions that strengthen community-wide soft skills and learning processes for sustainable and resilient community infrastructure which is envisioned under SDG 9. The SDG 9 indicators should consider capturing contributions that communities make towards infrastructure development through local initiatives.

This chapter is organised as follows. In Section 2, we provide a conceptual framework that guides analysis of the issues under this study and elaborates the study methodology. The study results are presented in Section 3, and the discussion follows in Section 4. In section 4, we further analyse our study findings in relation to SDG 9. The conclusions and policy recommendations are presented in Section 5.

2 Conceptual framework and methodology

2.1 Conceptual Framework

Literature on local initiatives for infrastructure development in relation to SDG 9 is non-existent. However, existing literature on endogenous and neo-endogenous development partially examines local and non-local initiatives (Bosworth et al., 2015). Related literature also articulates bottom-up and top-down approaches to development (Kassam 2018; Lowe et al., 2019). The focus of this literature is mainly on rural development.

Using the top-down approaches to development, funding institutions and developed countries provided direction on how, where and what types of development projects the recipient-developing country could execute. Subsequently, central governments in developing countries used the same top-down approaches to implement development programmes within their jurisdictions. Growing public pressure for accountability and participation in decision-making led to greater advocacy for bottom-up approaches to development. Consideration of bottom-up approaches to development have transformed the way how central governments and funding institutions implement development projects worldwide.

In the African context, literature on local economic development (LED) partly deals with local initiatives for economic development (Nel 2019). The main limitation of the LED literature is that it focuses on economic rather than on sustainable development. There is dearth in Africa-specific literature on local initiatives for sustainable development. Therefore, this chapter provides new knowledge and insights on local initiatives for sustainable development in Africa by emphasising the implications of SDG 9.

The phrase ‘local initiatives’ is infuriatingly vague and finding an apt definition is elusive. Local initiatives are widely known for what they are - without a clear definition. Yet, it is important to define the phrase ‘local initiatives’ to improve the analytical understanding. The principal moot point is whether it is the idea, the actors, or the geographical demarcation that makes an initiative local or not. In most African countries, borrowed or adapted ideas from elsewhere are at the core of the so-called local initiatives. In table 1, we present the key conceptual elements for local initiatives premised at a community-level of analysis.

Table 1: Key elements constituting local initiatives

Variable	Variable attribute	Variable Explanation
Idea	Origin	<i>Internal Origin:</i> Evolving from the community.
Actors	Sense of Belonging	<i>Community-based actors:</i> Strong sense of belonging to the community through birth, descent, and migration. Having a presence within the community.
Geographic	Demarcation	<i>Fit with a defined geographic community boundary:</i> Falling within a defined geographic boundary. The boundary may be imaginary but is covering families/households that fall under the defined locality.

Source: Authors (2019)

Given these key characteristics, local initiatives can be defined as interventions supported by members of a given community to deal with their felt needs (Bradshaw 1972, p. 72). Whilst there is controversy about the utility of the concept of felt needs (Wade 1989, p. 116), it is still relevant and applied in various practice contexts (Onyenemezu and Olumati 2013, p. 156).

Since the study focuses on successful local initiatives, it is necessary to explain their characteristics. These characteristics differentiate successful local initiatives from failed ones. In table 2, we present the main characteristics of a successful local initiative.

Table 2: Characteristics of successful local initiatives

Main Characteristics	Explanation
Participation	Active participation in resource mobilisation and provision throughout the project's life cycle.
Empowering	Implementation of the initiative empowers/ capacitates the community to deal with other community-felt needs.
Ownership	Sense of community ownership during and post the initiative's execution.
Networking	Community networks with interested and affected parties to promote and to facilitate the initiative's success. Networking allows communities to mobilise internal and external resources for the initiative.
Sustainability	Community takes charge of the cost or processes of the initiative in the post-execution phase. Intergenerational mix and socialisation of the youth are required to ensure perpetuation of similar actions by the community beyond the executed initiative.
Learning	The community members go through a process of learning-by-doing and gain great capabilities from the process of executing the initiatives.
Technology and skills transfer	Acquisition of new skills. Leveraging, adoption and successful deployment of software and hardware technologies.

Source: Authors (2019)

2.2 Materials and methods

The mining communities' case studies are from South Africa and Zimbabwe—two neighbouring countries in Southern Africa. Public-private partnerships (PPPs) for infrastructure development were introduced in South Africa and in Zimbabwe

in 1998, and South Africa completed a total of 34 projects between 1998 and 2019, while the uptake of PPPs projects in Zimbabwe has been very low (National Treasury, 2019; Massimo 2015; Zinyama and Nhema 2015). Most private firms involved in PPPs are motivated by profit-making. Therefore, there has been limited uptake of PPPs for social infrastructure construction in South Africa and Zimbabwe. In addition, it is unclear whether and how PPPs include and encompass a local initiatives-related ethos.

This study is part of a larger interfaith work baseline study encompassing communities surrounding platinum mines in South Africa and Zimbabwe. South Africa's platinum belt, located in the Bushveld Complex, is technically divided into Western, Northern and Eastern limbs (Glaister and Mudd 2010, p. 439). The study area falls under Limpopo and North West provinces of South Africa. The specific communities assessed include those living around Amandelbult, Polokwane Smelter, Mogalakwena, Twickenham, De Brochen and Rustenburg in South Africa. In Zimbabwe, most platinum mines are located along the Great Dyke, a mineral rich ridge containing the second world largest reserves of the platinum group of metals (Oberthür et al. 2013, p. 191). We assessed platinum mine communities around Shurugwi/ Zvishavane and Chegutu/ Ngezi.

The study covered 15 and 40 diverse host communities in Zimbabwe and South Africa respectively. While some communities are located within ten kilometres from the mines, others are located further away from the mines. The communities close to the mining operations "represent a case of co-habitation and proximity to production" (Owen and Kemp 2015, p. 482). Whereas some communities resulted from resettlement processes, other communities existed before the mines and never were relocated.

Data for this study were collected between February 2018 and August 2019. Standardised reporting templates, standard operating procedures and interview guides were used across all sites. We used an interview guide to gather data during focus group discussions (FGDs) and key informant interviews (KIIs). FGDs are a "carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive non-threatening environment" (Kruger and Casey 2015, p. 2). Apart from FGDs, we engaged some key informants who served "as gatekeepers regulating access to people and information and as cultural experts explaining culture to an outsider" in KIIs (McKenna and Main 2015, p. 116). Whereas each FGD lasted about two hours, each KII lasted about 45 minutes to one hour.

We purposively selected the initial key informants to commence the study. Selected initial key informants were supposed to meet the criteria established by Tremblay (1957, p. 692), namely: "hold formal positions in the community, have knowledge relevant to the study, be willing to share this knowledge, communicate well, and be unbiased or able to reflect upon their own biases". Selected key informants helped in organising FGDs' participants. We used a snowballing method

to recruit other informants from the initial key informants that commenced the study.

Most key informants were community members, including educators, farmers, farm workers, traditional chiefs, faith group leaders, war veterans, and health and allied workers. A few key informants comprised of members of local municipalities, non-governmental organisations (NGOs), private sector (including owners of small businesses and sole traders), and the mining workers from the mining firms. All key informants and focus group participants voluntarily participated in the study in their individual capacities.

Respectively, 40 and 180 key informants were interviewed in Zimbabwe and South Africa. Whereas 10 focus groups held in Zimbabwe, 24 were held in South Africa. All KIIs and FGDs were recorded and notes were written during the interviews. No personally identifying information was collected during interviews and discussions. Rather, allocated study numbers were used to identify study participants.

Across the two countries, FGDs comprised of 6 to 10 persons. Our study took a retrospective approach enabling communities to narrate the history of existing community assets, especially water, sanitation and school infrastructure. Community members explained their direct contributions to the existence of the assets. Structured observations and extensive desktop reviews of existing secondary literature corroborated information collected through KIIs and FGDs.

Qualitative recorded data from KIIs and FGDs were transcribed. We used a thematic content analysis approach to write theme-based summaries of the qualitative data comprising of transcribed summaries and notes. A clear data analysis framework guided the triangulation of data from KIIs, FGDs, and secondary data under the established themes. In the study results section, we present the findings of the triangulated data gathered through KIIs, FGDs, structured observations as well as desktop reviews of literature. We did not present conflicting data in our results.

3 Study Results¹

3.1 Local initiatives and community infrastructure development

We found that there are multiple perceptions of what local initiatives are in platinum-mining communities in Zimbabwe and South Africa. A study participant in Zimbabwe pointed out that, “When a community project is realised by our sweat,

¹ See also the two “Highlights” with the Cases in the Annexes, containing an Educational Infrastructure Initiative in South Africa and a Health Infrastructure Initiative in Zimbabwe.

then it is definitely a local initiative” (Key informant in Ngezi, April 2019). In Shurugwi, one informant averred, “The project must be of benefit to this community and not our neighbouring communities. Once it benefits neighbouring communities, it is no longer local to us but may be to them” (Key informant in Shurugwi, May 2019).

Participants from South Africa expressed these views differently. They perceived a local initiative as predicated on community consultations. Members of a focus group discussion (FGD) in Twickenham noted that “a local initiative is something we are consulted, and we provide our ideas to” (FGD in Twickenham, April 2019). Similarly, a key informant noted, “any local initiative involves community consultation, especially with the community where the project will be implemented. Nothing about us without us” (Key informant in De Brochen, April 2019).

These results show that communities explicitly expressed the geographic and actors’ determinants of a local initiative. The responses given by study participants from South Africa implicitly highlight the ideas dimension of a local initiative. Although most study participants responded that ideas underlying local initiatives originated from members of their communities, especially from chiefs, farmers, educators, faith group leaders, key informants from NGOs and mining firms contradicted this. Key informants from NGOs and mining firms noted that even though they initiate the ideas, they make the communities articulate the ideas as their own.

Despite the multiple perspectives about what a local initiative is, communities easily pointed out successful local initiatives for infrastructure development that resulted in tangible water, sanitation, church, agriculture (dip tanks, gardens), community halls, and schools (teacher houses, school classrooms, school latrines, school gardens) infrastructure. Thus, local initiatives have contributed to local community infrastructure development in platinum-mining communities in South Africa and Zimbabwe.

3.2 Approaches in local initiatives for infrastructure development

Our study findings show two context-specific approaches used in local initiatives for infrastructure development, which we classified as mandatory and non-mandatory approaches. These approaches are somehow related to the commonly espoused notions of legal and social licences to operate. While South Africa has consistently followed a mandatory approach, Zimbabwe has vacillated from a non-mandatory to a mandatory and then back to the non-mandatory approach.

The premise of the mandatory approach is the existence of an explicit legal framework that compels mining firms, such as platinum-mining companies, to fund community development activities, including infrastructure development. Therefore, we see that South Africa post-1994 followed a mandatory approach

because the country enacted the Minerals and Petroleum Resources Development (MPRD) Act 28 (of 2002) with provisions for community development activities.

Under this Act, “all mineral rights are placed under the custodian of the state – a landowner owns only the surface rights and does not have the rights to minerals below” (Ololade and Annegarn 2013, p. 569). The MPRD further requires “mining companies to develop social and labour plans (SLP), in consultation with mining-affected communities in order to be eligible for mining rights” (Mtero 2017, p.191). Once consultations are completed, the commitments in the SLP are submitted to the Department of Mineral Resources (DMR), which through the Minister issues a mining licence.

We see that the Act provides for mining companies to first interact with communities and to understand the community development needs in the mining area before they are granted the mining rights. In fact, the MPRD enjoins platinum-mining firms to provide SLP for labour-sending and mining-host communities. Mtero (2017, p. 191) observes that, through the MPRD, state’s power to grant or to refuse the right to mine is applied to ensure mining companies to offer communities opportunities to benefit from the resources in their area. Corrigan (2019, p. 1) avers that,

“Through the post-apartheid introduction of the Mineral and Petroleum Resource Development Act (MPRD), South Africa became a regional leader in the movement to increase the social benefits derived from resource extraction through legislation aimed at improving the social responsibility of mining and petroleum companies”.

The above quote affirms the mandatory approach which South Africa has taken to facilitate infrastructure development in mining communities.

A more recent judgement by the High Court of South Africa in a mining case between the Australian miner Transworld Energy and Mineral Resources (TEM) and the Xolobeni community inadvertently strengthened the mandatory approach to local initiatives for community infrastructure development (High Court Judgement case 73768/2016). In this case, the judge ruled that the DMR had no lawful authority to grant a mining right to TEM in terms of the MPRD, until TEM and the DMR have complied with the Interim Protection of Informal Rights to Land Act 31 of 1996. The judge further ruled that the DMR had to obtain full and informed consent of the community before issuing a mining licence to TEM under the MPRD Act.

Our interpretation of this judgement is that it strengthened the mandatory approach by subsuming the provisions of the MPRD Act under those of the Interim Protection of Informal Rights to Land Act 31 of 1996. The judgement completely changed the requirement for consultation enshrined in the MPRD to full and informed consent, meaning communities can refuse to permit mining activities especially if the mining firm does not meet the community demands—a right they

did not have under the MPRD Act. Therefore, this judgement gives more bargaining advantage to communities to communicate their demands before a mining firm is granted a mining licence. Overall, the judgement may have unintentionally transferred the right to issue a mining licence from the DMR to the communities.

In the non-mandatory approach, governments do not enforce existing legal instruments that compel platinum-mining companies to develop infrastructure for local mining communities. Thus, platinum-mining companies get involved in infrastructure development as part of their voluntary ethical and philanthropic corporate social responsibility (CSR) contributions. In this case, mining firms get involved in community development to get their social licence to operate.

In Zimbabwe, the Mines and Minerals Act [Chapter 21:05] governs the operations of mining firms and their relationship with communities and government. Although this Act was “enacted to protect the social and environmental rights of communities”, its enforcement from 1980 to 2006 was rather lax (Nyawuyanga 2015, p. 23). Section 188 (7) of the Mines and Minerals Act [Chapter 21:05] states that compensation for communal land should be paid to the Rural District Council (RDC), which will in turn use it to advance local community development. However, most RDCs use the money for other activities not related to community development. Hence, the Mines and Minerals Act [Chapter 21:05] does not fully cater for the community development needs of local communities. Given this, between 1980 and 2006, mining companies in Zimbabwe were involved in infrastructure development as part of their voluntary CSR. Most mining firms developed and maintained infrastructure, such as roads, that facilitated access to their mines. Thus, mining firms voluntarily got involved in community infrastructure development when they deemed it necessary.

From 2007 to 2018, the non-mandatory approach changed to a mandatory approach due to the introduction of the Indigenisation and Economic Empowerment Act of 2007, [Chapter 14:33]. In Section 3 of the Act, all foreign owned large private mining companies had to cede a 51% equity share to indigenous Zimbabweans. The mining firms could partially fulfil their 51% equity share through establishing community share ownership schemes or trusts (CSOS/T) as stipulated in Section 14 of Statutory Instrument 116 of 2010, related to the Indigenisation and Economic Empowerment (General) (Amendment) Regulations, 2010.

Statutory Instrument 116 of 2010 specifies that funds provided by mining firms under CSOS/T funds should cater for provision, operation and maintenance of community infrastructure development. The stipulated community infrastructure includes schools, other educational amenities and scholarships, health facilities, dipping tanks, roads, water and sanitation, and infrastructure for gully reclamation, conservation, prevention of soil erosion, and general environmental conservation.

Many large mining firms invested in CSOS/T. Key examples include Zvishavane-Shurugwi Community Share Ownership Trust (CSOT), Gwanda

Trust, Tongogara CSOT, Bindura CSOT and the Zimplats Mhondoro Ngezi Chegutu Zvimba CSOS/T) (Kurebwa, et al. 2014, p.1; Mabhena and Moyo 2014, p. 72; Machinya 2014, p.1; Matsa and Masimbiri 2014, p. 151; Zvarivadza 2018, p. 92). Through these policies, Zimbabwe took a mandatory approach to community infrastructure development, lasting until early 2018.

Mining firms resisted implementing the Indigenisation and Economic Empowerment Act of 2007, [Chapter 14:33]. When Mugabe was removed from power in November 2017, the Mnangagwa government repealed the provisions for mining companies to cede 51% to black Zimbabweans for all firms except those in diamond and platinum. However, there is anecdotal evidence that the government will completely repeal the Act as it aims to attract foreign direct investment. Given this, we posit that Zimbabwe post-2018 is now again pursuing a non-mandatory approach.

3.3 The successful local initiatives for infrastructure development

In Zimbabwe, most communities mentioned that they have been involved in developing their infrastructure since attainment of independence in 1980. Discussions with war veterans elaborated that the government deliberately took a decision that local communities were supposed to be involved in developing their local infrastructure. The government was to act as a partner in the process. A war veteran stated,

“After demobilisation, we were deployed across the width and breadth of the country to mobilise the masses to work together in cooperatives or communities in partnership with government to build the infrastructure destroyed by war, or that was non-existent previously. We went from village to village ensuring communities took charge of constructing clinics, schools, roads, small dams, bridges, among others (Key Informant, Ngezi May 2019).

Community members corroborated this statement, “At independence, the government was clear that it had no money to build all community infrastructure. We were to contribute towards construction of our local infrastructure. Since then, we have been contributing towards development of our area” (FGD participant in Ngezi, May 2019). A chief pointed out, “Most heroes came from our area. We should be enjoying the sacrifices we made for independence. We were told that the government was not able to do much for us. Therefore, we partnered with them in development” (Chief key informant in Shurugwi, June 2019).

Members of the NGOs and private firms made similar observations. For instance, one key informant stated, “The norm in Zimbabwe is that we bring resources not available locally. Communities bring locally available resources. This is cheap for us” (NGO key informant in Ngezi, March 2019). Another key informant stated that, “The tradition here has been for communities to partner with us in community development. Communities actively participate by providing labour

and other locally available resources. We hand over finished projects to the community” (Platinum-mining firm key informant in Shurugwi, June 2019).

One farmer noted that, “while the old generation that were involved in the war of liberation has been providing local resources and labour for local development, the big question is whether the new generation will continue with this” (Farmer key informant in Ngezi, May 2019). A war veteran commented “the community-government partnership for rural infrastructure development originated from the war of liberation. We built infrastructure in camps during the war. We took the same approach when we came back home. But, the born-free generation may not accept this (War veteran key informant in Ngezi, January 2019). A key informant from the Rural District Council (RDC) stated, “The youths are asking why rural people have to collaborate with government, which provides everything to town dwellers. This discourse is a sign that the old ways may not be acceptable to the young generation” (RDC key informant in Ngezi, April 2019).

The above discourse is about intergenerational continuity of local initiatives for infrastructure development premised on community members providing locally available resources. Our results from structured observations show that some newly married couples get involved in the local initiatives especially if their children will benefit from the infrastructure. However, most households with young couples prefer to pay money towards realisation of the desired school, sanitation and water infrastructure instead of providing their labour.

Data from interviews show that the Indigenisation and Economic Empowerment Act of 2007, [Chapter 14:33] changed the dynamics of local initiatives around platinum-mining communities. Respondents from platinum-mining firms offered long-term insights on local community development initiatives. One key informant stated,

“There are changes in how we do community development here. We used to bring all materials not available in this community. The communities would support the project by providing all locally available resources, namely labour, stones, bricks, water, you name it. However, the indigenisation policy affected this by making us pay for everything and the communities started to fold their hands waiting for us to do everything” (Platinum-mining firm key informant in Shurugwi, June 2019).

A key informant from the RDC gave a different opinion on changes brought about by the Indigenisation and Economic Empowerment Act of 2007, [Chapter 14:33]. He observed that, “the Act made communities enjoy the fruits of the minerals in their area. Rather than being labourers, the Act made communities engage in strategic planning, monitoring and evaluation of what the mining firms would be implementing” (RDC key informant in Ngezi, May 2019). An NGO worker lamented the change, “that Act was terrible. We began to see communities reluctant to continue with partnerships and wanting everything done for them. This is not good for sustainability” (NGO key informant in Shurugwi, April 2019).

We explored the measures of successful local infrastructure development initiatives in Zimbabwe. The primary dimensions highlighted by the respondents were participation, ownership, networking, technology and skills transfer, and sustainability. Notions of empowerment and learning were less articulated. One community member in Ngezi said, “the school building project was successful because we participated in it. We brought in local resources that made it succeed” (FGD participant in Ngezi, May 2019). Another participant emphasised “When we look at these structures, we see our structures. We own them. They resulted from our efforts” (FGD participant in Shurugwi, June 2019). A chief further stated, “my community participated in all these projects from the beginning to the end. The community owns these communally and we will ensure that they are used from generation to generation” (Chief key informant in Shurugwi, June 2019). An RDC employee stated, “Successful local initiatives involve community, are sustainable and are owned by the communities. We also emphasise that they fit in existing community structures” (RDC key informant in Ngezi, May 2019). For another key informant, “successful local initiatives include participation, ownership, technology and skills transfer, sustainability, and partnerships” (NGO key informant in Shurugwi, June 2019).

In South Africa, the planning for community infrastructure construction mainly involves the platinum-mining firms, local municipalities, the traditional authorities, and community engagement forums. A key informant stated, “We create the SLP’s in collaboration with local stakeholders. We assess with local municipalities what the communities want, and we integrate their requirements into our SLP” (Platinum-mining key informant in Twickenham, August 2018). Another key informant put this differently, “We look at the community development plans of local municipalities and select what we can implement. We integrate these with community expectations in our SLP. We interact with local municipalities to implement the activities” (Platinum-mining key informant in De Brochen, September 2018). Noteworthy, these key informants simplified the processes for community infrastructure development around platinum-mining communities.

Our study found that the process leading to the realisation of community infrastructure is complex. Traditionally, platinum-mining firms were supposed to analyse the community development plans which are developed by local municipalities in collaboration with traditional authorities and community engagement forums. The platinum firms would then choose from the plans which projects they intend to execute and include these in their SLPs. The SLPs would be sent to the DMR for approval. Once the DMR approved the SLPs, the firms contracted service providers to work on the approved projects. The service providers would recruit a few local staff and would construct the infrastructure to completion. The completed infrastructure is handed over to the local municipalities, to the district or the national government department.

Noteworthy, while the process seems straightforward, it is quite challenging in practice. For instance, what the communities desire, is often different from what is expected by local municipalities. The platinum firms have a complex balancing process of selecting projects which are to be included in the SLP. Once the DMR approves the SLPs, the firms have further challenges of contracting competent service providers, balancing community interests for available opportunities, and delivering the projects.

Overall, platinum-mining firms essentially fund some of the costs for service delivery for local municipalities. The firms deliver services on behalf of local municipalities. One key informant lamented, “we were basically doing the service delivery job for local municipalities and yet communities don’t know or acknowledge this” (Platinum-mining firm key informant, September 2018). Structured observations showed that platinum-mining firms funded school infrastructure construction, health centres, roads construction, water purification plants and supply systems, sewage systems, scholarships, and early childhood education, among others.

The role of the community is limited to communicating their felt needs during consultations and waiting for the projects to be realised. One community member stated, “We are asked to provide our ideas of what the community wants. We wait for feedback on implementation. We don’t do much as we are poor” (FGD participant in Rustenburg, August 2018). Another stated this differently, “We give information about community needs. The rest is in the hands of the chiefs, local municipality, and mining firms. We put pressure when they don’t deliver” (FGD participant in Polokwane, August 2018). Indeed, platinum-mining communities constantly cause a closure of mining operations to protest the poor service delivery.

Of late, some platinum-mining firms have employed community development workers to directly assess and capture the felt needs of the local communities. A key informant stated, “We are making attempts to consult the communities directly. We will directly implement the projects they request. We hope communities will start to appreciate our community development activities” (Platinum-mining key informant in Polokwane, October 2018).

We also assessed the measures of success for local initiatives for infrastructure development in South Africa. Respondents articulated the importance of consultation/ participation, job creation, technology and skills transfer, and empowerment. In terms of consultation/participation, community members stated, “We need to be directly consulted before projects are implemented. This is key for us to say this is a successful project” (FGD participant in Mogalakwena, October 2018). A key informant supported this, “Community members need to be directly consulted and they should actively participate in the projects. They can then judge whether the outcome was a success or not” (Platinum-mining key informant in

Rustenburg, November 2018). However, another key informant viewed this differently,

We want holistic development. We can't have a situation where we all go to communities and come up with community development plans. This causes confusions in our communities. We need to have a consolidated development plan. The local municipality facilitates consultation, coordination and consolidation of development plans. Through this approach, we know who is doing what, where and when. Hence, we are using effectively available resources (Local Municipality key informant in Rustenburg, November 2018).

Our assessment is that while there is consensus that consultation/ participation is an important indicator to measure the success or failure of local initiatives for infrastructure development, there are different perspectives about whom and how the consultation should be done. There is an emerging culture of mistrust in communities, particularly regarding the ability of government to deliver on promises. Furthermore, there is a rampant emerging 'gatekeeper' phenomenon amongst those in leadership positions, as they tend to act as corrupt brokers between mining firms and other stakeholders.

Many respondents mentioned providing job opportunities as an important measure of success for a local initiative. One key informant stated, "We need jobs. Any successful initiatives must bring jobs to us" (Key Informant in Twickenham, April 2018). Another FGD participant stated, "All initiatives should provide jobs especially to the youths. Levels of unemployment are too high in our communities" (FDG participant in De Brochen, September 2018). Our study found out that unemployment is a serious problem in platinum-mining communities. Given this, our study provided a forum for community members to articulate their need for employment opportunities. Furthermore, there is a strong feeling that mining firms and contractors should prioritise local persons when hiring employees. However, most youths lack the requisite skills needed by the companies.

Another key success measure mentioned was business opportunities, which we associated with empowerment. A local businessperson mentioned, "We need mining firms to give us business opportunities. They must contract us to provide them with services first" (Local Business forum key informant in Polokwane, November 2018). Another FGD participant supported this, "There are many services that we can provide to these mining firms as local business operators. They need to empower us through giving us contracts" (FGD participant in Mogalakwena, November 2018). A key informant from the platinum-mining firms stated, "Empowerment is a good measure of success tied to legal compliance. We contract local competent suppliers and further capacitate those with potential. Some businesses succeed and others fail" (Platinum-mining firm key informant in Rustenburg, August 2018).

Our study findings show that there was less mention of ownership, networking, sustainability, and learning as measures of success for local initiatives for infrastructure development. In terms of ownership, most respondents clearly stated that local infrastructure in their communities belonged either to the platinum-mining firms or to local municipalities. A key informant lamented, “Communities here don’t have a sense of ownership of these infrastructures. If a classroom window breaks, they wait for us to come and repair it. They think the school belongs to the mining firm” (Platinum-mining firm key informant in Polokwane, September 2018).

3.4 Impacts of successful local initiatives on infrastructure development

Our study findings show several economic and social impacts of local initiatives for infrastructure development in platinum-mining communities in Zimbabwe and in South Africa. In Zimbabwe, for example, local initiatives facilitated the construction of schools, school latrines, dip tanks, and water points. These would not exist in the absence of local initiatives. Local initiatives for infrastructure development have enabled rural children to attend and to learn in decent schools, villagers are enabled to have access to clean water from community boreholes or water points, and farmers are enabled to protect their cattle from vector-borne diseases through regular dipping. Therefore, local initiatives are central to infrastructure provision in platinum-mining communities in Zimbabwe.

Our study shows three main thrusts of local initiatives for infrastructure development, namely constructing new infrastructure, upgrading existing infrastructure, and maintaining or repairing dilapidated infrastructure. Communities developing new infrastructure work together over long periods. This creates shared bonds as well as conflict. One community member stated, “We took over four months to have materials ready for the school. We began to know which community member is hardworking and which one is lazy. No one wanted to work with lazy members, and this caused some conflicts” (Key informant in Ngezi, April 2019). An NGO representative expressed a similar sentiment, “before you start a new long-term project, you need to work on the social aspects of how community members interact. These projects will involve community members over many months, and they will end up fighting” (NGO key informant in Ngezi, April 2019).

Although ad hoc in nature, local initiatives to upgrade or to maintain existing infrastructure normally take less time. In most cases, not everyone in the community is involved in implementing the project activities. The communities create a duty roster permitting a few community members to get involved at a given time. A Chief stated, “If we want to paint a school classroom block, not every community member is involved. We have first to decide which villages have to get involved and which ones will be involved later. We create a duty roster” (Chief Key

Informant in Shurugwi, June 2019). A farmer expressed similar sentiment, “During the dry season water becomes a problem and community members have to fill the dipping tanks. We create a duty roaster. Villages rotate to fill the dip tank. This enables us to dip our cattle” (Farmer key informant in Ngezi, February 2019).

Local initiatives provide employment opportunities in the communities. In Zimbabwe, platinum-mining communities mentioned how local initiatives created opportunities for trained villagers to get income. A villager stated, “NGOs always ask whether there are qualified local builders or carpenters to do the job. The villagers know us, and we get the jobs. We get income to support our families” (Key informant in Zvishavane, March 2019). NGOs involved in the area attested that they give priority to qualified local community members. In some cases, the NGOs trained locals to do the work, and they recruited and paid the trained cadres. A key informant stated, “We trained 12 men to dig water points and to build them so that they are protected. We employed these men to dig 35 boreholes in certain villages. We paid them handsomely. So, they got the skills and income” (NGO key informant in Zvishavane, March 2019).

We found that local initiatives for infrastructure development could either perpetuate existing gender roles or change these. For example, in Ngezi and Shurugwi areas local initiatives for schools’ construction perpetuated existing gender norms. A chief stated, “We always analyse which work can be done by women and which one can be done by men. Men do the hard work while women do the light work” (Chief key informant in Ngezi, April 2019). Another key informant stated, “Men dig the soil for brick-making, while women are involved in brick-making. Men build the kilns, look for the firewood, and burn the bricks. We all ferry the bricks to the construction site” (Key informant in Shurugwi, June 2019). These statements show that local initiatives perpetuate existing gender roles.

However, an NGO key informant cautioned that local initiatives which include NGOs tend to change existing gender norms. She stated, “We make sure that communities select a committee to manage implementation of local initiatives for infrastructure construction. We ensure that women are involved and oftentimes they lead the committees. This is against the norm” (NGO key informant, Masvingo February 2019). Another key informant stated, “We change existing gender norms depending on the type of project to be executed. We recently trained and had a group of women painting a school on their own in Shurugwi/Zvishavane area, something the community had never experienced before” (NGO key informant in Gweru, February 2019). An RDC key informant in Masvingo stated,

“Whether a local initiative changes existing gender norms or not depends on who is behind it, the communities and the type of project to be executed. Remember, most of these infrastructure projects were successfully executed before, and so so communities tend to follow what they did in the past. There may be no need to rock the boat unnecessarily. I am yet to see women who are

willing to get underground and dig the holes for community water points in this area. This is an area reserved for men only”.

We found that the Indigenisation and Economic Empowerment Act of 2007, [Chapter 14:33] negatively affected local initiatives. Many community-based key informants alluded to the proliferation of corruption. A community member stated, “The CSOS/T caused havoc here. Suddenly, chiefs were driving new cars, getting money, stipends, and sitting allowances. They became corrupt and arrogant. Community activities were planned far from the people at RDC offices. There was no transparency” (Key informant in Shurugwi, June 2019). A war veteran stated, “CSOS/T benefitted some individuals, disenfranchised and alienated communities. We did not know how much the platinum-mining firms were paying and for what. Money went to consultants and the leaders. Communities got no money. Yes, there was corruption” (A war veteran key informant in Zvishavane, February 2019).

Platinum-mining firms and RDC key informants refuted the allegations of corruption. A key informant stated, “CSOS/T were introduced in a politically charged environment. We were learning by doing. I would not say there were deliberate acts of corruption, but I agree some actions done were rather political than promoting community development” (Mining firm key informant in Shurugwi, June 2019). An RDC official pointed out, “We did many things by the book. It is unfortunate that the book changed regularly. We did not buy cars for the chiefs to bribe them, but these were some of the benefits provided for by the committee” (An RDC key informant in Mhondoro, June 2019).

While the key informants refuted outright acts of corruption, they did not rebut allegations that CSOS/T excluded some community members, created inequalities, and were not transparent. An RDC key informant stated, “CSOS/T were run in a corporate fashion, with sitting allowances, some consultants’ fees, salaries, and per diems. A few of us know what was happening. Information and plans did not cascade to communities. This is a lesson for us” (RDC Key informant in Mhondoro, May 2019).

There are many impacts of successful local initiatives in South Africa as well. Successful local initiatives are at the centre of plugging the gaps in local municipalities’ budgets and enhancing service delivery. A key informant stated, “Since mining firms implement agreed projects, they actually help fund initiatives we may not have the money to fund. We then save resources and channel these to meet other community needs” (Local Municipality key informant in Mogalakwena, October 2018). Another key informant stated, “We helped the municipality by building a road, a health centre, and now a water system. We are enhancing service delivery for local municipalities” (Platinum-mining firm key informant in Polokwane, November 2018).

It is worth mentioning that the diverse infrastructure which was built has various impacts to the communities. For instance, construction of health centres led to

high clinics usage, improved universal access to health, and to better quality of life for the community members, while road infrastructure improved access, security and connectivity of people, of pupils and of communities that were isolated from each other. Similarly, schools' infrastructure affected the pass rate in some schools, improved school student intake, improved the number of students per class ratio, and enhanced student access to library and laboratories. Finally, water purification plants, water points and boreholes increased access to portable, safe, and drinkable water for humans and animals and solved the problems of lack of water service delivery to paying customers. Roads to water points were upgraded, and this solved the problem of seasonal water provision because of failure to access the water points.

Another key impact of successful local initiatives is job creation for members of the local communities. Service providers contracted by mining firms to fulfil the SLP provide jobs to locals. Due to skills shortages, most community members are involved in menial tasks. Those employed get a salary or wage. Most of the jobs provided perpetuate traditional gender roles as they mainly include men. A key informant stated, "Infrastructure construction mostly involves men. We promote women employment, but this is implemented when there are suitable tasks" (Platinum-mining firm key informant in Rustenburg, September 2018). The employed men are more independent to make decisions, while employed women are subservient to the men. In fact, many women and women headed households depend on social grants in these mining communities. Negatively, as local communities ring fence available job opportunities, external service providers and job seekers are side-lined and denied opportunities, even if they are better qualified to do the job.

Local initiatives for infrastructure development in South Africa promote enterprise development, especially by building the capabilities of local businesspeople in the communities. Mining firms contract local suppliers to provide certain services such as catering and cleaning services. These small-scale businesses undergo various training programmes for them to deliver the services required by the mining firms. Thus, skills transfer happens between the mining firms and local businesses.

Local initiatives for infrastructure development have led to leadership squabbles, conflict and turmoil. These are associated with perceived benefits and expectations for contracts, tenders, and stipends from the mining firms. In fact, inequalities caused by unequal access to opportunities have created social strife in some communities. There is an increase in unemployed youths involved in criminal activities.

4 Discussion: local initiatives for infrastructure development and SDG Nine

Overall, our study results show that local initiatives are an imperative for community infrastructure development especially in Zimbabwe and South Africa. Although our study findings were specific to platinum-mining communities, they have contextual applicability and meaning in other contexts, especially African communities where local initiatives are central to the construction of schools, roads, and water and agriculture infrastructure. Our study results show that local initiatives deliver infrastructure to communities that would otherwise be deprived of these. The moot point is whether the infrastructure is resilient to climate change effects as envisioned in SDG 9.

The OECD (2018, p. 4) points out that climate-resilient infrastructure “is planned, designed, built and operated in a way that anticipates, prepares for, and adapts to changing climate conditions. It can also withstand, respond to, and recover rapidly from disruptions caused by these climate conditions”. This study did not explore the resilience of infrastructure developed through local initiatives in Zimbabwe and South Africa. Further studies should focus on whether infrastructure resulting from local initiatives is resilient to the effects of climate change as envisioned in SDG 9.

Noteworthy, our observation across the two countries is that the school, water and sanitation infrastructure projects follow nationally set designs and standards. Most of these standards were set when concerns about climate change and climate resilience were not a principal imperative. Therefore, it is important to ingrain climate change considerations in local initiatives for infrastructure development. It is essential to change the standards to encompass climate change considerations and to supervise the construction processes to ensure that standards are adhered to.

For climate-resilient infrastructure to be realised in local communities, it is necessary to provide “enhanced financial, technological and technical support to African countries”, as aptly stated in the SDG 9 infrastructure-specific target (UN 2015, p. 20; UN 2016, p. 26). Our study demonstrates that platinum-mining firms are an important source of financial and technological resources for community infrastructure development, for upgrades and for maintenance. Given this, we can infer that mining and other private companies can provide financial, technical, and technological resources for climate-resilient infrastructure in communities. Re-engineering current processes so that mining firms as well as other corporations provide resources for climate-resilient infrastructure through local initiatives is encouraged.

While the SDG 9 indicator being imperative for this study is “total official international support (official development assistance plus other official flows) to infrastructure” (UN 2016, p. 26), we argue that it is important to widen the scope

of this indicator to capture the contributions made through local initiatives. For instance, whilst costing the contributions of communities to community infrastructure in Zimbabwe may be a daunting task, our study results show that community involvement is central to the realisation of local infrastructures. Similarly, it is imperative to capture the contribution of platinum-mining companies. Accurately recording these contributions provides a holistic picture of the resources channelled towards climate-resilient infrastructure and realisation of SDG 9.

Our study points to two approaches to local initiatives for infrastructure development, namely the mandatory and the non-mandatory ones. The mandatory approach depends on enforcement of legal statutes by governments. This demands strong institutions. The non-mandatory approach depends on the goodwill of firms to facilitate community development especially through CSR activities. The mandatory approach can easily facilitate accurate recording of resources channelled towards the SDG 9 indicator, namely “total official international support (official development assistance plus other official flows) to infrastructure” (UN 2016, p. 26). In the case of South Africa, the quantum for each community project is included in the SLP submitted to the DMR before the legal licence to mine is granted to mining firms. Furthermore, annual reports with the actual amounts disbursed for the realisation of each project are submitted to the government. The government’s role may be to collate the information and to present this against the SDG 9 indicator. The non-mandatory approach may not facilitate accurate and timely collecting and collation of the vital information pertaining to the SDG 9 indicator.

Our study found that technologies and skills can be transferred through local initiatives, albeit study respondents did not articulate clearly the learning dimension. The learning component was not properly captured because of incorrect administration of the interview guide by our researchers. Despite this, the fact that skills and technologies can be transferred through local initiatives makes local initiatives imperative for the realisation of the SDG 9. Indeed, the infrastructure-specific aim of SDG 9 clearly points to the importance of “enhanced financial, technological and technical support” to African and other countries in need of such support. Our study explained the training steps that occur in the various phases of implementation of local initiatives and showed that both the mandatory and the non-mandatory approaches to local initiatives facilitate the transfer of hardware technologies to communities. Future research should explore in-depth the types of technologies and skills transferred through local initiatives for infrastructure development in relation to SDG 9. It is important to have accurate records of these for reporting against SDG 9.

The key measures of a successful local initiative for infrastructure development espoused in our study results are to a certain extent associated with the element of resilience stated in SDG 9. To highlight the relationship, we explore in depth indicators such as sustainability and ownership. In terms of sustainability, our study results on this indicator as a measure of success of local initiatives are

mixed. Notably, most platinum-mining communities in Zimbabwe and South Africa mentioned sustainability as an important indicator for measuring success of local initiatives. Sustainability includes intergenerational use, which demands regular upgrades and maintenance of infrastructure—a key thrust of local initiatives. However, concerns about intergenerational continuity were raised in Zimbabwe, while in South Africa infrastructures are handed over to local municipalities, district or national government departments without an assessment of sustainability. We conclude that the strengthening of the ethos of sustainability will to a certain extent contribute towards climate-resilient infrastructures.

Our study results on ownership have implications for SDG 9. The study findings show that there is a strong sense of community ownership among platinum-mining communities in Zimbabwe and little sense of community ownership among platinum-mining communities in South Africa. We conclude that it is highly improbable for climate-resilient infrastructure to emerge in contexts with little sense of community ownership. A strong sense of community ownership impels communities to invest in local infrastructure. For instance, necessary upgrades and maintenance or repairs to infrastructure will happen within agreed timelines. This reduces the risks of existence of dilapidated infrastructure with little resistance to extreme weather events and other climate change-induced disasters. Our study findings point out that participation and consultation are important for local ownership. We submit as results that participation and consultation are important for climate-resilient infrastructure development, especially through local initiatives.

The results of this study lead to the conclusion that non-mandatory approaches to local initiatives may be a cheaper way to develop community infrastructure. By bringing locally available resources for community infrastructure construction, platinum-mining communities will be reducing the costs associated with constructing the infrastructure. Effective and efficient use of resources is a practice imperative. Future studies should analyse the non-mandatory approaches in different contexts and should draw some lessons and empirical evidence to inform future local initiatives. The studies should examine these points in relation to SDG 9.

Our study results pointed to some negative aspects that can arise from local initiatives, such as forms of corruption, perpetuation of unfair gender norms and practices, and emerging inequalities. While these elements hinder the realisation of desired community infrastructure, they are barriers for the realisation of SDG 9 as well. There is growing evidence that demonstrates that corruption derails development efforts (Šumah 2018, p. 70; Wei 1999, p. 3). Therefore, it is important to prevent all forms of corruption related to local initiatives. Unfair gender norms and practices constrain human development in general by limiting human rights and freedoms (Fukuda-Parr 2003, p. 313). Existing literature points out that development is essentially the widening of human freedoms (Sen 1999, p. 3). As such,

local initiatives for infrastructure development should not emasculate freedoms by perpetuating unfair gender practices. In addition, local initiatives should help to curb inequalities while fulfilling the sustainability and resilience ethos enshrined in SDG 9.

5 Conclusions and Policy Recommendations

In this study, we examined successful local initiatives for infrastructure development, particularly elaborating their impacts on water, sanitation, and school infrastructure. We used case studies of local initiatives for infrastructure development in platinum-mining communities in Zimbabwe and South Africa. We found that the definition of local initiatives is predicated on actors involved, geographic delimitation, and ideas undergirding them. Ideas can originate from elsewhere and are localised through adaptation, assimilation, and articulation by local communities. We conclude that these definition elements of local initiatives for infrastructure development can inform the infrastructure-specific aims and the indicators of SDG 9. Noteworthy, to realise the SDG 9 envisioning sustainable and resilient infrastructure, ideas from different contexts need to be fused, adapted, and adopted to local settings.

This study examined how local initiatives contribute to infrastructure development in communities. The study findings demonstrate that local initiatives contribute immensely towards water, sanitation, school, and health infrastructure. We noted that local initiatives oftentimes provide essential basic infrastructure in resource-limited settings deprived of the infrastructure. Given this, further studies that explore the contributions of local initiatives to infrastructure development in other settings and countries are encouraged.

We further explored the approaches used in local initiatives for infrastructure development and highlighted the existence of the mandatory and non-mandatory approaches. We did not judge the efficacy of one approach over the other but pointed out the practical utility of each approach by explaining how each approach was applied in the given context. We consider our research as an exploratory study. Therefore, further studies to shade deeper insights on these approaches are essential. The empirical evidence from the researches should inform policy and practice.

The study pointed out that the success of the mandatory approach is largely dependent on enforcement of the relevant policies. Given this, we recommend a review of existing policies in order to gain insights on strengths and weaknesses of existing policies and application or enforcement frameworks of the policies. We further recommend capacitating the institutions that enforce existing policies and we propose creating policy instruments to guide non-mandatory initiatives which are currently informed by informal agreements.

We examined local initiatives for infrastructure development that were successful and the indicators for measuring the success. As stated before, water, sanitation, schools and health infrastructure projects were successfully constructed through local initiatives in platinum-mining communities. The indicators for measuring success include participation or consultation, ownership, sustainability, technology and skills transfer, job creation, empowerment, and networking. There was less mention of learning caused by mistakes in administrating the interview guide. Despite this, learning is an important indicator for measuring success of local initiatives.

The process of learning is linked to knowledge. Lundvall (2010, p. 1) notes, “Learning is predominantly an interactive and, therefore, a socially embedded process which cannot be understood without taking into consideration its institutional and cultural context”. There are various forms of learning, namely learning-by-doing; learning-by-using, and learning-by-interacting (Lundvall 2010, p. 10). Learning in its various forms is important for innovation, and necessary for realising sustainable and resilient infrastructure envisioned in SDG 9.

Lundvall (2010, p. 12) points out that “innovation is rooted in learning”. We conclude in this regard that realising climate-proof infrastructure demands innovation and interactive learning. We recommend community-centred programmes that strengthen interactive learning and innovation being essential for sustainable and resilient infrastructure as envisioned in SDG 9. Policy frameworks must promote interactive learning and sharing of learned experiences across communities. The innovation for sustainable and resilient infrastructure aligned to SDG 9 can be incremental or radical (Freeman 1995, p.18), depending on contextual factors. We recommend a policy-mix that promotes interactive learning and innovation at community level.

Finally, we examined the impacts of successful local initiatives on community infrastructure development. The study highlighted various social and economic impacts of local initiatives for infrastructure development (see also the two Highlights in the Annexes). We pointed out that physical infrastructure construction seems to be still guided by archaic standards which were created before concerns about sustainability and resilience to adverse climatic conditions became paramount. Therefore, we recommend that infrastructure development-related policies and standards be reviewed to prioritise construction of climate-resilient infrastructure, including through local initiatives.

The highlighted impacts went beyond creating physical infrastructure. The study highlighted the double-edged effects of local initiatives for infrastructure development concerning gender norms and practices, forms of corruption, and emerging inequalities. Noteworthy, the processes of infrastructure development should be inclusive, prevent corruption, and reduce inequalities. Therefore, we recommend creating explicit policies to guide implementation of local initiatives

for infrastructure development. These policies should promote transparency, prevent corruption, and promote equality as well as inclusivity. Once promulgated, these policies will further the realisation of the infrastructure-specific aims of SDG 9.

We advance that the outcomes of infrastructure development projects should improve the quality of lives of members of the community where they are constructed. An innovative policy mix that considers the indispensability of local initiatives will enable communities to adapt and to be resilient to climate change impacts, and ultimately will facilitate the realisation of the infrastructure aims under SDG 9.

References

- Bosworth, G., Annibal, I., Carroll, T., Price, L., Sellick, J., Shepherd, J. (2015): Empowering Local Action through Neo-Endogenous Development; The Case of LEADER in England, *Sociologia Ruralis*, 56 (3): pages 427-448, DOI: 10.1111/soru.12089.
- Bradshaw, J. (1972): Taxonomy of social need. In: McLachlan, Gordon, (ed.) *Problems and progress in medical care: essays on current research*, 7th series. Oxford University Press: London
- Corrigan, C. C. (2019): Deriving social benefits from mining through regulation: Lessons learned in South Africa, *The Extractive Industries and Society*, <https://doi.org/10.1016/j.exis.2019.05.017>
- Freeman, C. (1995): The 'National System of Innovation' in historical perspective, *Cambridge Journal of Economics*, 19: 5-2
- Fukuda-Parr, S. (2003): The Human Development Paradigm: Operationalizing Sen's Ideas on Capabilities, *Feminist Economics*, 9(2-3): pages 301 – 317
- Glaister, B. J. and Mudd, G. M. (2010): The environmental costs of platinum-PGM mining and sustainability: Is the glass half-full or half-empty?, *Minerals Engineering*, 23: pages 438–450
- Indigenisation and Economic Empowerment Act of 2007, [Chapter 14:33]
- Interim Protection of Informal Rights to Land Act 31 of 1996
- Kassam, A. (2018): Top-Down and Bottom-Up Approaches in Development, <https://doi.org/10.1002/9781118924396.wbiea1753>
- Kruger, R. A. and Casey, M. A. (2015): *Focus groups: a practical guide for applied research*, Thousand Oaks, California: SAGE
- Kurebwa, J. (2014): Contribution of the Bindura Community Share Ownership Trust to Rural Development in Bindura Rural District Council of Zimbabwe, *Journal of Public Administration and Governance*, 4 (4): pages 1-17.
- Lowe, P., Phillipson, J., Proctor, A., Gkartzios, M. (2019): Expertise in rural development: A conceptual and empirical analysis, *World Development*, 116: pages 28–37

- Lundvall, A.-B. (2010): *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London, Pinter.
- Mabhena, C. and Moyo, F. (2014): Community Share Ownership Trust scheme and empowerment: The case of Gwanda Rural district, Matabeleland South Province in Zimbabwe, *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, 19, 1(XI); pages 72-85
- Machinya, J. (2014): *The role of the indigenisation policy in community development: A case of the Zvishavane Community Share Ownership Trust, Zvishavane District, Zimbabwe*, MA (Economic/Industrial Sociology) Dissertation, Johannesburg: University of the Witwatersrand
- Massimo, C. (2015): *An assessment of Public-Private Partnerships policy as a panacea to state owned enterprises: The case of National Railways of Zimbabwe*, Department of Peace and Governance, Bindura University of Science Education, pages 1-19.
- Matsa, M. and Masimbiti, T. (2014): The Community Share Ownership Trust Initiative as a Rural Development Solution in Zimbabwe: The Tongogara Experience in Shurugwi District, *International Journal of Humanities and Social Science*, 4, 8(1): pages 151-163
- McKenna, S. A. and Main, D. S. (2015): The role and influence of key informants in community-engaged research: A critical perspective, *Action Research*, 11(2): pages 113–124
- Mines and Minerals Act. [Chapter 21:05]
- Mineral and Petroleum Resources Development Act No. 28 of 2002.
- Mtero, F. (2017): Rural livelihoods, large-scale mining and agrarian change in Mapela, Limpopo, South Africa, *Resources Policy*, 53: pages 190–200
- Nel, E. L. (2019): *Regional and Economic Development in South Africa: The experience of the Eastern Cape*, Routledge, New York: USA.
- Nyawuyanga, T. G. (2015): *Corporate social responsibility as a tool to accelerate the achievement of development goals in Zimbabwe* (LLM Dissertation), Cape Town: Faculty of Law, University of the Western Cape
- National Treasury, (2019): *Budget Review 2019*, National Treasury, Republic of South Africa
- Oberthür, T., Melcher, F., Buchholz, P., Locmelis M. (2013): The oxidized ores of the Main Sulphide Zone, Great Dyke, Zimbabwe: turning resources into minable reserves—mineralogy is the key, *The Journal of The Southern African Institute of Mining and Metallurgy*, 113: pages 191-201
- OECD. (2018): *Climate-resilient Infrastructure, Policy Perspectives*, OECD: OECD Environment Policy Paper No.14
- Ololade, O. O. and Annegarn, H. J. (2013): Contrasting community and corporate perceptions of sustainability: A case study within the platinum mining region of South Africa, *Resources Policy*, 38: pages 568–576

- Onyenemezu, E. C. and Olumati, E. S. (2013): The Imperativeness of Felt-Needs in Community Development, *Journal of Education and Practice*, Vol.4, No.2: pages 156-159
- Owen, J. R. and Kemp, D. (2015): Mining-induced displacement and resettlement: a critical appraisal, *Journal of Cleaner Production* 87: pages 478-488
- Sen, A. (1999) *Development as freedom*, New York: Anchor Books, Random House, Inc.
- Statutory Instrument 116 of 2010, *Indigenisation and Economic Empowerment (General) (Amendment) Regulations*, 2010.
- Šumah, Š. (2018): *Corruption, Causes and Consequences*, IntechOpen, <http://dx.doi.org/10.5772/intechopen.72953>
- Tremblay, M. A. (1957): The Key Informant Technique: A Non-ethnographic Application, *American Anthropologist*, 59: pages 688-701
- Wade, J. L. (1989): Felt Needs and Anticipatory Needs: Reformulation of a Basic Community Development Principle, *Journal of the Community Development Society*, 20:1, pages 116-123, DOI: 10.1080/15575338909489998
- Wei, S. J. (1999): *Corruption in Economic Development: Beneficial Grease, Minor Annoyance, or Major Obstacle?*, Cambridge: Harvard University and National Bureau of Economic Research (NBER)
- United Nations/UN (2015): *Transforming our world: the 2030 Agenda for Sustainable Development*, New York: UN General Assembly
- United Nations/UN (2016): *Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators*, Geneva: Economic and Social Council
- Zinyama, T. and Nhema, A. G. (2015): Public-Private Partnerships: Critical Review and Lessons for Zimbabwe, *Public Policy and Administration Research*, 5(6): pages 39-44
- Zvarivadza, T. (2018): Large-scale Miners-Communities partnerships: A plausible option for communities' survival beyond mine closure, *Resources Policy*, 56: pages 87-94

Annexes: Cases from South Africa and Zimbabwe

Highlight 1: Local infrastructure construction for education in South Africa

In South Africa, the Minerals and Petroleum Resources Development (MPRD) Act 28 of 2002 enjoins mining firms to implement social developments in labour-sending and mining host communities. Maotsi village in Surbiton area of Limpopo Province of South Africa is a mine host community which is located close to Twickenham Mines. The local community development committee, the traditional authority, and the local municipality recognized that Masebudi Primary School lacked proper and adequate educational infrastructure. Some primary

school-going age pupils were not taking their lessons in conditions conducive for learning. During social and labour plans engagements with the Twickenham Mines, the community and the municipal leadership structures raised the need to have additional classrooms and an administration building constructed at the school.

After consulting with the Department of Basic Education (DBE), the Department of Minerals Resources (DMR), the local municipality, the project steering committee, the traditional authority, and a platinum-mining firm involved at Twickenham Mines incorporated the construction of the classrooms and the administrative building into its social and labour plans. The social and labour plans were submitted to the DMR for approval, and they were subsequently approved. Given the provisions of the Minerals and Petroleum Resources Development (MPRD) Act, the Twickenham Mines were legally compelled to construct the identified educational infrastructure at Masebudi Primary School.

To fulfil the requirements of the MPRD Act, a platinum-mining firm constructed four new classrooms and an administrative building at Masebudi Primary School. The platinum firm contracted a construction firm to do the job up to the full completion without any community involvement. Upon completion of the construction in 2019, the mining firm handed over the newly constructed educational infrastructure at Masebudi Primary School to the Department of Basic Education. The construction of additional school infrastructure guaranteed a better learning environment for many of the rural children.

Highlight 2: Health infrastructure construction in Zimbabwe

From 1980 when Zimbabwe attained independence until 5 June 2018, community members in Ruchunyu area, governed under the Tongogara Rural District Council in Zvishavane area of Zimbabwe, walked over 25 kilometres to access health care facilities located in Mapanzure and Marishongwe areas in Zvishavane. During community engagements with the Tongogara Rural District Council (TRDC), the community always complained about the lack of an easily accessible health facility. Pregnant women, the elderly, children, the chronically ill, and persons living with a disability were amongst the population groups most affected by the lack of access to a nearby health facility. The relatives of a sick person were also affected as they had to accompany the ill patient to the distant health facilities.

During protracted engagements with Tongogara Rural District Council (TRDC), community members in Ruchunyu area volunteered to provide local available materials for construction of a clinic in the area. The Tongogara Rural District Council (TRDC) then requested support from mining companies which were operating around Zvishavane area. A platinum-mining firm which had been

involved in relocating 20 households from a community nearby, namely Rietfontein village, agreed to support the construction of a clinic in Ruchunyu area.

An agreement was signed between the mining firm and the Ministry of Health and Child Welfare (MHChW), the Tongogara Rural District Council (TRDC), and the Tongogara Community Share Ownership Trust (TCSOT). The Ministry of Health and Child Welfare accepted to provide health care workers and to support their services upon completion of the clinic. The Tongogara Rural District Council managed the community relations and monitored the realization of the project. As per the agreement, the community provided locally available materials and support to the project from initiation to completion. The mining firm funded the construction of the clinic and further equipped the clinic. The Tongogara Rural District Council supervised the construction process and reported outcomes to the government. The Ministry of Health and Child Welfare supplied the required medications and staff for the clinic.

Construction of the clinic started in 2016 and the clinic was inaugurated on 5 June 2018. The construction of the facility improved the health outcomes in the area. The clinic provides healthcare to the relocated 20 households in Rietfontein village and for Ruchunyu community. Members of the community currently get medication for various diseases from the clinic, including anti-retroviral treatment (ART) for people living with HIV. In addition, medications for tuberculosis, high blood pressure, asthma, and diabetes are dispensed at the clinic. This local initiative, premised on community and Community Share Ownership Trust involvement in infrastructure development, is an example of a life-saving infrastructure project that meets the felt needs of the local community. It reduced unproductive time wasted by community members who walked long distances to seek healthcare. Upon inauguration, the clinic was handed over to the Ministry of Health and Child Welfare and the local community. The local community has a great sense of ownership which guarantees sustainable use, care, and maintenance of the clinic.

Unit 3: Book Reviews and Book Notes

Guidelines for Readers by Editor/Co-Editor

Samia Satti Osman Mohamed Nour¹ and Karl Wohlmuth²

The purpose of the Guidelines for Readers is to help them to identify the subject areas of books and documents and the publications which had been selected by the two book reviews/book notes editors. The theme of volume 22 of the African Development Perspectives Yearbook on SDG 9 and African Development was covered in six sections of Unit 3. It was the intention of the editors to go beyond the literature on SDG 9 by considering the major international literature on the progress of the 17 SDGs and the interlinkages of SDG 9 with other SDGs. In section 1 of Unit 3 the global reports are reviewed to learn more about methods and evaluation criteria to assess the progress and the performance in regard of the SDGs. In section 2 the African reports on the progress and performance of the SDGs were covered, as now major regional centres in Africa work on these reports. Section 3 presents reviews on literature covering SDG 9, while section 4 is considering the African reports done on SDG 9. Section 5 has reviews on specific themes related to industry, innovation, and infrastructure, the three key issues concerning SDG 9. Section 6 is reviewing the reports, documents, and books, and is showing how interlinked SDG 9 is with other SDGs, especially those on “no poverty”, “zero hunger”, “decent work and economic growth”, “climate action”, “responsible consumption and production”, and “peace, justice and strong institutions”. A great advantage is that all these reports are accessible on an open access basis. So, not only the critical reviews and evaluations but also the full reports are available to the readers all over the world.

In the sections 7 to 11 there are reviews of important publications which are indirectly related to the SDGs, but these publications have a long history as being part of important series of international and regional documents. In Section 7 there are found reviews of global economic reports which are discussing global development perspectives, contributed mainly from sources of international organizations. Section 8 refers to reviews on reports about global development issues in relation to African development. Section 9 covers reviews of regional African economic reports, as provided by regional African organizations. Section 10 has reviews important publications on development finance and development aid for

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sustainable development in Africa. The final section 11 reviews books and documents on African economic development and on major development themes of our times.

The editors carefully have selected the reports, documents and books which were included in Unit 3. But, as in the past, we will also in the future concentrate on books, reports and documents which are directly related to the major theme of the volume which is issued. This has great advantages as readers can continue and deepen their readings as they get access to major literature. Some of the reviewed publications are also mentioned in the essays of Unit 1 and of Unit 2. A great thank you is addressed to the reviewers. Again, it was possible to motivate competent researchers to act as reviewers.

1 The Sustainable Development Goals – Global Reports on Progress, Policies and Measurement

Sustainable Development Report 2020, The Sustainable Development Goals and Covid-19, Includes the SDG Index and Dashboards, by Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. June 2020. Cambridge: Cambridge University Press, 520 pages; Download: <https://sdgindex.org/reports/sustainable-development-report-2020/>, and: https://s3.amazonaws.com/sustainabledevelopment.report/2020/2020_sustainable_development_report.pdf, and free access at website for report: <https://www.sdgindex.org/> and website for data visualization: <https://dashboards.sdgindex.org/>

The Sustainable Development Report 2020 (SDR 2020) has the title ‘The Sustainable Development Goals and Covid-19,’ and focuses on the Sustainable Development Goals in the context of Covid-19. The report is composed of five parts. Part 1 focuses on Covid-19, the SDGs, and the recovery; it examines Covid-19 and the future of sustainable development and compares early Covid-19 controls in the OECD countries. Part 2 discusses the SDG Index and Dashboards; it investigates the 2020 SDG Index, the SDG Index score over time, international spillovers, the SDG dashboards, and the absolute SDG performance gaps in the G20 countries. Part 3 focuses on policy and monitoring frameworks for the SDGs; it explains the political leadership, policy environment, and data, statistics, and monitoring. Part 4 discusses the methods and explains the Index and Dashboards results. Finally, Part 5 presents the country profiles.

The Sustainable Development Report 2020 (SDR (2020)) discusses the interaction between the Sustainable Development Goals and Covid-19. It shows that Covid-19 will have severe negative impacts on most SDGs. The world is facing

the worst public health and economic crisis in a century. The health crisis is affecting all countries, including high-income countries in Europe and North America. The necessary measures taken to respond to the immediate threat of Covid-19, including the shutdown of many economic activities for weeks, have led to a global economic crisis with massive job losses and major impacts especially on vulnerable groups. This is a significant setback for the world's ambition to achieve the SDGs, specifically for poor countries and population groups.

The SDR 2020 shows that significant progress has been achieved in many regions and on many goals over the past five years. Asian countries have made the most progress towards the SDGs since the adoption of the goals in 2015. Asian countries have also responded most effectively to the Covid-19 outbreak. While the world in general terms has made progress on the SDGs, countries in East and South Asia in particular have progressed the most in terms of their SDG Index score. Countries in this region have also managed the Covid-19 outbreak more effectively than in other parts of the world. The health, economic, and social crises call for increased international collaboration and solidarity to support the most vulnerable countries. The SDR 2020 discusses Covid-19, the SDGs, and the recovery, and indicates that the world is still in the early phase of the vast Covid-19 crisis. Economies are in a deep and growing crisis, and inequalities within and among countries are rising, as the poorest suffer a disproportionate share of the infections and deaths, and global tensions are rising, as this crisis is the worst since World War II. The economic ramifications could rival those of the Great Depression in the 1930s. The implications of the pandemic encompass public health, economics, social stability, politics, and geopolitics. The crisis is unprecedented in severity at least since the influenza epidemic at the end of World War I.

The SDR 2020 contributes to the global discussion on Covid-19 and the SDGs. The SDR 2020 presents some early thoughts on the Covid-19 crisis and on the future of sustainable development; it reviews early responses and identifies short-term priorities for action by governments and their partners around the world, and it reviews the ways the governments have responded to the immediate health crisis. The SDR 2020 discusses the SDG Index and Dashboards, and presents and aggregates the data on country performance towards the SDGs; it discusses the "pre-Covid-19" SDG Index and Dashboards that remain useful for understanding goal-by-goal progress across countries and regions since the adoption of the SDGs in 2015. This serves three purposes; first, it helps countries to understand the pre-crisis vulnerabilities and challenges, which partly explain why so many countries were ill-prepared to respond to Covid-19; second, the SDGs provide the framework for the long-term recovery from Covid-19; third, the SDG dashboards underscore the urgent need for investments in more timely and comprehensive SDG data.

Regarding methods, the SDR 2020 describes each country's progress towards achieving the SDGs and indicates areas requiring faster progress. A country's

overall SDG Index score and its scores on individual SDGs can be interpreted as a percentage of optimal performance. The SDG Index and Dashboards summarize countries' current performance and trends in relation to the 17 SDGs. The SDG trend dashboards indicate whether a country is on track to achieve a particular goal by 2030, based on its recent performance on given indicators. Indicator trends are aggregated at the goal level to give a trend indication of how the country is progressing towards that SDG. The SDR 2020's SDG Index 2020 covers 166 countries, compared with 162 countries in 2019, and estimates changes in performance on the SDG Index using the SDR 2020 indicators. The limitations and data gaps are due to changes in the indicators (incorporation of several new indicators) and in the methodology, so that the SDG Index rankings and scores cannot be compared with those of previous editions.

The SDG Index 2020 tracks country performance on the 17 SDGs, as agreed by the international community in 2015 with equal weight to all 17 goals. The score signifies a country's position between the worst (0) and the best or target (100) outcomes. For example, Sweden's overall Index score (85) suggest that the country is on average 85% of the way to the best possible outcome across the 17 SDGs. The SDG Index and Dashboards 2020 include 85 global indicators plus an additional 30 indicators for the OECD countries. As in previous editions, three Nordic countries top the 2020 SDG Index: Sweden, Denmark, and Finland. Most countries in the list of the top 20 are OECD countries. Yet even these countries face significant challenges in achieving several SDGs. Every country has a weak score on at least one SDG in the dashboards. Covid-19 will likely negatively impact progress towards most SDGs in the short and medium-term, including in high-income countries. Low-income countries tend to have lower SDG Index scores. This is partly due to the nature of the SDGs, which focus to a large extent on ending extreme poverty and on giving access to basic services and infrastructure (SDGs 1–9). Except for countries that face armed conflicts and civil wars, however, most low-income countries are making progress in ending extreme poverty and in providing access to basic services and infrastructure, particularly for SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth), as illustrated by the SDG trends dashboards.

Regarding the SDG Index score over time the SDR 2020 indicates that overall, the world has been making progress towards the SDGs. The report indicates that countries in East and South Asia have progressed the most since 2010, and since the adoption of the SDGs in 2015. Africa made significant progress during the millennium development goals (MDGs) period (2000–2015), and has also made some progress since the adoption of the SDGs. Latin America and the Caribbean, Eastern Europe and Central Asia, and the Middle East and North Africa region also have made progress between 2010 and 2019 and have increased their SDG Index score by more than one point on average. Finally, the OECD countries, which have on average the highest SDG Index score, progressed moderately since

2015. On average, progress since 2015 has been faster in low- and middle-income countries compared with high-income countries. The report indicates that there are significant disparities in the progress that countries have made on the SDGs, including within regions. The three countries that have progressed the most in terms of the SDG Index score are Cote d'Ivoire, Burkina Faso, and Cambodia. By contrast, the three countries that have declined the most are Venezuela, Zimbabwe, and the Republic of the Congo. In general, conflicts and civil wars have led to a reversal in SDG progress. The report noted that Covid-19 will likely have a strongly negative impact on SDG performance in many countries, but this has not been reflected yet in the data available to date.

The SDR 2020 explains progress by SDGs and argues that since 2015 the world has seen the most rapid progress towards SDG 1 (No Poverty), SDG 9 (Industry, Innovation and Infrastructure), and SDG 11 (Sustainable Cities and Communities). Overall, as underlined by the United Nations Statistics Division (UNSD), the percentage of people living in extreme poverty globally in 2018 had decreased by 1.4 percentage points since the adoption of the SDGs: from 10% in 2015 to 8.6% in 2018. Following these historic trends, this figure was projected to reach 6% by 2030, but Covid-19 now threatens to increase extreme poverty in many countries. Access to basic transport infrastructure and broadband connection has also been growing rapidly. Ninety percent of the world's population live within the range of a 3G or higher-quality mobile network. Global investment in research and development has also been growing. At the same time, SDG 9 (Industry, Innovation, and Infrastructure) is the goal that exhibits the largest spread between top and bottom performers. This emphasizes the need to accelerate the spread of technologies and innovation globally and to strengthen capacities and skills. The SDG dashboards highlight the strengths and weaknesses of each country in relation to each of the 17 SDGs.

For the Sub-Saharan Africa (SSA), the average SDG Index score for countries in Sub-Saharan Africa has improved significantly since 2015. Yet, all Sub-Saharan African countries continue to face major challenges in achieving the SDGs, and now Covid-19 threatens to undo much of the progress made in recent years. Owing to the poverty in the region, performance on socioeconomic goals and access to basic services and infrastructure (SDGs 1 to 9) is poor compared to other world regions. In some countries, insecurity and conflict have lowered performance on various goals. The Covid-19 outbreak and the disruption in international supply chains, including the food supply chain, are likely to have very negative impacts on the SDGs performance in many Sub-Saharan African countries. International solidarity and support will be needed to prevent losing the development gains of recent decades. The SDR 2020 assesses policy and monitoring frameworks for the SDGs, and the policy efforts to implement the SDGs. It indicates that further efforts are needed to address persistent data gaps and data time lags in relation to the

SDG indicators, and argues that more policy trackers are needed to increase visibility on how governments are pursuing the SDGs, are strengthening accountability, and are sharing data on best practices and lessons learnt, which will help other countries to accelerate progress towards the SDGs.

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United Nations, The Sustainable Development Goals Report 2020, United Nations publication issued by the Department of Economic and Social Affairs (DESA), United Nations 2020, New York, ISBN: 978-92-1-101425-9/e-ISBN: 978-92-1-004960-3/ePub ISBN: 978-92-1-358332-6/ISSN: 2518-3915/e-ISSN: 2518-3958/Sales No. E.20.I.7, 66 pages; Download: <https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf>

This is a report about the progress of the 17 SDGs, but there are also introductory and concluding chapters. In his Foreword António Guterres, Secretary-General of the United Nations, states: “The Sustainable Development Goals Report 2020 brings together the latest data to show us that, before the COVID-19 pandemic, progress remained uneven and we were not on track to meet the Goals by 2030. Some gains were visible: the share of children and youth out of school had fallen; the incidence of many communicable diseases was in decline; access to safely managed drinking water had improved; and women’s representation in leadership roles was increasing. At the same time, the number of people suffering from food insecurity was on the rise, the natural environment continued to deteriorate at an alarming rate, and dramatic levels of inequality persisted in all regions. Change was still not happening at the speed or scale required.”

For the analysis in the present volume of the African Development Perspectives Yearbook (ADPY) the report is a useful reading; the global position of SDG 9 and its interactions with other SDGs is described, and some cases are presented. The main message is that the effects of COVID-19 may threaten all the progress reached towards SDG 9 in the past years. Even a reverse trend could follow from COVID-19 and from other impacts at global political and economic levels, such as the climate crisis. Especially the manufacturing and transport industries of developing countries may suffer and realise severe losses. Global manufacturing growth has declined in 2018 and 2019 and registered a sharp drop in the first months of 2020. The consequence is that the major target of SDG 9 on industry cannot be met. Small-scale industries in developing countries need more credit lines, a deficit that is especially affecting these enterprises in Sub-Saharan Africa. Lines of credit are far too low to allow for a rapid industry growth. Not a quarter of the small-scale industries in Sub-Saharan Africa have a credit line. Connectivity is also a problem; most of the offline population lives in LDCs, where only 19 per

cent use the Internet, compared with 87 per cent in developed countries. Key reasons for this large gap are the cost of using the Internet and the lack of the necessary skills. The report is a useful description of the trends related to the 17 goals. The pre- and post-COVID-19 situation is highlighted, also by including useful graphs and boxes. The report is easy reading, full of informative data and food for thought about the global situation.

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2 The Sustainable Development Goals - African Reports on Progress, Policies and Measurement

SDG Center for Africa and Sustainable Development Solutions Network (2019): Africa SDG Index and Dashboards Report 2019. Kigali and New York: SDG Center for Africa and Sustainable Development Solutions Network, June 2019, 230 pages. For download: <https://www.sdgindex.org/reports/2019-africa-sdg-index-and-dashboards-report/>, and: https://s3.amazonaws.com/sustainabledevelopment.report/2019/2019_africa_index_and_dashboards.pdf

The Africa SDG Index and Dashboards Report 2019 focuses on the efforts that African governments are taking to incorporate the SDGs into their national strategies, budgets, public engagements, and towards the coordination among branches of government. The report indicates that governments have a unique and central role to play in achieving the UN's Agenda 2030 as well as Africa's own Agenda 2063, which will continue beyond the SDG timeline. The report indicates that while good governance is a Sustainable Development Goal in its own right (SDG 16), the active role of government is instrumental to every other SDG. The report explains that it is necessary not only for each country to reflect on its current SDG status and progress, but to analyse how government-led efforts can be improved and accelerated. The Africa SDG Index and Dashboards Report 2019 provides an assessment not just of where African countries stand with respect to the SDGs and their progress toward the goals, but also how African governments are implementing strategies for achieving them.

The Africa SDG Index and Dashboards Report 2019 intended to enlighten policy makers and the public on the progress so far towards the SDGs in Africa, to serve as a catalyst to inspire increasing efforts by citizens, governments, businesses, academics, NGOs, and other partners within and beyond the continent to support the SDGs in Africa and to encourage all partners to redouble their efforts to achieve the SDGs. The Africa SDG Index and Dashboards Report 2019 includes three sections; the first section analyses SDG implementation efforts and includes five case studies; the second section presents the results and provides analysis; and

the final section explains the methodology. The Appendices section of the report presents the indicators, the country profiles, and the survey results.

The first Africa SDG Index and Dashboards report in 2018 was an attempt to provide a comprehensive and comparable monitoring framework for the SDGs at the continental, regional and national levels. The Index and Dashboards included inter alia the countries' specific performance and the trends for each of the 17 goals, and the overall country aggregate SDG index score ranking as well as the trend analysis showing the respective countries' distance to achieving the SDGs. This second report of the Africa SDG Index and Dashboards of 2019 includes additional indicators and eliminates some others. Due to a change in scope, methodology and indicators, the comparison of this index with last year's ranking is not possible.

The report for 2019 includes five case studies, one from each major region, to illustrate a variety of best practices on SDG implementation efforts: the African Business Coalition for Health SDGs; Agro-processing Industrial Parks in Ethiopia; Regional integration as a champion of the SDGs – East African Community; Socio-economic investment and environmental impacts of the mines in Zambia; and Jobs in the Digital Global Economy in Tunisia. The Africa SDG Index and Dashboards Report 2019 includes all 54 African countries compared to only 11 countries which were included in the 2018 report in the preliminary analysis of SDG implementation.

The Africa SDG Index and Dashboards Report 2019 focuses on six areas: national strategies and baseline assessments in the executive, budgeting practices and procedures in the executive, stakeholder engagement, coordinating units in the executive, legislative actions, and main challenges for implementation. The Africa SDG Index and Dashboards Report 2019 finds that the SDGs have widely received official endorsements by African governments and have been incorporated into many Government Action Plans and national strategies. There are still widespread gaps on behalf of countries in understanding the distances to SDG targets. There is a lack of understanding on what it will take to reach the SDGs, very little consideration for the financial resources that will need to be mobilized, and who will provide the necessary funds. The report confirms that the engagement with the public and other stakeholders can significantly be improved. The report finds that only four countries have an online portal where citizens can see their countries' progress toward the SDGs, and less than half of all countries have done awareness-raising activities. According to country experts, who validated results for 21 countries, a lack of funding and resources is reported to be the single most significant challenge both in terms of SDG implementation and monitoring. In terms of the current status and the trends toward achieving the SDGs in Africa, the 2019 report presents a comprehensive and comparable monitoring framework at the continental, subregional, and national levels. An additional new feature in the 2019 report is an analysis and grouping of countries according to their performance on each of

the SDGs. The report indicates that the changes in the methodology and the data sources used to generate the 2019 Africa SDG Index and Dashboards Report have produced different results from the 2018 report. The average SDG index score across countries has remained virtually unchanged, but some of the rankings have changed.

The 2019 report finds that, overall, North Africa is the best-performing region on average, while Central Africa is the worst-performing. Mauritius has replaced Morocco as the top-ranking country, while Morocco is now ranked in 4th place, behind Tunisia and Algeria. The report finds that, across the board, African countries perform comparatively well in terms of sustainable production and consumption as well as in climate action (SDGs 12 and 13), but they perform poorly in goals related to human welfare (SDGs 1 to 7 and 11). The report finds that there is a great deal of diversity with respect to the main SDG challenges in Africa's subregions. The report finds that countries can be broadly categorized into five major groups: continental leaders, which do better in terms of human welfare but need to improve environmental performance; growing countries, which are catching up to the leaders but have high inequality; middle-of-the-pack countries, which must maintain environmental performance while improving human welfare; emerging countries, which are also experiencing growth but still lag in terms of human welfare; and distressed countries, most of which are experiencing conflict, countries that will require the most support to achieve the SDGs.

The 17 Sustainable Development Goals (SDGs) represent an ambitious and voluntary undertaking by governments to implement and monitor progress on sustainable development. So far, only 19 out of the 54 African Member States have undertaken Voluntary National Reviews (VNR), with a further 16 presenting a VNR for the first time in 2019. The report finds that more than one third of the countries have not yet engaged with the official process. This high proportion indicates that reporting remains incomplete and signals mixed levels of commitment to the SDGs. The report finds that on the data side of monitoring, methodological and data gaps prevail; nearly half of the 169 targets are not quantified and only 40% of the indicators in the Global SDG framework have data. Some indicator data collection has not yet materialized, while some indicator methodology is still undefined. The report indicates that the data gaps are particularly egregious in African countries. As detailed in last year's report, there are wide disparities in statistical capacity throughout the continent, but, overall, it is low. There are common challenges across institutions, relating to technical capacity, data collection and processing, and in regard of the adoption and application of international statistical standards and new technologies. Additionally, while the harmonization of the 2030 SDGs Global Agenda and the African Union 2063 Agenda has initiated over the last year, the full integration of the data frameworks is not yet complete. This is a further task for the African Union.

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African Union (2020): Impact of the Coronavirus (COVID 19) on the African Economy: African Union Commission, Addis Ababa, Ethiopia, 6 April 2020, 35 pages; Download:

<https://www.tralac.org/documents/resources/covid-19/3218-impact-of-the-coronavirus-covid-19-on-the-african-economy-african-union-report-april-2020/file.html>

The rapid and worldwide spread of the corona virus is accompanied by massive economic consequences. The development was very immediate. Prevention measures, such as the so-called lockdown, were decided and implemented within a very short time. The medium-term effects of these and possibly subsequent measures can currently hardly be assessed. It is all the more important that scientific studies are now being drawn up for different regions of the world. This enables an overview of the current situation. On this basis, assessments and recommendations can be made. The African Union has achieved this with its Report "Impact of the Coronavirus (COVID 19) on the African Economy". The general global situation is first described before the socio-economic aspects in Africa are discussed in detail. Methodologically, the report is based on a description of specific key indicators of the African economy. Building on this, possible development scenarios are constructed. In the following, the impact on the African economy for each of the scenarios is worked out. Key measures taken by selected African Union Member States are presented as well. The paper ends with a conclusion and key policy recommendations.

The basic assumption is that there are two effects in connection with COVID 19: exogenous effects as effects of economic weakness affecting African trading partners, e. g. the collapse of tourism, and endogenous effects as a direct consequence of the spread of the corona virus in the African states themselves and the associated disruption of economic activities. The global economic situation in times of Corona is outlined in an overview. There is a strong focus on tourism as the most affected sector. The response to the crisis of different countries and some macro-economic measures taken at the international level are presented in the conclusion. The focus of the study is then on an analysis of the impact on the African economies. To assess the impact, the study considers two scenarios. The first scenario assumes that the pandemic will be under control in African countries from July 2020 onwards. In the second scenario, this assumption is postponed by one month. As can be seen in the meantime, both scenarios were made in a very optimistic assumption.

The impact of the pandemic on African economic growth is analysed in detail. A slump in foreign trade in African countries of at least 35 % compared to 2019 is expected. In the tourism sector alone, it is forecast that over 2 million people on the African continent will lose their jobs. Against this background, the following is summarized: "The COVID-19 pandemic has hit almost all African countries and

appears poised to worsen dramatically. The disruption of the world economy through global value chains, the abrupt falls in commodity prices and fiscal revenues and the enforcement of travel and social restrictions in many African countries are the main causes of the negative growth” (p. 13). A regional slowdown of economic activity takes place regarding the “Big Five Economies” of Nigeria, South Africa, Egypt, Algeria, and Morocco, countries which are particularly dependent on tourism and/or the oil sector.

The economic and financial measures to mitigate the socioeconomic impact are then presented in an overview table. This is done both for the whole continent (including the measures of the African Union and of the African Development Bank), but also in relation to selected nation states. Despite these measures, a pessimistic conclusion is drawn: “Besides, it is practically impossible for the continent to take an economic advantage of the wide spread of Covid-19 in other parts of the world, due to its inability to transform its raw materials to respond to the potential high demand of goods and services of the domestic and international markets. They may act as an additional constraint on Africa’s productive transformation, by making trade in value added more difficult. Regardless of the scenario whether optimistic or pessimistic, Covid-19 will have a harmful socioeconomic effect on Africa” (p. 30). Finally, several dozen recommendations for action are formulated. These are broken down into immediate measures and measures that are required after the end of the pandemic. A distinction is also made between national responsibilities and possible measures at the continental level by the African Union.

The study is very relevant and useful. In these times, in-depth analyses are required to describe the current situation and to be able to make possible future forecasts and recommendations for action. This is an important prerequisite for dealing with the pandemic and for preventing even more dramatic consequences. The importance of the paper lies precisely in the fact that both global developments following the pandemic and local effects on the countries of Africa are analysed. In addition to classic economic criteria to evaluate the impact, such as the development of economic growth, fiscal revenues, imports and exports, the impacts on foreign direct investments and on remittances are also considered. The African Union presents an important report that can provide orientation in the current times of crisis. At the same time, the analysis also shows the fragility of the African economy. Despite considerable growth rates, especially between 2000 and 2010, there are still global dependencies that are still too strong in some areas. The vulnerability of certain sectors, such as tourism, is also becoming clear. This shows that in the medium term a further diversification of the economic structure is required for African countries to become more resilient to fluctuations and crises.

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3 Sustainable Development Goal 9 – Evaluation and Assessment Reports

Luomi, M., Fuller, G., Dahan, L., Lisboa Båsand, K., de la Mothe Karoubi, E. and Lafortune, G. 2019. *Arab Region SDG Index and Dashboards Report 2019*. Abu Dhabi and New York: SDG Centre of Excellence for the Arab Region/Emirates Diplomatic Academy and Sustainable Development Solutions Network, November 2019. November 2019, 144 pages; Download: <https://sdgindex.org/reports/2019-arab-region-sdg-index-and-dashboards-report/>, and: https://s3.amazonaws.com/sustainabledevelopment.report/2019/2019_arab_region_index_and_dashboards.pdf

The Arab Region SDG Index and Dashboards Report 2019 indicates that the Arab region is a diverse region when it comes to sustainable development. In recent years and decades, there are major success stories in prosperity and stability, but also tragic conflicts and wars. At the same time, the 22 countries of the region are bound together by a common history, language, and culture. They share many similar challenges and opportunities. While progress in many areas of sustainable development is hindered by conflicts and instability, the fact is that durable regional peace and security can only be achieved if all its countries are able to provide well-being to their people while protecting their natural resources and the environment.

As for the structure of the report, the report contains five major parts. Part 1 introduces and analyses the results of the 2019 Arab Region SDG Index and Dashboards. Part 2 presents case studies that highlight SDG-related priorities, challenges, and success stories, which are related to thematic areas (water governance, food-energy-water nexus, and stabilisation), to policymaking issues (policy integration of the SDGs, and green growth issues) and to data collection matters (leveraging big data and improving statistical capacities). Part 3 presents detailed profiles for each of the 22 Arab countries, containing information at indicator and SDG level as well as trends in SDG achievement. Part 4 presents the results of the index per indicator, and Part 5 provides a thorough explanation of the SDG Index and Dashboards methodology, including changes introduced in the 2019 Arab Region edition.

The Arab Region SDG Index and Dashboards Report 2019 describes the Arab region countries' progress towards achieving the SDGs and indicates areas requiring faster progress. The report indicates that, similarly to the Global SDG Index and Dashboards Report, the Arab Region SDG Index and Dashboards Report 2019 is intended as a complementary tool for governments, policymakers, and other stakeholders at all levels to measure progress on the Sustainable Development Goals (SDGs), to highlight areas where further emphasis is needed to speed up the implementation of the 2030 Agenda in the region, and to highlight gaps in both

implementation and data. The Arab Region SDG Index and Dashboards Report 2019 aims to explain priority areas, policies, and actions.

Compared to the Global Sustainable Development Index and Dashboards Report 2019, that contains the SDG Index and Dashboards for all UN Member States, the Arab Region Index and Dashboards Report 2019 introduces 30 new indicators that reflect regional priorities and challenges. Inspired by the Africa SDG Index and Dashboards report, the Arab Region SDG Index and Dashboards Report 2019 makes two important amendments to the Global Index and Dashboards Report: introducing new indicators that reflect regional priorities and challenges; and removing indicators that are not useful or relevant for the region or where data coverage is currently insufficient. It is important to stress that because of the changes introduced, the results of the Arab Region SDG Index and Dashboards Report are not comparable with the Global SDG Index and Dashboards Report or with other regional index and dashboards reports. As a result of these changes, the Arab Region Countries' Index scores in 2019 are lower overall than in the 2019 Global Index. The share of the SDGs in red (major challenges) in the 2019 Arab Index and Dashboards Report (51%) is also higher than that in the 2019 Global Index and Dashboards Report (42%), which covers 21 out of the 22 Arab countries. These differences can be explained with the inclusion of indicators that focus on areas where the region's countries face sustainable development challenges and with the overall higher number of indicators.

The report illustrates that the region displays a wide range of sustainable development outcomes, with common challenges around sustainable food production systems and gender equality, among others. The variances between the 22 Arab countries reflect their very significant differences in performance on many socioeconomic indicators. Only a few common denominators are universal in the region, including the poor performance on SDGs 2 (Zero Hunger) and 5 (Gender Equality). There are also significant challenges in SDGs 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 8 Decent Work and Economic Growth), 9 (Industry, Innovation, and Infrastructure), 14 (Life below Water), and 16 (Peace, Justice and Strong Institutions), which cut across the region. Other SDGs show more variation, which makes overarching policy recommendations difficult – responses and solutions need to be country- and context-specific.

The report explains that five countries (Algeria, the United Arab Emirates, Morocco, Tunisia, and Jordan, in descending order) have reached two-thirds of the way to achieving the SDGs. In 2019, five countries emerge as regional leaders, with a total index score of 65 or above. Taken as a whole, the Arab region does not score high in terms of SDG attainment, with an average score of 58 out of 100. With only a decade left to achieve the 2030 Agenda the result is not favourable. The report explains that, across the region, there are numerous success stories in areas of great relevance for the SDGs, which are also closely related to sustainable

human development. Two-thirds or more of all Arab countries have either achieved or are on track to achieving SDG targets in combatting maternal, neonatal, and child mortality. Similar trends are also visible in universal electricity access and access to the Internet via mobile broadband. Other positive trends are found in infant vaccination rates, and in access to basic drinking and sanitation services and to clean cooking fuels. In addition to supporting these positive trends, it is important to ensure that countries across the region can achieve sustainable development in other areas as well.

The report finds that poor and conflict-affected countries face the highest risk of falling behind. Overall, the 22 Arab countries receive a red score for 51% of all the 17 SDGs. Three countries have achieved less than 50% of the SDGs, and so they are lagging: Comoros, Yemen, and Somalia. The region's six Least Developed Countries (LDCs) and two other countries, suffering from conflict (Syria, and Iraq), each have more than 10 SDGs in 'red' in the SDG Dashboard, indicating that they are far from achieving these Goals. These countries will require tremendous efforts, both domestically and by their regional and international partners, to ensure they are not left behind.

The report indicates that there is a positive momentum in two important areas relating to environmental sustainability, namely on water and on climate change. Several countries are on track in achieving SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action), and there are moderate increases in performance across several SDGs. From an environmental security perspective, achieving sustainable water systems and addressing climate change are crucial. Overall, however, only three countries of the region (Iraq, Jordan, and Lebanon) have achieved a total of 4 of the 17 SDGs. This means that 19 countries have not yet achieved a single SDG.

The report finds that significant gaps remain in data being necessary to measure sustainable development performance in the region, particularly relating to income and wealth distribution. The most significant data gaps are currently found on SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities). In both areas, the gaps are the result of a lack of data on income and wealth distribution. No publicly available regional datasets were identified in the process of developing the 2019 Arab Region SDG Index and Dashboards Report. The Arab region should urgently invest more attention and resources to generating and making available data in the areas outlined above. This will be essential not only for tracking SDG performance but also to enable data-driven, science-based planning and decision-making.

The report explains that the Arab region is facing two critical challenges regarding the core of the UN 2030 Agenda for Sustainable Development regarding the principle of leaving no one behind. First, poorer countries are unable to deliver even some of the most basic enablers of wellbeing for their citizens. Second, the region, considered as a whole, lags in achieving the 17 Sustainable Development Goals (SDGs). At the same time, there are positive trends on several SDGs across

the region that can be built on to support accelerated implementation. The report indicates that throughout the Arab region, governments are placing the SDGs at the heart of the policy process; the report discusses the SDGs in the Arab region, including related challenges, opportunities, data gaps, and implementation priorities.

The report finds that despite significant differences in circumstances between the different Arab countries, the region shares a number of development challenges, including the ones relating to: conflict, violence and poor governance; water resources and fisheries; malnutrition (both hunger and obesity); decarbonisation and the transition to renewables; women's role in society; and research, innovation and employment. The report discusses some of the complex challenges ahead for the Arab region, including the management of natural resources, the governance of shared water resources, and regional stabilization; the report also highlights possible solutions, including the food-water-nexus approach, water diplomacy, and understanding the linkages between stability and sustainable development. The report also describes some success stories in integrating the SDGs and the green growth approach into development planning and sectoral reform processes. At the same time, making progress towards the SDGs is a fundamental precondition for regional peace and prosperity – both these values cannot be achieved without improved health and water services, education, employment, gender and social equality, and governance. The report suggests several policy implications that highlight the urgency of ending conflicts and violence, which could prevent the realisation of the SDGs: undertaking major social efforts to end malnutrition; pursuing major environmental efforts in converting to renewables, sustainable agriculture, water efficiency and environmental safety; accelerating the transition towards gender equality; and building innovation-based societies and devoting more resources to science and technology.

The Arab Region SDG Index and Dashboards Report 2019 indicates that effective implementation of the SDGs requires well-designed policies that are founded in context-specific knowledge and high-quality data. The report represents a good contribution to the reported collective efforts to achieve the Sustainable Development Goals (SDGs) in the Arab region. The regional SDG Index and Dashboards Report 2019 is useful for governments and SDG stakeholders to assess national-level performance, to identify priority areas, and to understand major gaps in data availability.

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Benner, Maximilian, A New Arab Social Contract? Institutional Perspectives for Economic Reform in Arab Countries, Economic Geography Series, Cham Switzerland: Springer International Publishing; Copyright: Springer Nature Switzerland AG 2020, 192 pages; Identification: eBook ISBN 978-3-030-19270-9 DOI 10.1007/978-3-030-19270-9 Hardcover ISBN 978-3-030-19269-3 Softcover ISBN 978-3-030-19272-3; Web Info: <https://link.springer.com/book/10.1007/978-3-030-19270-9>

The main argument is that the social contract in Arab countries has broken down, with the result that the people have demonstrated for reforms, in a period since 2010/2011 which was since called Arab Spring. The author gives in five chapters a holistic view of possible avenues for change in Arab countries, arguing that isolated reforms will not work. He refers to “Arab core countries” (Morocco, Tunisia, Egypt, and Jordan). Many other Arab countries are left out of the discussion with their quite different experiences of Arab Spring events. Obviously there was a selection towards more diversified and more developed Arab countries, while oil-rich Arab countries, Arab least developed countries, and Arab countries with civil wars were not considered in detail.

There is an introductory chapter 1. Chapter 2 is on economic challenges in Arab Economies; the collapse of the Arab social contract is analysed, and a focus is on the weak private sector and especially the limited role of entrepreneurship. Chapter 3 is on the institutional contexts for economic reform by focussing on aspects of socio-economic regulation in core Arab Economies. The author prefers to synthesize in his study five groups of theoretical approaches towards regulation instead of presenting an own approach. Chapter 4 has two case studies (on Tunisia and Jordan). They show how coherent economic reforms could be done and how a new social contract might work. Key reforms that follow are the summarised in chapter 5 on integrated strategies to promote private-sector growth. In a holistic approach some key reforms towards a new social contract are presented. It is the belief of the author that isolated reforms will not work, so that holistic concepts are needed. It is not so clear from the book who (which stakeholders and groups of power?) will do the transition from a state-driven and public employment-focussed growth model to a private sector-driven and entrepreneurial economy, and under which conditions such a new growth model will work in the core Arab countries and in the many other Arab countries.

The book is an interesting plaidoyer for coherent economic reforms in Arab countries, and in this orientation the book is helpful and useful. The case studies are rich in information and show how different the reforms are which were undertaken since the Arab Spring events in Tunisia and in Jordan. These two countries were selected by the author because he is familiar with these two countries. These two countries have achieved something, but still the path towards a holistic reform agenda and towards a new social contract is undecided (and in the many other

Arab countries the situation is even worse). It may have been great if the author would have used more expertise from Arab experts and institutions who have drafted plans for a new Arab social contract.

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4 Sustainable Development Goal 9 and African Development – Potentials, Opportunities and Challenges

World Bank. 2020. The African Continental Free Trade Area: Economic and Distributional Effects. Washington, D. C.: International Bank for Reconstruction and Development/The World Bank, Bibliographic Information: ISBN (paper): 978-1-4648-1559-1/ ISBN (electronic): 978-1-4648-1560-7, 140 pages; Download: <https://openknowledge.worldbank.org/handle/10986/34139>, and: <https://openknowledge.worldbank.org/bitstream/handle/10986/34139/9781464815591.pdf?sequence=4&isAllowed=y>

The World Bank published in 2020 a study on “The African Continental Free Trade Area: Economic and Distributional Effects”, to analyse the effects of Africa’s ambition to create a continent-wide market. This ambition has implications for the SDGs of the Global Agenda 2030, as all SDGs become relevant when the African Continental Free Trade Area is implemented. A huge African market can support the implementation of all SDGs.

Proposed in 2012 and signed by almost all African countries on March 21, 2018, at the 10th Extraordinary Summit of the African Union, the African Continental Free Trade Area (AfCFTA) is an agreement which leads to the creation of a large free trade area, covering a huge geographical space and 1.3 billion people of 55 countries (the agreement was not signed by Eritrea). The area of the AfCFTA has a combined gross domestic product (GDP) valued at US\$ 3.4 trillion. Officially entered into force on May 30, 2019, after ratification of the agreement by 22 countries, the AfCFTA is planned to be implemented in two phases:

Phase One: The first phase comprised the negotiation of three protocols: Trade in Goods, Trade in Services, and Rules and Procedures for the Settlement of Disputes. Concerning Trade in Goods, the agreement requires members to progressively remove tariffs on at least 97 percent of the tariff lines that account for 90 percent of intra-Africa imports. Negotiations on Trade in Services began in June 2018, and countries have identified five priority sectors: financial services, transport, telecommunication/information technology, professional services, and tourism. For Rules and Procedures for the Settlement of Disputes, it is expected that AfCFTA will offer a common regulatory framework, thereby reducing market fragmentation created by different sets of rules. Also, AfCFTA is presented as an opportunity to regulate policy areas which are important for economic integration,

and which are often regulated in trade agreements but that so far have not been covered in most of Africa's Preferential Trade Agreements (PTA's).

Phase Two: In the phase two of the negotiations there will be focus on investment, competition, and intellectual property rights, issues with the potential for the deepening of AfCFTA.

The report is committed in the aim to guide policymakers as they continue the process of negotiating and implementing the agreement, because the AfCFTA offers big opportunities for development in Africa, and so the implementation of the agreement is a significant challenge. Making an overview of the content of the agreement, the report fixes the scope of AfCFTA and presents the data and the methodology used to analyse and to quantify the long-term economic and distributional implications of AfCFTA (focussing on macroeconomic impacts and on distributional impacts on poverty and employment). Anyway, despite the AfCFTA appears as an opportunity for African countries, as "a unique opportunity to competitively integrate into the global economy, reduce poverty, and promote inclusion", and also as a key to help Africa address the challenges of Covid-19, there are important caveats to be taken into account.

The history of AfCFTA is presented in the introduction of the report as well as the key data related to this area (data on Trade, GDP, and Population). The content of AfCFTA highlights the relation between AfCFTA and the subregional PTAs³ which are already existing; the main role of AfCFTA in promoting the economic integration process in Africa is highlighted on this basis. The analyses show that there are some differences between AfCFTA and PTAs which matter: some policy areas are included in the AfCFTA, but are not covered in Africa's subregional PTAs, while some policy areas are included in individual subregional PTAs but are not covered in the AfCFTA. Reading the literature review, we note that despite the recent creation of the AfCFTA, there is an abundant literature on the subject. The report makes a substantial review of this literature by looking at different scenarios and assumptions relative to (i) the removal of tariffs on intra-AfCFTA trade; (ii) the removal of tariffs and NTBs on intra-AfCFTA trade, and (iii) the removal of tariffs and NTBs on intra-AfCFTA trade and the implementation of the Trade Facilitation Agreement (TFA).

The report uses the Global Trade Analysis Project (GTAP) database⁴ for all the African regions which are part of this database. Taking core data from that database, the report, in addition, incorporates estimates of nontariff trade barriers

³Common Market for East and South Africa (COMESA), East African Community (EAC), Economic Community of West African States (ECOWAS), South African Development Community (SADC), South African Customs Union (SACU), West African Economic and Monetary Union (WAEMU), and Economic and Monetary Community of Central Africa (CEMAC).

⁴ See on GTAP: <https://www.gtap.agecon.purdue.edu/>

(NTBs) from World Bank's World Integrated Trade Solution (WITS) database. The quantitative estimates of the impacts of AfCFTA rely on the ENVISAGE (Environmental Impact and Sustainability Applied General Equilibrium) model, which is a computable general equilibrium (CGE) model⁵. The second set of data complementing the CGE model is related to the expected formation of skills in each country. The data and the methodology used was helpful to measure the distributional impacts of AfCFTA on poverty and employment. The distributional change, between and within countries, captures effects at the macro level (country averages) and on the evolution of factor markets at the micro level (dispersion). To capture both effects, the study uses the Global Income Distribution Dynamics (GIDD) microsimulation framework⁶ in combination with the ENVISAGE global CGE model.

The first point of interest is on the distributional effects on poverty. Concerning poverty, according to the latest estimate from the World Bank (2018), on the African continent 415 million people live in extreme poverty (57 percent of the global total number of people, and 60 percent of the people residing in countries with fragile situations). The report, analysing the evolution of extreme and moderate poverty under baseline and AfCFTA implementation scenarios (considering the period 2015–35), concludes that full implementation of AfCFTA could by 2035 lift an additional 30 million people, or 1.5 percent of the continent's population, out of extreme poverty, and could lift 67.9 million on the continent out of moderate poverty (at US\$ 5.50, PPP-adjusted, a day) by 2035. Relative to extreme poverty, West Africa would observe a decline of 12 million people attributable to full implementation of AfCFTA, while Central and East Africa would observe declines of 9.3 million and 4.8 million people, respectively. At the country level, the largest gains in poverty reduction from implementation of AfCFTA would occur in countries with high initial poverty rates, such as Guinea-Bissau (10.2 percentage points), Mali (7.6%), Sierra Leone (7.2%), Togo (7.2%), Liberia (5.7%), Niger (5.4%), and the Central African Republic (5.1%). Relative to moderate poverty, half of the people lifted out from moderate poverty would be living in six countries: Ethiopia (8.2 million), Nigeria (7 million), Tanzania (6.3 million), the Democratic Republic of Congo (4.8 million), Kenya (4.4 million), and Niger (4.2 million). So, AfCFTA is a project to work considerably on realising SDG 1 in a substantial way.

The second point of interest concerns the distributional effects on employment, by focussing on workers switching jobs, affecting especially the female employment intensity. By measuring AfCFTA-induced employment change, total

⁵ See on the ENVIUSAGE model: https://ledsgp.org/resource/environmental-impact-and-sustainability-applied-general-equilibrium-model/?loclang=en_gb

⁶ See on the GIDD model: <https://web.worldbank.org/archive/website01589/WEB/IM-AGES/PARAL-31.PDF>

and female, with respect to the baseline scenario, it can be expected that, based on the agreement, the continent would see a net increase in the volume of workers in energy-intensive manufacturing (such as in steel and aluminium industries with an increase of 2.4 million workers), in public services (4.6 million workers), recreational and other services (0.28 million workers), and trade services (0.13 million workers). A focus is also made on the formation of skills with a figure projected on employment change by gender and skills in North Africa and Sub-Saharan Africa, for the period between 2020 and 2035. Employment data and data on wages give information on skills development through the implementation of the AfCFTA. By 2035, employment in North Africa is expected to grow from 64.2 million to 75.9 million, at an annual rate of increase of 1.12 percent, while employment in Sub-Saharan Africa's is expected to grow from 437 million to more than 650 million, at an annual rate of increase of 2.7 percent. Then, with initial simulation parameters, the study develops some scenario assumptions on employment and wages in Africa and relies on changes of three specific instruments: (i) Tariffs on intra-continental trade; (ii) NTBs on both goods and services; and (iii) the Trade Facilitation Agreement (TFA). Also, the employment changes show that AfCFTA has a substantial impact on SDG 8 (decent work and economic growth)-

The third point of interest concerns the tariffs. Tariff lines are classified into three product categories (non-sensitive, sensitive, and excluded) to minimise tariff revenue losses. The analysis of the share of imports and of the average tariffs imposed on AfCFTA imports shows that tariff lines are ranked in descending order by tariff revenues generated by African imports. In regard of trade-weighted tariffs imposed on AfCFTA imports by country and by sector, between 2020 and 2035, the largest liberalization is expected, as resulting from AfCFTA, in countries with high initial barriers, such as Cameroon, Nigeria, Ethiopia, Madagascar, Democratic Republic of Congo, and the Arab Republic of Egypt. The reduction in tariffs will lower the prices of imported goods for consumers, as well as for producers using intermediate inputs. All this will have implications for SDG 1 (no poverty), SDG 2 (zero hunger), and for SDG 9 (innovation, industry, infrastructure). For Nontariff barriers, Trade-weighted nontariff barriers imposed on AfCFTA imports by country and by sector, between 2020 and 2035 a substantial decline in the NTB rates was assumed and negotiated, compared with those of the rest of the world. The average decline was 13 percentage points—17 points in agriculture, 14 points in manufacturing, and a relatively sizable 8 points in services. It is important to note that Nontariff barriers (NTBs) take the form of burdensome administrative procedures and as well various forms of technical requirements. Besides of distributional impacts, there is also a greater attention to the question of the trade facilitation agreement (TFA). The TFA could provide stronger mechanisms for the implementation of the AfCFTA. The gains from implementing the TFA are simulated

by econometric estimation of trade facilitation implementation and using the iceberg trade/transport costs reductions model.⁷ As a result, the biggest expected gains from implementation of the TFA are expected in countries such as Cameroon, the Democratic Republic of Congo, Egypt, Nigeria, and Tanzania with a decline in trade costs of 10 percentage points.

The fourth point of interest concerns the macroeconomic impacts. Macroeconomic impacts of AfCFTA can be measured only by accounting for the economic consequences of Covid-19; the potential benefits of AfCFTA for overcoming the impacts COVID-19 are obvious. The report presents in this section on macroeconomic impacts a box for an analysis of the impact of COVID-19 on economic activity in Sub-Saharan Africa. This is made because the context of the African Continental Free Trade Area (AfCFTA) appears as an opportunity for Sub-Saharan Africa to strengthen regional value chains as a response to negative economic impacts of the Covid-19. The macroeconomic impacts are measured by referring to real income gains, trade effects, regional output effects, and government revenue effects.

Regarding the real income gains, by measuring equivalent variation, percentage relative to baseline, percentage deviations from baseline of equivalent variation, exports, and imports, by 2035, the gains represent around US\$ 445 billion in 2035 in monetary terms. Then, under the AfCFTA scenario, real income would increase by 7 percent by 2035 relative to the baseline for the Africa region—a sizable gain. But the gains are unevenly distributed across the Africa region. At the very high end are Côte d'Ivoire with gains of 13 percent, and Zimbabwe with gains of 12 percent, followed by Kenya, Namibia, Democratic Republic of Congo, and Tanzania at more than 10 percent. At the lower end are a few countries clustered around a gain of 2 percent, including Madagascar, Malawi, and Mozambique.

For trade, measuring with variables such as exports and imports under the baseline scenario and the AfCFTA scenario, the impacts of AfCFTA on trade of member countries, deviation from baseline scenario by 2035, total exports and imports from Africa, deviation from baseline scenario by 2035, it is appearing that trade will grow substantially within the continent and the intra-continental imports will increase from 12 percent in 2020 to 18 percent in 2035. By 2035, and under the AfCFTA scenario, the countries that will benefit the most from the higher increases of imports are Côte d'Ivoire, the Democratic Republic of Congo, Egypt, Ghana, Kenya, Nigeria, South Africa, and Tanzania, where imports will increase within a range of between US\$ 10 billion and US\$ 32 billion. Smaller expansions in imports are expected in economies such as Malawi, Mauritius, and Rwanda, with import increases of less than US\$1 billion.

⁷ See on the iceberg transport costs model: https://en.wikipedia.org/wiki/Iceberg_transport_cost_model

For output, the AfCFTA is expected to boost regional output by US\$ 211 billion by 2035 as it shown for the AfCFTA scenario in a table highlighting the output difference compared to the baseline scenario for 2035. The impacts on output are highly varied across sectors. In broad terms, output rises most in natural resources and services (1.7 percent) and in manufacturing (1.2 percent), whereas agriculture declines (0.5 percent) relative to the baseline scenario in 2035. However, the aggregate numbers mask a lot of heterogeneity of outcomes across countries. Of the 24 economies represented in the simulations, the relative importance of agriculture increases in 14 countries, of natural resources in 12 countries, of manufacturing in 6 countries, and of services in 13 countries.

For government revenue, tariff revenues would decline by less than 1.5 percent for most countries except for the Democratic Republic of Congo (3.4 percent), The Gambia (2.7 percent), the Republic of Congo (2.1 percent), and Zambia (1.6 percent). Total tax revenues would seldom decline by more than 0.3 percent, except for Djibouti (0.5 percent), the Republic of Congo (0.6 percent), The Gambia (0.9 percent), and the Democratic Republic of Congo (0.9 percent). In the simulations, 10 out of 24 countries may see a decline of tax revenues from imports in the AfCFTA scenario compared with the baseline scenario in 2035, including Burkina Faso, Cameroon, the Democratic Republic of Congo, Ethiopia, Ghana, Madagascar, Malawi, Rwanda, Uganda, and Zambia. In fact, at short-term, AfCFTA will register small tariff revenue impacts for two reasons: Firstly, imports from African countries account for a small share of tariff revenues for most countries, and secondly, most tariff revenues can be shielded from liberalization with exclusion lists because these revenues are highly concentrated in a few tariff lines.

To conclude, the authors of the report underline the sensitivity of the analysis; it is noted that the results are sensitive to the key assumptions on the reduction of nontariff barriers (NTBs) in goods and services, as well as on trade facilitation. They also accompany their results by some caveats, giving the reasons for an underestimation of the overall gains. Those reasons include: the relative static assumption of the baseline scenario, the so-called love-of-variety effect, the additional impacts of rising exports, the absence of pro-competitive impacts and potentially pro-productivity impacts, and the effects of foreign direct investment on imports of higher-technology intermediate and capital goods.

There is not only a risk to underestimate the overall gains of AfCFTA; there is also a risk to overestimate the gains from trade for two reasons: the analysis ignores (i) the potential costs of lowering the nontariff barriers and of the trade facilitation measures; and (ii) the transitional costs associated with trade-related structural change such as employment shifts and potentially stranded assets such as capital. Despite all these caveats, the scenario assumptions and the result of the analysis lead us to agree with Caroline Freund and Albert Zeufack in the fact that

“AfCFTA is a major opportunity for Africa”, even if it is clear that “implementation will be a significant challenge”. Nevertheless, the African Continental Free Trade Area (AfCFTA) provides a great and important opportunity for countries in the region to competitively integrate into the global economy, reduce poverty, and promote inclusion. Because of all these analyses and data, the book is of importance for researchers and policymakers. It can be seen that the AfCFTA is of relevance for the Agenda 2030 as most if not all of the SDGs are promoted by this project.

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5 Specific Components, Targets and Indicators of SDG 9 and African Development - Innovation, Industrialization, and Infrastructure

UNRISD 2020, Protecting and Supporting Vulnerable Groups Through the Covid-19 Crisis, United Nations Research Institute for Social Development (UNRISD)/COVID-19 RESPONSE, July 2020, Survey Report, UNRISD: Geneva, Switzerland, ISBN 978-92-9085-111-0, 24 pages; Download: [https://www.unrisd.org/80256B3C005BCCF9/\(httpAuxPages\)/0AC8BC84CFBB2D488025859F001EB3C3/\\$file/UNRISD---Vulnerable-Groups-Covid-19-Crisis.pdf](https://www.unrisd.org/80256B3C005BCCF9/(httpAuxPages)/0AC8BC84CFBB2D488025859F001EB3C3/$file/UNRISD---Vulnerable-Groups-Covid-19-Crisis.pdf)

Written by Paul Ladd and Eva Bortolotti, and produced by the UNRISD Communications and Outreach Unit, this report on “Protecting and Supporting Vulnerable Groups Through the Covid-19 Crisis”, published in July 2020, “offers insights on how interventions to address the Covid-19 pandemic—by governments and non-state actors—have affected vulnerable groups, especially those living in poverty and experiencing informal and precarious work, as well as older persons”. The Covid-19 pandemic that has unfolded in the first six months of 2020 has proceeded in waves with different hotspots. The disease started first in China, then touched Italy, and expanded to the Europe and the rest of the world. All the regions of the world had been touched; therefore, the information used for this report covers all regions of the world and countries at all income levels. The infection had different stages and then different responses according countries; and inside countries, there is the difference between rural and urban areas.

Global responses were lockdowns and physical distancing, physical isolation, border and school closures, and internal travel restrictions. But for those measures to be effective, there was a need of complementary socioeconomic measures, such as scaled-up cash transfers and food distribution programmes for poorer countries. The ability to develop and effectively to implement many of these policy responses

has depended on the capacity of state institutions. So, in some of the poorer countries, because of the lack of complementary socioeconomic measures, lockdowns and physical distancing measures have been less effective and were undermined. Several responses in Nigeria noted the lack of “palliative” measures for poor people. In some low- and middle-income countries, there were initiatives linked to the provision of cash support, food, water, and shelter. But the efficacy of these initiatives depends on the capacity of the government to manage the provision of support. For example, in Algeria, cash transfers for informal workers were considered as too slow because of “poor ministry coordination”.

The UN survey launched by UNRISD in April 2020 had the aim to analyse the impact and the efficacy of Covid-19 pandemic’s policy responses on the vulnerable people and groups. The UN survey identified, by the responses given, about 11 vulnerable groups classified in two major groups: 1. The groups and people in extreme poverty, and with insecure and informal work; 2. The people and groups being in exclusion and in relative poverty. Characteristics of the two groups are highlighted below:

Group 1 of the vulnerable people: The impacts of the crisis and the responses to the crisis on people under high levels of poverty, and especially the workers in the informal sector and their families, were analysed in low-income African countries such as Tanzania, the lower-middle-income countries such as Cameroon, Egypt, Nigeria, and in upper-middle-income countries, such as Algeria and South Africa. The results note that lockdown and physical isolation policies were perceived as less effective in low- and lower-middle-income countries (Tanzania, Cameroon) if they were not accompanied by social and economic support policies. To reinforce lockdown and physical isolation approaches, there was a need of an effective food distribution system. But in African countries, such as Ethiopia, Mali, Niger, Somalia; Ghana, and South Africa, respondents complained that there was a lack of effective food distribution. Therefore, the Covid-19 pandemic’s policy responses lead to more inequalities and to more poverty for the poor. Particularly in Ghana, targeting of food distribution was identified as a problem leading to “inclusion and exclusion errors”. Relative to international and state border closures, this measure came too late in countries such as Nigeria and in Cameroon and was undermined by economic necessity. However, for border closures to be an effective measure, these measures need to be implemented within existing state capacities. Then, if border closures are largely (but not always) perceived as an effective strategy to prevent the virus spread, and hence as measures to protect all the people, the lack of state capacity as mentioned for Chad, Cameroon, Togo, Uganda, Ghana, South Africa, and Algeria has considerably reduced this efficacy. Concerning school closures, in such countries as Tanzania; Cameroon, Kenya, Morocco, Nigeria, Senegal, and South Africa, education inequalities were exacerbated because poorer households were less e-connected and so the students of those households lost valuable school time.

Group 2 of the vulnerable people: The impacts of the crisis and the responses to the crisis on the second vulnerable group, the people in exclusion and in relative poverty, were more apparent in responses for countries with higher income levels. Just one African country was mentioned here, namely Zambia. For the case of this country, it is noticed that the public communication campaigns were neither efficient nor effective since information was not disseminated in local indigenous languages.

Included as a problem in the two vulnerable groups was the gender dimension of policy responses to the Covid-19 pandemic. The UN survey led to the conclusion that women were more likely to be negatively affected compared to men. In countries such as Mali, Tanzania, Cameroon, Ghana, Kenya, Nigeria, Zambia, and South Africa, the women suffer because of a greater workload and because of psychological stress. Overall, there are differences within a country between policies implemented in urban and rural areas, and in the support received from local, state, and national governments. Differences of needs in urban and rural areas induce some specific and necessary interventions in urban areas, while rural areas face unique challenges and policy interventions. Also, in regard of the organisation of the policy responses to the Covid-19 pandemics, the relationship between national, state, and local governments varied widely across countries.

However, in some countries there was a lack of reliable information on the specific characteristics, locations, and needs of vulnerable groups that could have been used to design and effectively to deliver appropriate responses. Considering this, undoubtedly the interventions of governments will have non-intended consequences such as increasing social and economic inequalities. But the most important non-intended consequence registered in all income levels countries was the significant rise in levels of domestic abuse, against both women and children. The increase of domestic violence, as reported, was “shocking” in Nigeria and “massive” in Uganda. In Tanzania, the report emphasises the increase of violence against children. The limits of the governments were compensated partly by the initiatives of non-state actors and by the vulnerable groups themselves. In Cameroon, local NGOs led the efforts of distributing masks and disinfectants to the local population. But, despite their actions, vulnerable groups remain severely touched by the pandemic and do not effectively benefit from the measures which are taken against the Covid-19 pandemics. There is a need of different strategies for different contexts and groups, and some further protection mechanisms need to be put in place for a better protection of vulnerable groups in this situation of the Covid-19 pandemics. For example, there is a need for additional Social protection policies; the working for Inclusive and responsive state institutions; better and more efficient Health care and medical support; and for more Collaboration and solidarity. All these actions and measures will have a lasting effect on the realization of SDG 9.

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National Income Dynamics Study (NIDS) – Coronavirus Rapid Mobile Survey (CRAM), 2020, The Covid-19 crisis and the South African informal economy, ‘Locked out’ of livelihoods and employment, by Michael Rogan and Caroline Skinner, 15 July 2020, Study 10, 28 pages; Download: <https://www.africancentreforcities.net/the-covid-19-crisis-and-the-south-african-informal-economy-locked-out-of-livelihoods-and-employment/>, and: <https://cramsurvey.org/wp-content/uploads/2020/07/Rogan-Covid-crisis-and-the-South-African-informal-economy.pdf>

Michael Rogan and Caroline Skinner, being part of the action research network “Women in Informal Employment: Globalizing and Organizing” (WIEGO), analyse in this paper the first wave of the NIDS-CRAM⁸ survey to identify how the effects of the COVID-19 crisis differ in South Africa within the informal economy and, in particular, by gender and type of employment (to distinguish by self-employment, informal wage employment, and casual employment). The South African government has introduced special COVID-19 grants and measures to support small businesses for workers and their households in the form of food parcels, unemployment insurance benefits, and increases of the social grants. But one needs to consider that, before the Covid-19 crisis, the informal sector was in crisis since the year 2008/9, as evidenced by a dramatic decrease of the female workforce in informal self-employment.

The South African National Income Dynamics Study - Coronavirus Rapid Mobile Survey (NIDS-CRAM) data were used to measure the impact of the lockdown, of the restrictions on the ability to work, and of the reductions in (or the loss of) earnings on the informal economy, specifically on three groups of informal workers (women, workers in self-employment, and informal casual workers). The survey, broadly nationally representative, was based on telephone interviews with more than 7,000 individuals between May and June 2020. According to the International Conference of Labour Statisticians (ICLS), the concept of the “informal sector” refers to employment and production that takes place in unincorporated, small, or unregistered enterprises while the concept of ‘informal employment’ refers to employment without social protection in working conditions both inside and outside the informal sector. The concept of the ‘informal economy’ refers to all units, activities, and workers so defined, and the output produced from them.

Michael Rogan and Caroline Skinner focus in their analysis on the impacts of the policy responses to the pandemics in the informal sector of South Africa, by

⁸ National Income Dynamics Study (NIDS)-Coronavirus Rapid Mobile Survey (CRAM)

asking if the sector can really be a shock absorber in crisis. Such a role is considered as important because globally informal employment accounts for 61 per cent of total employment and because many workers in the informal economy live below (or just above) the poverty line. For South Africa, the situation of the informal sector has changed since 2008/09. The authors therefore started by presenting the situation of the informal sector in South Africa since the economic crisis of 2008/09. In fact, the 2008/09 global economic crisis has revealed that the informal sector was affected disproportionately by the crisis, relative to the formal sector. During the crisis, the total employment in the informal sector contracted from 17 per cent of total employment in 2008 to 15.5 per cent in 2009. In this period 2008/09, 347,000 workers in the sector lost their job. Therefore, the informal sector was not able to absorb job losses from the formal sector, to be a shock absorber. Gender analysis of this situation revealed that the female workforce in informal self-employment decreased dramatically by 15%. The authors concluded that “the contraction of informal sector employment in the immediate aftermath of the global economic crisis was gendered”.

It is in this context that the government measures, such as travel bans, stay-at-home orders, the closure of public spaces, and bans on trading to control the pandemics, had to take place. The authors analyse the impact of lockdown restrictions on earnings, household income, and food security. In fact, the restrictions imposed by the lockdown regulations in response to COVID-19 led to a loss of 75 per cent of informal sector earnings. Within two weeks of the lockdown, two-thirds of the population in poor urban areas had no money to buy food. Based on this result, it was projected that, in the absence of direct income support, the rate of extreme poverty among households with informal workers (constituting roughly 21 million people) would increase from 10 per cent to 26 per cent. In response to these threats, government increased the levels of social grants and introduced the special COVID-relief grant to compensate the loss of earnings due to lockdown restrictions.

The authors analysed the increase of the number of food insecure people from March 3 to June 4 and noted that the food parcel distribution had only reached 12 per cent of those who needed them. Looking at the employee relief scheme, it was appearing that most informal workers were not registered for the UIF (Unemployment Insurance Fund). And in response to this situation, the Minister changed the regulations so that workers could apply directly and extended the TERS (Temporary Employer Relief Scheme) to cover workers not registered for the UIF. The socioeconomic impacts of COVID-19 and the associated government responses on South African households were widely seen as negative on the informal sector. Informal sector workers were unable to work during the lockdown, specifically women. The impacts of COVID-19 government responses on the informal sector workers under lockdown were measured in figures analysing “Locked out of employment”, “Working hours in February and April”, and “Decreases in earnings

during the April lockdown”. The conclusions were that: 1. informal workers, and particularly women, experienced substantial decreases in both the ability to work and in the hours that they spent in employment in April; 2. self-employed were particularly negatively impacted in several ways. The decrease of their work hours was greatest (more than 50%), 37% reported zero earnings in April, and their earnings were 60% lower than in February. For women, the earnings were almost 70% lower in April compared with February; 3. The impact of the Covid-19 crisis was of a gendered nature. The negative impact of this crisis on women was explained by the Schools and Educare Centres⁹ closure which puts women in a dilemma, to find a balance between childcare responsibility and the need to earn an income.

Considering those results, the authors made some specific reflections on some recommendations, such as: scaling up the provision of food parcels; rapidly extending the coverage of unemployment insurance to informal wage workers; increasing the amounts allocated in the social grants; extending the coverage of the Special COVID grant; revising the registration requirements to access DSDB (Department of Small Business Development) small business support.

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6 Sustainable Development Goal 9 and related SDGs (No Poverty; Zero Hunger; Decent Work and Economic Growth; Climate Action; Responsible Consumption and Production; Peace, Justice and Strong Institutions)

Sachs J. et al., (2020) “Fixing the Business Of Food. How To Align the Agri-Food Sector with the SDGs”, Barilla Foundation, UN Sustainable Development Solutions Network, Columbia Center on Sustainable Investment, Santa Chiara Lab University of Siena. ISBN 9788894528084. September 2020 Edition. 111 pages. Download: <https://www.barillacfn.com/en/publications/fixing-the-business-of-food-1/>, and: <https://www.barillacfn.com/m/publications/fixing-the-business-of-food-2020-report1.pdf>

The report argues that despite growing corporate sustainability efforts, it remains unclear ‘what does it mean for a food and agriculture company to be aligned with the Sustainable Development Goals (SDGs)?’. Companies, investors, consumers, and citizens continue to face challenges in understanding what it means for a company or an investment to be considered “sustainable” or not. The lack of a rigorous and comprehensive framework through which to assess corporate alignment with

⁹ See: <https://www.growecd.org.za/>

the SDGs leaves companies without clear guidance on supporting SDGs achievement. This gap also enables companies to downplay some areas of the SDGs when reporting on their sustainability performance.

As for the purpose and importance of the report, it presents the first deep iteration of a conceptual framework to guide business alignment of the food sector with the SDGs and the Paris Climate Agreement (PCA). The report proposes a Four Pillar Framework, which seeks to contribute to corporate SDGs alignment by bringing rigor and clarity on the aspects of business activity that relate to the SDGs. To understand how the framework might be applied to the food sector, the report also elaborates on the key environmental, nutrition, and social and governance topics that companies in the food and agriculture sector need to tackle to achieve the SDGs. The report further assesses current sustainability reporting standards, frameworks, and certifications against the Four Pillar Framework and key identified topics, exploring whether available reporting instruments sufficiently support SDGs alignment. It concludes by examining how business indicators might be developed under the Framework to support its application, using greenhouse gas (GHGs) emissions as an example.

The report finds that even as corporate sustainability efforts increase—as seen in the rising number of sustainability initiatives and standards, in the Environmental, Social, and Governance (ESG)-screened investment increases, and in the mainstreaming of sustainability reports — corporate alignment with the SDGs continues to face fundamental challenges. These include: a lack of consensus on the key principles defining an “SDG-aligned” business or project, thereby creating confusion and enabling greenwashing. There is no one commonly accepted definition of a “sustainable corporation” or a “sustainable investment”, nor is there clarity on what an SDG-aligned business entails. The second challenge is that the existing frameworks and ESG data providers have generally overlooked or neglected critical aspects of business engagement with companies’ stakeholders, value chains, and policymakers that are decisive for understanding the overall influence and the impacts of companies on the SDGs. Moreover, existing ESG frameworks heavily emphasize risk identification and mitigation, rather than considering a company’s contributions to and impacts on society or the planet. The third challenge is that many standards and reporting frameworks focus on corporate policies and codes of conduct, which have proven insufficient to tackle and to eradicate rights violations and poor practices in business operations and throughout the value chains. The fourth challenge is that the current practices that allow for company self-reporting of sustainability performance, coupled with the diverse scope of the SDGs and associated targets, as well as a vast range of sometimes inconsistent ESG metrics and criteria, have allowed companies to cherry-pick their preferred reporting criteria while ignoring less convenient SDGs. In terms of financial products, “SDG-aligned investing”—and the corresponding tools and

funds—still take vastly different approaches to definitions, functions, and even purposes.

The Four Pillar Framework seeks to contribute to corporate SDGs alignment by bringing more rigour and clarity to the critical aspects of business activity that affect the achievement of the SDGs, from the product itself, to business operations, to supply and value chains, and through to corporate citizenship. The framework provides a holistic approach to corporate SDGs alignment, and the principles elaborated in these four indivisible pillars should underpin business strategies, reporting, and measurement. The report indicates that in 2019, the Fixing the Business of Food Initiative presented a Four Pillar Framework for alignment of the food and agriculture sector with the SDGs.

The report presents a deeper iteration of that conceptual framework to guide business alignment with the SDGs and the Paris Climate Agreement (PCA), specifically for companies in the food and agriculture sector. The report proposes a Four Pillar Framework, which seeks to contribute to corporate SDGs alignment by bringing rigor and clarity on the aspects of business activity that affect the SDGs. To understand how the framework might be applied to the food and agriculture sector, the report also elaborates on the key environmental, nutrition, and social and governance topics that companies in the food and agriculture sector need to tackle to achieve the SDGs. The report further assesses current sustainability reporting standards, frameworks, and certifications against the Four Pillar Framework and key identified topics, exploring whether available reporting instruments sufficiently support SDGs alignment. It concludes by examining how business indicators might be developed under the Framework to support its application, using greenhouse gas (GHGs) emissions as an example, and with some recommendations.

The report explains that the Four Pillar Framework for Corporate SDGs Alignment has been developed based on more than a year of research and consultation with diverse stakeholders. It identifies four dimensions of all business activities that holistically and indivisibly impact on society and the planet. The Framework aims at providing a tool for businesses of all sectors to align with the SDGs and the PCA. In this report, it has been specifically applied to the food and agriculture sector, and it is evolving. The first pillar ‘Beneficial Products and Strategies’ addresses the impact of companies’ products, services, and strategies on human wellbeing and the planet’s sustainability. For the food sector, this pillar focuses on business contributions to healthy and sustainable dietary patterns through their products and strategies. This includes whether product lines are healthful, and whether product use is conducive to wellbeing and supportive of improved living standards and consumers’ life goals. The second pillar ‘Sustainable Business Operations and Internal Processes’ considers the environmental and social impacts of business operations, including their production processes and other internal processes. This pillar focuses on issues such as resource use (land, water, energy) and

emissions, respect for human rights, diversity and inclusion, and decent work conditions that improve livelihoods of employees and their families. It also assesses whether companies encourage and reward conduct that strives to internalize externalities. The third pillar ‘Sustainable Supply and Value Chains’ reflects the company’s role in and responsibility for the broader ecosystem of which it is part, including its interaction with its supply chain and value chain, producers, clients, consumers, and the industry in which it operates. This pillar focuses on whether the company supports realization of the SDGs through these interactions, and whether it collaborates to promote, incentivize, and ensure more sustainable practices and better livelihoods within its own value chain as well as within the relevant industries or sectors that its operations influence. The fourth pillar ‘Good Corporate Citizenship’ refers to how companies engage externally and how they seek to influence the rules that govern them. It assesses whether companies avoid strategies that would diminish social goods or societal well-being, and whether companies do value and do not undermine the crafting and effective deployment of law and policies that advance sustainable development.

The “Fixing the Business of Food Initiative” has initiated a focused framework for business alignment with the SDGs. The report indicates that a more sustainable food system requires greater and more focussed commitments by businesses; a more comprehensive and coherent framework to align corporate practice, measurement, and reporting to the SDGs; and the creation of more precise SDGs-aligned metrics. Given the depth of the transition required, the support of international and national institutions and investors to agri-food companies is imperative. The Four Pillar Framework aims to support businesses to confidently contribute to the realization of the SDGs, and to be recognized for their critical contributions to that end. Based on those objectives, the report recommends sustainability standards to help companies to better align to the SDGs and the PCA. Companies in the food and agriculture sector should address the areas highlighted by the Four Pillar Framework, as well as an SDGs indicator framework to measure and report their impact on the SDGs. Policymakers should support more ambitious regulation, emphasizing more forceful alignment of business practices with the SDGs and the PCA, as well as support robust and rigorous measurement and reporting of such alignment. And finally, the investors in the food and agriculture sector should closely monitor companies’ performance on issues covered by all Four Pillars of the Framework and should make investment and engagement decisions accordingly.

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The Politics of Uncertainty: Challenges of Transformation, Pathways to Sustainability Series, edited by Ian Scoones and Andy Stirling, First Edition, Bibliographic information: ISBN 978-0-367-90337-4 (hbk); ISBN 978-0-367-90335-0 (pbk); ISBN 978-1-003-02384-5 (ebk); First published 2020, 197

pages, Earthscan from Routledge; Download via Open Access: <https://www.taylorfrancis.com/books/politics-uncertainty-ian-scoones-andy-stirling/e/10.4324/9781003023845>

In times of the Global Agenda 2030 a book about the “uncertainty and the politics of transformation” (so the title of the Introduction provided by the two editors Ian Scoones and Andy Stirling) has a significant role for policymakers and for the research community. The title and the content of the publication require an appropriate introduction by the reviewer of the book. Interested development economists being focussed on Africa should not hesitate to study the outstanding publication. The title and the content consider sustainability and transformation different than used in the conventional and traditional perception. Both terms can be perceived by risk and uncertainty, which may be managed by non-traditional procedures. All contributions assume that unless a broader and more holistic strategy is not applied failures may be experienced.

The book is compiled from papers contributed to a conference initiated and organised by the ESRC STEPS (Social, Technological and Environmental Pathways to Sustainability Centre), funded by UK’s Economic and Social Research Council. Risk and uncertainty differ in the theoretical analysis and in the case-studies being envisaged. A review does not provide room to discuss the elaborated definitions in detail. The informative and complete introduction in chapter 1 (pp. 1) provides a guideline summarizing risk and uncertainty: “Risk is where we know what the possible outcomes are and can estimate the probabilities. Uncertainty is where we are unsure of the probabilities of particular outcomes...” (p. 3, similar p. 61, p. 76). A detailed typology of risk and uncertainties is elaborated in the papers: they cover financial futures (pp. 31), insurance and disaster (pp. 45), technology regulation (pp. 58), managing risks and uncertainties (pp. 73), living and planning of cities (pp. 85), climate change (pp. 99), managing disease outbreaks (pp. 113), disaster and emergencies (pp. 127), and migration as well as mobility (pp. 141), disputing security and risk (pp. 151), and uncertainty in spirituality and religion (pp. 164). The contributions are starting with an analysis, describing methods of relevant factors, and are elaborating policy proposals, thereby enabling a perception of possible solutions referring to the items.

There are papers which underline a cross-sectional approach: see the chapter 5 by Emery Roe on “Control, manage or cope? A politics for risks, uncertainties, and unknown-unknowns” (pp. 73) and the chapter 11 by Helena Farrand Carapico, Narzanin Massoumi, William McGowan and Gabe Mythen on “Disputing security and risk: the convoluted politics of uncertainty” (pp. 151). Roe’s conclusions in chapter 5 may be quoted: “Management is not control, and control is not only the only power...a politics of uncertainty is more about increasing processes in terms of options and strategies....it must be assumed practices already exist that evince such sensitivities of different types of unpredictabilities or uncertainties,

along with different strategies with which to address them more effectively.” (p. 83) Carrapico and others in chapter 11 conclude “rather than analysing uncertainty in a purely abstract concept, we need to situate it in specific concepts of knowledge and grounded milieu....it is important...to speak consistently about particular strands across a chosen set of observations...to be aware of – and alert to – the pursuit of narrow, sectoral interests that may lurk beneath the veil that uncertainty enables....we would counsel against ‘uncertainty imperialism’, whereby the term becomes as a catch-all *lingua franca* that is devoid of specificity.” (p. 161). The other contributions underline the non-applicability of a system based on “One size fits for all”.

Aside from these quotations it is obvious from all papers that a complete strategy of risk and uncertainty must imply technological and managerial elements which embrace adaptive and innovative methods and are combined in a flexible as well as a reverse procedure. Special consideration is attended to an open approach through communication with the intended beneficiaries and a deregulated open society. (“Shaping responses”, p. 169). Cases of mismatch between the people’s attitude and the scientists and/or the policymakers are referred to (p. 105). Such elements are not an alternative, but complementary in the analysis of the situation, the definition of instruments, and the assessment of advantages and failure. Many papers prefer a bottom-up strategy to widen the knowledge, to sharpen the effectiveness of the procedures and to intensify the support of the communities being involved (p. 130). Formal institutions when exerting strong intervention into the decision-making process do not consider distributional effects and fail to warrant social transformation and human emancipation (p. 83).

The publication is an outstanding document of the state of art and a brilliant source being addressed to politicians, the scientific community, and practitioners. The editors invite a helpful insight into the study and offer a wide range of issues in a detailed presentation. A recommendation how to handle as a reader with the book I propose to read slowly piece by piece and then to compare the texts. The excellent formal editing as well as the subject itself, preferably when “uncertainties are everywhere and define our contemporary era” (p. 1), are additional arguments to study the publication. It is obvious that in times of a Global Agenda 2030 we need such complex analyses of risks and uncertainties to understand how sustainable development goals (SDGs) interact with reality in a dynamic global system.

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7 Global Economic Reports and Global Development Perspectives

Cornell University SC Johnson College of Business, INSEAD, and WIPO/World Intellectual Property Organization (2020). The Global Innovation Index 2020: Who Will Finance Innovation? Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent, Editors of the 13 TH Edition, © Cornell University, INSEAD, and the World Intellectual Property Organization, 2020 Ithaca, Fontainebleau, and Geneva. 448 pages. Bibliographic Information: ISSN 2263-3693/ ISBN 978-2-38192-000- Download via: <https://www.insead.edu/sites/default/files/assets/dept/globalindices/docs/GII-2020-report.pdf>

The Global Innovation Index Report 2020 with the subtitle ‘*Who Will Finance Innovation?*’ presents the state of the Global Innovation Index (GII) and discusses how the situation of innovation finance is changing rapidly. The Global Innovation Index (GII) report 2020 provides useful insights about innovations and the rank on various innovation indicators for all countries which are included in the report. The GII report 2020 presents the current state and the evolution of financial support mechanisms while exploring needed advances and remaining challenges. The 13th GII report continues to support and to foster innovation across many countries by presenting data, giving information, and providing analysis so that a comparison is possible for countries and periods. The aim of the GII is to provide insightful data on innovation and, in turn, to assist policymakers in evaluating their innovation performance and making informed innovation policy decisions. The GII report 2020 analyses how economies rank on innovation in 2020 and provides an early assessment of the impact of the COVID-19 crisis on innovation.

Regarding the structure, the report includes 16 chapters; Chapter 1 presents an introduction to the GII report 2020; it reveals and analyses the annual GII innovation rankings—by top-performing economies, regions, and innovation components. Chapter 2 discusses the sources of funding innovation and entrepreneurship. Chapter 3 explains the role of sovereign wealth funds and of innovation investments in an era of mounting uncertainty. Chapter 4 discusses government incentives for entrepreneurship. Chapter 5 explores financing “tough tech”¹⁰ innovation; entrepreneurs work in an area where science meets engineering (“deep tech/frontier tech” solutions). Chapter 6 focuses on financing innovation through shaping the unknown. Chapter 7 examines financing innovation from financial growth to generative growth (focusing on private equity), it conceptualizes a new class of

¹⁰ See on the term: <https://medium.com/tough-tech-today/what-is-tough-tech-8b06f236d874>

investment strategies that is emerging to support generative growth. Chapter 8 discusses Filipinnovation¹¹, as financing science for the people and as describing the challenges that the Philippines had faced in pursuing regionally inclusive innovation strategies and the collaborative efforts to address them. Chapter 9 assesses the process of support for research, development, and innovation in the Czech Republic. Chapter 10 discusses support and financing mechanisms for innovation in Brazil, the main challenges, and how the country can overcome these challenges. Chapter 11 explains the challenges and opportunities for financing innovation in India. Chapter 12 shows Israel's challenging transformation from a start-up nation to a scale-up nation. Chapter 13 discusses equity group—financing innovation in Kenya¹². Chapter 14 explains the case of Abu Dhabi: innovation at the heart of a modern, diversified, and sustainable economy. Chapter 15 examines Intellectual Property (IP) as an asset for financing innovation based on research findings from projects conducted by the United Kingdom (U.K.)'s Intellectual Property Office. Chapter 16 examines the opportunities to reap financing through IP for innovation and addresses major opportunities and challenges with respect to the financing of innovations and IP.

Concerning the method, sources of data and conceptual framework, the GII report uses data obtained from several sources, including the data obtained from the WEF/World Economic Forum's Executive Opinion Survey (EOS). In the GII report 2020 the GII model includes 131 countries/economies, which represent 93.5% of the world's population and 97.4% of the world's GDP in purchasing power parity current international dollars. The GII relies on two sub-indices—the Innovation Input Sub-Index and the Innovation Output Sub-Index—each built around pillars. The first sub-index of the GII, the Innovation Input Sub-Index, has five input pillars capturing elements of the national economy that enable innovative activities: institutions, human capital and research, infrastructure, market sophistication, and business sophistication. Enabling pillars define aspects of the environment being conducive to innovation within an economy. The Innovation Output Sub-Index measures the innovation outputs as the results of innovative activities within the economy. Although the Output Sub-Index includes only two pillars, it has the same weight in calculating the overall GII scores as the Input Sub-Index. There are two output pillars: first, knowledge and technology outputs, and second, creative outputs. The overall GII score is the average of the Input and Output Sub-Indices. Each pillar is divided into three sub-pillars, each of which is composed of 80 individual indicators. The GII pays special attention to presenting a scoreboard

¹¹ See on the concept: <http://industry.gov.ph/wp-content/uploads/2018/12/Inclusive-Filipinnovation-and-Entrepreneurship-Roadmap.pdf>

¹² Equity Group Holdings is a Pan-African financial services group in Kenya, mentioned in chapter 13.

for each economy that includes strengths and weaknesses in the performance of each economy included in the report.

The Global Innovation Index Report 2020 provides an important contribution that appears from six key findings included in the report. These key findings imply first, that the COVID-19 crisis will impact innovation—leaders need to act as they move from containment to recovery; second, innovation finance declines in the current crisis, but there is hope too; third, the global innovation landscape is shifting as China, Viet Nam, India, and the Philippines are consistently on the rise; fourth, stellar innovation performance is found in developing economies¹³; fifth, regional divides persist, yet some economies harbour a significant innovation potential; and sixth, innovation is concentrated at the level of science and technology clusters in select high-income economies, plus mainly China. These findings give hope for emerging economies but also for some African economies to overcome the digital divide.

The Global Innovation Index (GII) 2020 indicates that the COVID-19 crisis will impact on innovation, and the leaders need to act as they move from containment to recovery. The coronavirus disease (COVID-19) is a pandemic and has triggered an unprecedented global economic shutdown. The current crisis has hit the innovation landscape at a time when innovation was flourishing. In 2018, research and development (R&D) spending grew by 5.2%, i. e., significantly faster than global GDP growth, after rebounding strongly from the financial crisis of 2008-2009. Venture capital (VC) and the use of intellectual property (IP) were at an all-time high. In recent years, political determination to foster innovation has been strong, including in developing countries; this is a relatively new and promising trend toward democratizing innovation beyond a select number of top economies and clusters only. Now that global economic growth will fall deeply in 2020, and as innovation is now central to corporate strategies and to national economic growth strategies, there is hope ahead that innovation will not slump as deeply as foreshadowed. Fundamentally, the pandemic has not changed the fact that the potential for breakthrough technologies and innovation continues to abound. Clearly, the top companies and R&D spenders would be ill-advised to drop R&D, IP, and innovation in their quest to secure competitiveness in the future. Further, the COVID-19 crisis might well catalyse innovation in many traditional sectors, such as tourism, education, and retail. It may also spark innovation in how work is organized at the firm- and at the individual level, and how production is (re)organized locally and globally. Unleashing the above potential is now essential and requires government support as well as collaborative models and continued private sector investment in innovation. The short-term and longer-term impacts of the

¹³ See on “stellar” as an open network for storing and moving money: <https://www.stellar.org/>

pandemic on the science and innovation systems need to be monitored and possibly acted on. Some aspects are positive, such as the unexpected level of international collaboration in science and the reduction of red tape for scientists. Some aspects, however, are alarming, such as the standstill of major research projects, the possible (and uneven) reduction of R&D expenditures in some fields/ some sectors, and the loss of employment prospects for junior researchers. Also, there are increased risks to international openness and knowledge flows, in view of the expected significant fall in trade, the downturn of the global economy, and the increasing protectionist pressures.

The GII report indicates that the innovation finance declines in the current crisis. The impact of this shortage in innovation finance will be uneven, with the negative effects felt more heavily by early-stage VC funds/companies/investors, by R&D-intensive start-ups with longer-term research interests in fields such as life sciences, and by ventures outside of the top VC hotspots. The report shows that the global innovation landscape and the geography of innovation is shifting as evidenced by the GII rankings. This year, China, Viet Nam, India, and the Philippines are the economies with the most significant progress in their GII innovation ranking over time. All four are consistently on the rise and are now in the top 50 group of innovation countries. Switzerland, Sweden, and the U.S. lead the innovation rankings, followed by the U.K. and the Netherlands. This year marks the first time that a second Asian economy—the Republic of Korea—cracks the top 10 group of countries, next to Singapore. The report shows that “stellar” (outstanding) innovation performance is found in developing economies. Beyond GII top-level rankings, innovation performance manifests itself in a few other ways, highlighting that top innovation performance takes place in emerging markets too. The report shows that regional divides persist, yet some economies harbour a significant innovation potential. Despite some innovation “catch-up”, regional divides exist with respect to national innovation performance: Northern America and Europe lead, followed by South East Asia, East Asia, and Oceania, and more distantly followed by Northern Africa and Western Asia, Latin America, the Caribbean, Central and Southern Asia, and Sub-Saharan Africa, respectively. The report indicates that the African continent—comprising Sub-Saharan Africa and Northern Africa—has one of the most heterogeneous innovation performances across continents. While some economies rank in the top 75 group (e. g., South Africa, Tunisia, and Morocco), others rank much lower. Innovation systems in Africa are broadly characterized by having low levels of science and technology activities, high reliance on government or foreign donors as a source of R&D, limited science-industry linkages, low absorptive capacity of firms, limited use of IP, and a challenging business environment. The GII report indicates that innovation is concentrated at the level of science and technology clusters in select high-income economies, plus mainly China. Divides also exist as to the ranking of the global science and technology (S&T) clusters. The top 100 clusters have their home in

26 economies, of which 6 countries—Brazil, China, India, Iran, Turkey, and the Russian Federation—are middle-income economies. The U.S. continues to host the largest number of clusters (25), followed by China (17), Germany (10), and Japan (5).

The GII report is a highly significant contribution during the critical time when the world is making a great effort to cope with the economic and social implications of the coronavirus (COVID-19) pandemic. The GII report 2020 - with its main conclusions on innovation developments generally, in the context of COVID-19 currently, and with respect to innovation finance specifically—contributes to this effect. The GII report indicates that most economies that have moved up the ranks in the GII over time have strongly benefitted from their integration in global value chains and innovation networks (for example, China, Viet Nam, India, and the Philippines). The GII report finds that the coronavirus disease (COVID-19) pandemic confirms the importance of innovation, mainly, supporting medical innovations to support the efforts in finding treatments and a vaccine to overcome the impacts of the coronavirus disease (COVID-19) pandemic and the economic lockdown. The report indicates that the coronavirus disease (COVID-19) pandemic has caused extensive disturbances by significantly affecting global businesses and economies. The report's special theme: *Who Will Finance Innovation?* is particularly relevant and timely in view of the increasing recognition of innovation as the way to build a sustainable and inclusive future. And, given that innovation is taking place, a central challenge facing innovators worldwide is the mobilization of stable and accessible financing mechanisms. Financing affects all stages of an innovation cycle, from ideation to commercialization, expansion, and, eventually, long-term business sustainability. The report indicates that every crisis brings opportunities and room for creative disruption. One side effect of the current crisis has been to stimulate interest in innovative solutions for health, naturally, but also for areas such as remote work, distance education, e-commerce, and mobility solutions. The GII report 2020 suggests that it is important for business leaders to utilize the most innovative technologies to facilitate adaptation and resilience to cope with the impacts of the crisis. The discussion of the theme is of fundamental importance for business innovation efforts and for guiding public policies.

The GII report indicates that the world economy and innovation have been confronted with an unprecedented challenge: the coronavirus disease (COVID-19) pandemic that has been triggering a global economic shutdown. The GII report explains that, confronted with an unprecedented crisis, it is important to fully leverage the power of innovation to collectively build a cohesive, dynamic, and sustainable recovery. In doing so, it is important to emphasize the countercyclical role of policies to ensure the continuity of innovation financing. The GII report explains that the reaction of the economies and researchers to the COVID-19 crisis, and the joint search for medical solutions during the pandemic, has demonstrated

how powerful openness and cooperation can be. The speed and efficacy of this collaboration might well inspire internationally coordinated R&D missions on important societal topics—such as the development of new energy technologies—in the future and shows that internationally coordinated R&D missions can effectively counteract the tendency for increased isolationism and address important societal topics—now and in the future. The GII 2020 report indicates that one visible effect of the current crisis has been to stimulate interest in innovative solutions for health, naturally, but also for areas such as remote work, distance education, e-commerce, mobility, and others, and supporting the collective pursuit of societal goals, including reducing or reversing long-term climate change.

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World Economic Forum/United Nations Development Programme/Columbia Center on Sustainable Investment/Sustainable Development Solutions Network, 2016, Mapping Mining to the Sustainable Development Goals: An Atlas, White Paper. 77 pages. Cologny/Geneva, Switzerland: World Economic Forum. July 2016. Access for Download: http://www3.weforum.org/docs/IP/2016/IU/Mapping_Mining_SDGs_An_Atlas.pdf

The Atlas for Mapping Mining to the Sustainable Development Goals is very useful report to guide policymakers who are deciding on mining projects. The report aims at mapping mining to the sustainable development goals, by explaining the linkages between mining and the SDGs and by analysing the role of mining and the private sector in sustainable development. Concerning the methodology and the data, the Atlas is based on desktop research and interviews with over 60 global experts from industry, civil society, governments, academia, international organizations, and financial institutions conducted between June and August 2015. Regarding the organization of the publication, the Atlas report is organized in several chapters; each chapter of the Atlas includes a brief explanation of the sustainable development goal (SDG) which is considered, reflecting the official UN definition and then followed by a summary of the contribution the mining industry can make; a list of key UN-defined SDG targets (sub-goals) that are relevant to mining is added. The Atlas report has a chapter for each of the SDGs, focussing on the contribution which the mining industry can make to that goal and identifying opportunities and examples of how the mining industry and the mining companies can contribute to achieving the sustainable development goal. Incorporated for the mining industry are both, the integration of the SDGs into their core business and the collaboration with other stakeholders to leverage resources to address the SDGs. Each chapter also includes case studies illustrating examples of the mining sector's contribution from which to draw in building innovative, systematic, and sustained collaborative efforts.

The significance of the Atlas report appears from explaining the important interaction between the SDGs and the mining and metals industry. The Atlas report argues that the mining industry has an unprecedented opportunity to mobilize significant human, physical, technological, and financial resources to advance the SDGs. Mining is a global industry and is often located in remote, ecologically sensitive, and less-developed areas that include many indigenous lands and territories. When managed appropriately, it can create jobs, spur innovation, and bring investment and infrastructure at a game-changing scale over long time horizons. Yet, if managed poorly, mining can also lead to environmental degradation, carbon emissions, displaced populations, worsening economic and social inequality, increased armed conflicts, among other challenges.

The importance of the Atlas report also appears from mapping the relationship between mining and the SDGs by using examples of good practice in the industry and of existing knowledge and resources in sustainable development that, if replicated or scaled up, could make useful contributions to the SDGs. It presents a broad overview of opportunities and challenges to demonstrate the actual and potential contributions of the mining sector to the achievement of the SDGs – from exploration through production and eventually mine closure. It is especially relevant for existing mines, whose operations can be adjusted in line with this Atlas report to contribute to the SDGs. The Atlas report aims to improve the dialogue about how mining companies, working both individually and collaboratively with governments, communities, civil society, and other partners, may be supported to achieve the SDGs.

The Atlas report is useful for companies to see initiatives which they are already implementing or participating in, while some may find new ideas to support implementation, and others will discover new linkages between their existing work and the SDGs. The Atlas report is also useful for the civil society and the communities that may find ideas which support new partnerships or inform useful policy reforms. The Atlas report is also useful for the national and local governments that may see opportunities to link policies, regulatory activity, and funding strategies to the SDGs. The Atlas report aims to facilitate three outcomes: increased understanding of how the SDGs and mining industry relate to one another; increased awareness-raising of opportunities and challenges that the SDGs pose for the mining industry and its stakeholders and how they might address them; and supporting a multi-stakeholder dialogue and a collaboration towards the achievement of the SDGs.

The relevance and significance of the Atlas report is also demonstrated from the current efforts of the UN and national governments to design country-level dialogues on how to move the SDGs agenda forward with the mining, oil, and gas sectors. These efforts will offer opportunities for companies to share their work and to identify new opportunities for collaboration and innovation. Dialogue

across sectors will ensure that best practices are shared, and that the potential contribution of the mining industry is fully leveraged for sustainable development. The Atlas report is important since it encourages many companies in the mining industry to support the achievement of the sustainable development goals (SDGs). The SDGs offer opportunities for companies not only to focus inward on their own operations and metrics, but also outward, by participating in ongoing discussions with industry and its stakeholders on contributing to sustainable development.

The Atlas report provides an interesting contribution that appears from three key findings included in the report. These key findings imply first, that the mining industry has the opportunity and the potential to positively contribute to all 17 SDGs; second, while the mining industry is diverse, the scope and nature of typical mining activities highlight some common opportunities to leverage and to contribute to the SDGs; and third, achieving sustainable development is challenging and the mining industry must ramp up its engagement, partnership and dialogue with other industry sectors, the government, the civil society, and the local communities.

The first key finding of the Atlas report argues that the mining industry has the opportunity and potential to positively contribute to all 17 SDGs. The mining industry can impact positively and negatively across the SDGs. Mining can foster economic development by providing opportunities for decent employment, business development, increased fiscal revenues, and infrastructure linkages. Many of the minerals produced by the mining industry are also essential building blocks to technologies, infrastructure, energy, and agriculture. Historically, however, mining has contributed to many of the challenges that the SDGs are trying to address – environmental degradation, displacement of populations, worsening economic and social inequality, armed conflicts, gender-based violence, tax evasion and corruption, increased risk for many health problems, and the violation of human rights. In recent decades, the industry has made significant advances in mitigating and managing such impacts and risks, by improving how companies manage their environmental and social impacts, protect the health of their workers, achieve energy efficiencies, report on financial flows, and respect and support human rights. Importantly, mining companies' positive contributions to the SDGs include both, improvements toward the SDGs and the corresponding targets above the baseline, as well as preventing or mitigating negative impacts on the SDGs and corresponding targets. Throughout the Atlas report, both baseline improvements as well as mitigating steps are considered to be contributions to the SDGs.

The second key finding of the Atlas report indicates that while the mining industry is diverse, the scope and nature of typical mining activities highlight some common opportunities to leverage and contribute to the SDGs. Opportunities for mining companies to positively contribute are found across all the sustainable development goals, and individual companies will need to do the analysis to understand how their business can make an impact. A company's specific actions and

opportunities will depend on the local social, political, and economic context, the type of mineral resource, the phase of mining activities (exploration, development, extraction, or closure), and the inputs received from local communities and other stakeholders through formal dialogue and engagement. For companies seeking to align their operations with the SDGs, the goals relating to social inclusion, environmental sustainability, and economic development are a useful starting point. Regarding the environmental sustainability, mining activities typically cause impacts on land, water, the climate and the flora, the fauna and the people that depend on these resources. Concerning social inclusion, mining can significantly impact local communities, bringing economic opportunities, but also challenges relating to livelihoods and human rights: – SDG 1 – End Poverty, SDG 5 – Gender Equality, and SDG 10 – Reduced Inequalities. Mining generates significant revenues through taxes, royalties, and dividends for governments to invest in economic and social development, in addition to opportunities for jobs and businesses locally. Mining companies can take an inclusive approach by working with communities to understand the mines’ actual and potential positive and negative impacts. Regarding economic development, mining can have a local, regional, and national impact on economic development and growth that can be leveraged to build new infrastructure, new technologies, and new workforce opportunities. Concerning SDG 8 – Decent Work and Economic Growth: Mining can generate new economic opportunities for citizens and members of local communities, including jobs, training, and business development relating to mining operations, associated service providers, or new local economies linked to the mine. Concerning SDG 9 – Infrastructure, Innovation and Industrialization and SDG 12 – Responsible Consumption and Production: Mining can help to drive economic development and diversification through direct and indirect economic benefits and by spurring the construction of new infrastructure for transport, communications, water, and energy. Mining also provides materials critical for renewable technologies and the opportunity for companies to collaborate across the supply chain to minimize waste, and to reuse and to recycle.

The third key finding of the Atlas report is that achieving sustainable development is challenging and the mining industry must ramp up its engagement, partnership and dialogue with other industry sectors, the government, the civil society, and the local communities. To realize the full potential for contributing to the achievement of the goals, mining companies must continue to work to integrate changes into their core business and, along with the mining industry as a key sector, must bolster collaboration, partnership and meaningful dialogue with government, civil society, communities, and other stakeholders.

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TWI2050 - The World In 2050 (2018), Transformations to Achieve the Sustainable Development Goals, Report prepared by the World in 2050 initiative,

International Institute for Applied Systems Analysis (IIASA), International Institute for Applied Systems Analysis, Schlossplatz 1, A-2361 Laxenburg, Austria. Homepage: www.iiasa.ac.at, and www.twi2050.org, First Published In July 2018. 157 pages. Bibliographic Information: ISBN-10: 3-7045-0154-9 ISBN-13: 978-3-7045-0154-7 DOI: 10.22022/TNT/07-2018.15347; Access for Download: http://pure.iiasa.ac.at/id/eprint/15347/1/TWI2050_Report081118-web-new.pdf

The World In 2050 (TWI2050) report indicates that The World In 2050 (TWI2050) initiative endeavours to demonstrate how the objectives of sustainable development within planetary boundaries can be met, ensuring prosperity, social inclusion, and good governance for all. The World In 2050 (TWI2050) is a global research initiative which was established and launched by the International Institute for Applied Systems Analysis (IIASA), the Sustainable Development Solutions Network (SDSN), and the Stockholm Resilience Centre (SRC), to provide scientific foundations for the 2030 Agenda. It aims to develop pathways toward achieving the SDGs. Regarding the organization of the study, the report includes four chapters: Chapter 1 presents the framing and the introduction; Chapter 2 discusses the challenges ahead, and the non-linear interactions in societal dynamics; Chapter 3 explains the sustainable development pathways; and Chapter 4 shows the means of governing the transformations towards sustainability.

The relevance and significance of The World In 2050 (TWI2050) report (2018) is demonstrated from the fact that it examines the current trends and the dynamics that promote and jeopardize the achievement of the SDGs. It presents the TWI2050 framework, the integrated pathways which harness the synergies and the multiple benefits across SDGs, and the approaches to governing this sustainability transformation. The World In 2050 (TWI2050) report identifies six exemplary transformations which will allow achieving the SDGs and the long-term sustainability by 2050 and beyond: first, human capacity and demography; second, consumption and production; third, decarbonization and energy; fourth, food, biosphere, and water; fifth, developing smart cities; and sixth, managing the digital revolution. The importance of the report also appears from providing policy recommendations on how to achieve integrated pathways that implement these transformations. The World In 2050 (TWI2050) report shows that a transformation toward the sustainable future is possible with strong political commitment. The TWI2050 report provides policy and decision makers around the world with invaluable new knowledge to inform action and commitment towards achieving the SDGs; also, it provides a roadmap toward a sustainable future along integrated pathways, and it will divert from the alternatives that transcend the planetary boundaries and leave billions behind.

The World In 2050 (TWI2050) report (2018) provides interesting arguments that the SDGs are universal, and that they need to be achieved in unison, that attaining them by 2030 requires deep transformations at many scales, from local to global and across all areas of human activity, while simultaneously calling for actions at reducing pressures on the Earth systems. It also requires new social values and norms as well as changes in individual belief systems that shape attitudes and behaviours toward achieving a sustainable future for all. TWI2050 is a first attempt of exploring transformational pathways that take a comprehensive people and planet approach to attaining the SDGs within planetary boundaries – with a view of ensuring a prosperous and healthy future for all on a resilient and healthy planet. The 2030 Agenda is an essential part of this long-term transformation. The fundamental changes brought about by meeting the 2030 goals would need to extend through to 2050 and beyond to ensure a sustainable future for all and the provision of stable Earth systems as a support for future generations.

The World In 2050 (TWI2050) Report (2018) is a global multi-year, multi-stakeholder, interdisciplinary research initiative and conceived as a partnership between science and policy that aims to contribute to the realization of science-based transformational and equitable pathways to sustainable development. It aims at providing this information and guidance for policymakers and for the wider public. Using an integrated and systemic approach, TWI2050 addresses the full spectrum of transformational challenges related to achieving the 17 SDGs, to avoid potential conflicts among them, to reap the benefits of potential synergies, and to reach the desired just and safe space for people and planet by 2050 and beyond. The report indicates that the core strength, that sets the TWI2050 apart from other initiatives contributing to the scientific knowledge creation for the SDGs, is its competence in integrated assessment through modelling, scenario development, and the application of theories of governance and large-scale dynamics of social change. The TWI2050 framework includes qualitative and quantitative elements and consists of a broad transformational narrative (targets and indicators for 2030, for 2050 and beyond), and of specific sustainable development pathways for six key domains that include quantitative elements based on modelling approaches and complementary storylines. The TWI2050 framework is designed to allow modelling and analytical groups (Integrated Assessment modellers, Earth system modellers, and others) to identify and to explore a portfolio of measures needed to achieve all the SDGs jointly, accounting for synergies and trade-offs. The TWI2050 framework facilitates the inter-comparison of results. This report presents various exemplary sustainable pathways derived from recent analyses, such as the Shared Socioeconomic Pathways¹⁴.

¹⁴ See on the concept: <https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change>

The World In 2050 (TWI2050) Report (2018) provides an important contribution that appears from key messages included in the report. These key messages imply that the transformation towards a sustainable future is possible but that an ambitious action is needed now; six transformations are necessary to achieve the SDGs; attaining the SDGs in a resilient and lasting way requires vigorous action now, and a people and planet focus beyond 2030 is needed. The key messages also imply that, as everything is integrated in the connected world, the “grand transformation” requires a holistic perspective; transformational change is needed considering winners and losers; effective and inclusive governance is a central element of the sustainability transformation; a consideration of long-term global cooperation is requested; and current local actions are important for the implementation of the SDGs.

One of the key messages of the World In 2050 (TWI2050) Report (2018) is that the transformation towards a sustainable future is possible but that ambitious action is needed now. The world and almost all regions are currently off course from achieving the SDGs. Yet, with bold and appropriate changes in values and the deployment of policy instruments, the world can be steered towards achieving the SDGs by 2030 and providing a just and equitable future for all on a stable and resilient planet. These changes need to reflect that sustainable development is a societal as well as an environmental challenge. The key is to invest in future priorities such as high-quality schools, improved health systems, efficiency and zero-carbon energy, environmental conservation and restoration, better food systems, more sustainable lifestyles, good governance institutions, and global cooperation initiatives to leverage dynamics towards the implementation of the SDGs. The World In 2050 (TWI2050) shows how to bring about six key transformations that will raise living standards, promote jobs, ensure social inclusion, and protect the natural environment.

The second key message of the World in 2050 (TWI2050) Report (2018) explains that the six transformations necessary to achieve the SDGs include substantial advances in human capacity that are needed through further improvements of education and health care. Education and health are instrumental for enabling people to live a self-determined life, find decent work and generate income to sustain themselves, but also to undertake climate change mitigation and deal with environmental problems. The ambitions go hand in hand with the goals to end poverty in all its forms and to reduce global inequality. In addition, responsible consumption and production are needed to cut across several of the other transformations. Evidence shows that it is possible to reduce consumption of resources considerably by taking a more service-oriented and circular economy-oriented approach with respect to mobility, housing, food systems, and other sectors of the economies. Reductions in demand leverage large saving potentials at different stages of the supply chain. In addition, decarbonizing of the energy system is essential for providing clean and affordable energy for all. Pathway analysis shows that energy-

efficiency, increasing the share of renewable energy, electrification and carbon-capture and storage all play a key role in decarbonizing the energy system around 2050, while providing access to modern energy for all. Moreover, achieving access to nutritional food and clean water are needed for all while protecting the biosphere and the oceans requires more efficient and sustainable food systems. It is possible to meet the needs of a growing world population and at the same time limit the food system's environmental impacts by combinations of increasing agricultural productivity, reduction of waste and losses, and changes towards a less meat-intensive diet. The highest priority is to provide healthy and affordable food for all and thereby to eradicate hunger. Moreover, transforming the cities will benefit a large share of the world population.

Pathways show that by 2050 around two thirds of the human population will live in urban areas. Sustainable cities are characterized by high connectivity and 'smart' infrastructure, enabling high quality services, with low environmental footprint. Transforming slums into decent housing is feasible with low energy and material requirements. Good city design, sustainable lifestyles, empowered local actors, and participatory approaches that avoid one-size-fits all solutions are needed to achieve this transformation to sustainable cities. In addition, science, technology, and innovations (STI) are a powerful driver but the direction of change needs to support sustainable development. Mainly, the digital revolution symbolizes the convergence of many innovative technologies, many of which are currently ambivalent in their contribution to sustainable development, simultaneously supporting and threatening the ability to achieve the SDGs. There is an urgent need to bring the sustainability and the digital and technology communities together to align the direction of change with the 2030 Agenda and a sustainable future beyond. There is also a need to implement forward-looking roadmaps and governance structures that allow the mitigation of potential trade-offs of a STI revolution, particularly relating to its impact on the workplace, on social cohesion, and human dignity.

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8 Global Reports and African Development Perspectives

International Monetary Fund/IMF, 2020, *Regional Economic Outlook: Sub-Saharan Africa: A Difficult Road to Recovery*, World Economic and Financial Surveys, Washington, D. C.: International Monetary Fund/IMF, October 2020 Edition. 32 pages. Identifiers: ISBN 9781513557601 (English Paper), ISBN 9781513557991 (English ePub), ISBN 9781513558004 (English Web PDF), Access for Download: <https://www.imf.org/en/Publications/REO/Issues/2020/10/20/Regional-Economic-Outlook-October-2020-Sub-Saharan-Africa-A-Difficult-Road-to-Recovery-49787>

The International Monetary Fund/IMF Report of 2020, “Regional Economic Outlook: Sub-Saharan Africa: A Difficult Road to Recovery”, October 2020 edition, discusses the impact of COVID-19 on Sub-Saharan Africa. The main finding of the report is that, faced with an unprecedented health and economic crisis, countries have acted swiftly to protect their people from the worst of the crisis. But amid high economic and social costs, many have been reopening their economies. The current outlook for 2020–21 is broadly unchanged from the June 2020 update, with the economic activity in 2020 projected to contract by 3.0 percent, still the worst outcome on record. This represents a drop in real per capita income of 5.3 percent, bringing per capita incomes back to the 2013 levels. For 2021, regional growth should recover modestly to 3.1 percent. This outlook is subject to some key downside risks, particularly regarding the path of the COVID-19 pandemic, the resilience of the region’s health systems, and the availability of external financing. Policymakers aiming to rekindle their economies now have fewer resources at their disposal and will likely face some difficult choices. On current trends, significant financing gaps are likely to prevail, and without significant additional financial assistance, many countries will struggle to simply maintain macroeconomic stability while also meeting the basic needs of their populations. The need for transformative domestic reforms to promote resilience (including revenue mobilization, digitalization, and fostering better transparency and governance) is more urgent than ever.

The outlook report for October 2020 indicates that Sub-Saharan Africa (SSA) is contending with an unprecedented health and economic crisis—one that, in just a few months, has jeopardized years of hard-won development gains and upended the lives and livelihoods of millions. The onset of the pandemic was delayed in Sub-Saharan Africa, and infection rates have been relatively low compared with other parts of the world. However, the resurgence of new cases in many advanced economies and the spectre of repeated outbreaks across the region suggest that the pandemic will likely remain a very real concern for some time to come. Nonetheless, amid high economic and social costs, countries are now cautiously starting to reopen their economies and are looking for policies to restart growth. With the imposition of lockdowns, regional activity dropped sharply during the second quarter of 2020, but with a loosening of containment measures, higher commodity prices, and easing financial conditions, there have been some tentative signs of a recovery in the second half of the year.

The outlook report of October 2020 indicates that overall, the region is projected to contract by 3.0 percent in 2020. The largest impact of the crisis on growth has been for tourism-dependent economies, while commodity-exporting countries have also been hit hard. Growth in more diversified economies will slow significantly, but in many cases will still be positive in 2020. Looking ahead the regional growth is forecast at 3.1 percent in 2021. This is a smaller expansion than expected in much of the rest of the world, partly reflecting sub-Saharan Africa’s relatively

limited policy space within which to sustain a fiscal expansion. Key drivers of next year's growth will include an improvement in exports and commodity prices as the world economy recovers, along with a recovery in both private consumption and investment. The current outlook is subject to greater-than-usual uncertainty and hinges on both the persistence of the COVID-19 shock, the availability of external financial support, and the availability of an effective, affordable, and trusted vaccine. Other risks include political instability, but also the return of climate-related shocks (such as floods or droughts). On policies, where the pandemic continues to linger, the priority remains to save lives and to protect livelihoods. The outlook report for October 2020 supports meeting the region's financing needs and indicates that Sub-Saharan Africa is expected to face a substantial funding shortfall over the medium term in the wake of the COVID-19 pandemic. Without assistance from the international community, many countries will be forced to undertake far deeper adjustments, which will jeopardize growth and adversely affect social stability.

The outlook report for October 2020 quantifies the COVID-19 effects on public debt in Sub-Saharan Africa. The COVID-19 pandemic is driving a resumption of rapid debt increases in Sub-Saharan African countries. After the Heavily Indebted Poor Countries (HIPC) and the Multilateral Debt Relief (MDR) initiatives, public debt declined significantly in Sub-Saharan African countries until the end of the 2000s. Subsequently, as Sub-Saharan African countries took advantage of the fiscal space generated by these initiatives (including to build human and physical capital), public debt rose from about 35 percent of GDP in the early 2010s to about 55 percent of GDP in the mid-2010s. It broadly stabilized thereafter and was expected to start declining in 2020 as several countries were embarking on fiscal consolidation. However, as the COVID-19 pandemic hit, Sub-Saharan African countries needed to respond, relaxing their fiscal stance. Thus, Sub-Saharan Africa's public debt is currently projected to increase to 65 percent of GDP by the end of 2020, and the largest increases are in oil-exporting countries.

The outlook report for October 2020 supports building a better future and focusing on resilience and argues that despite the damage, the opportunities for lasting transformational reforms have not been lost. The potential of the region and the resourcefulness of its people remain intact. With the help of the international community, the region will eventually find its way back to a path of sustainable and inclusive development, to the benefit of all. The alternative, however, is a path of macroeconomic and social instability, low growth, and continued inequality for years (or generations) to come. Countries in the region can also help to ensure better outcomes through a renewed commitment to reform, allowing them to both contribute to and to benefit from the global effort to promote a more resilient future. The outlook report supports a greener recovery and indicates that the post-crisis goal is to boost productivity and growth while simultaneously fostering an

economy that is more resilient to outside shocks. For many countries in Sub-Saharan Africa, this will require a particular focus on climate change—where the region is especially vulnerable. Globally, the crisis has also underscored the need for collective action in the face of a worldwide threat and has highlighted the potential for a coordinated, greener recovery. This will entail investment and technologies that support public goods like clean air, flood defences, resilient infrastructure, and renewable energy.

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International Monetary Fund/IMF, 2020, *Regional Economic Outlook, Sub-Saharan Africa, COVID-19: An Unprecedented Threat to Development*, World Economic and Financial Surveys, 29 pages, Identifiers: ISBN 9781513536835 (English Paper), ISBN 9781513538495 (English Web PDF), ISBN 9781513538501 (French Paper), ISBN 9781513538532 (French Web PDF), Washington, D. C: International Monetary Fund/IMF, April 2020. Access for Download: <https://www.imf.org/en/Publications/REO/SSA/Issues/2020/04/01/sreo0420> See also the *Regional Economic Outlook Sub-Saharan Africa, June 2020 Update*, 10 pages; Access for Download: <https://www.imf.org/en/Publications/REO/SSA/Issues/2020/06/29/sreo0629>

The International Monetary Fund/IMF Report for April 2020 has the title ‘Regional Economic Outlook: Sub-Saharan Africa, COVID-19: An Unprecedented Threat to Development’. The April 2020 edition explains the unprecedented COVID-19 threat to development on Sub-Saharan Africa. The Regional Economic Outlook for April 2020 has three chapters. Chapter 1 describes developments in the region, the growth outlook, and risks, and elaborates on policies needed for countries to weather the current crisis. Chapter 2 discusses policies and structural areas to help in adapting to climate change in Sub-Saharan Africa. Chapter 3 explains the digitalization process in Sub-Saharan Africa.

The main finding of the report is that the COVID-19 pandemic threatens to exact a heavy human toll, and the economic crisis it has triggered can upend recent development progress. Growth in sub-Saharan Africa in 2020 is projected at –1.6 percent, the lowest level on record. The policy priority is to ramp up health capacity and spending to save lives and to contain the virus outbreak. Support from all development partners is essential to address the sizable financing needs, including debt relief for the most vulnerable countries. Fiscal, monetary, and financial policies should be used to protect vulnerable groups, mitigate economic losses, and support the recovery. Once the crisis subsides, fiscal positions should return to sustainable paths.

The Regional Economic Outlook report finds in Chapter 1 that Sub-Saharan Africa is facing an unprecedented health and economic crisis. One that threatens to throw the region off its stride, reversing the encouraging development progress

of recent years. Moreover, by exacting a heavy human toll, upending livelihoods, and damaging business and government balance sheets, the crisis threatens to slow the region's growth prospects in the years to come. Previous crises tended to affect countries in the region differentially, but no country will be spared this time. Thus, the outlook report projects the region's economy to contract by -1.6 percent this year—the worst reading on record. This reflects the multiple shocks that will weigh on economic activity heavily: the strong containment and mitigation measures that countries have had to adopt to limit the spread of the coronavirus disease (COVID-19) outbreak which will greatly disrupt production and reduce demand sharply; plummeting global economic growth and tighter global financial conditions which are having large spillovers to the region; and a sharp decline in commodity prices, especially for oil, which is set to compound these effects, exacerbating challenges in some of the region's largest resource-intensive economies, notably Angola and Nigeria. The regional economic outlook report indicates that these large adverse shocks will interact with existing vulnerabilities to exacerbate social and economic conditions. The measures that countries have had to adopt to enforce social distancing and keep people from circulating are certain to imperil the livelihoods of innumerable vulnerable people. Given the limited social protection tools in place to offset the income losses, people will suffer. For the public sector in many countries in the region, the crisis could not have come at a much worse time. The pandemic is reaching the shores of the continent when budgetary space to absorb the effects of the shocks is limited in most countries, thus complicating the appropriate policy response.

The regional economic outlook report argues that in this context, decisive measures are urgently needed to limit humanitarian and economic losses and to protect the most vulnerable societies in the world. The first measure implies putting people first, which implies that the immediate priority is for countries to do whatever it takes to ramp up public health expenditures to contain the virus outbreak, regardless of fiscal space and debt positions. The second measure related to fiscal policy implies that timely and temporary fiscal support is crucial to protect the most affected people and firms, including those in the informal sector. Given the one-off nature of the shock, some discretionary fiscal support is warranted, even in countries with limited space. Policies could first, include cash transfers to help people under strain (including through digital technologies), while second, targeted and temporary support could be allocated to hard-hit sectors. Once the crisis has subsided, countries should revert its fiscal positions to paths that ensure debt sustainability. The third measure is related to international solidarity, but the ability of countries to mount the required fiscal stance is highly contingent on ample external financing, on grant and concessional terms, being available from the international financial community and to a higher degree than usual. In the absence of adequate external financing the risks are great of turning temporary liquidity issues into solvency problems, resulting in shocks becoming long rather than

short-lived. A fourth measure is related to monetary policy, as a more supportive monetary stance and the injection of liquidity can also play an important role to stimulate demand. Financial market supervision should aim to maintain the balance between preserving financial stability and sustaining economic activity. For countries with floating regimes, exchange rate flexibility can help to cushion external shocks, while some drawdown of reserves to smooth disorderly adjustment may mitigate potential financial implications from foreign exchange mismatches.

The regional economic outlook report indicates that for countries facing sudden reversals of external financing and a resulting imminent crisis, temporary capital flow management measures could be considered as part of a wider policy package. Economic forecasts at this juncture are, of course, subject to a much higher-than-usual degree of uncertainty but subject to the decisive actions laid out above, the report expects growth to bounce back in 2021 to about the 4 percent mark. However, the depth of the slowdown in 2020 and the speed of recovery will depend on several factors, including how the pandemic interacts with weak local health systems, the effectiveness of national containment efforts, and the strength of support from the international community.

The regional economic outlook report Chapter 2 examines policies and structural areas that could help the Sub-Saharan Africa region to make strides in adapting to climate change by building resilience and improving coping mechanisms. It shows the effects of climate change in Sub-Saharan African countries, mainly, for economic growth and inequality; also it highlights the key policy areas being most effective in building resilience and coping mechanisms. The chapter 2 of the report argues that Sub-Saharan Africa is the region in the world most vulnerable to climate change. Rising temperatures, rising sea levels, and rainfall anomalies are increasing the frequency and intensity of natural disasters and are markedly transforming the region's geography. Economic development has brought considerable progress in recent decades, but resilience and coping mechanisms across Sub-Saharan Africa remain limited, reflecting structural factors which are restricting countries' ability to respond to and to recover from shocks. The heavy reliance on rain-fed agriculture increases humanitarian, social, and macroeconomic vulnerabilities to rising temperatures and extreme weather shocks, which most heavily affect the poorest segments of the region's rapidly growing population. Climatic change in sub-Saharan Africa is especially pronounced with intensified temperature extremes, precipitation anomalies, and natural disasters that annually leave millions in peril, injured, homeless, or food insecure, and cause serious and costly economic damage. One-third of the world's droughts occur in sub-Saharan Africa, and the frequency of storms and floods is growing fastest in this region. The potential impact of rising temperatures and extreme weather events on growth is larger and longer lasting in sub-Saharan Africa than in the rest of the world, reflecting the region's lower resilience and coping mechanisms, and its dependence on rain-fed agriculture. The resulting amplification of inequalities and the scarcity

of fertile lands, combined with high population growth, increase the risk of contributing to mass migration and conflict.

The regional economic outlook report finds in Chapter 2 that financing adaptation to climate change will be more cost-effective than frequent disaster relief. For Sub-Saharan Africa, adaptation will be expensive—estimated at US\$ 30–50 billion (2–3 percent of regional GDP) each year over the next decade—but less costly than frequent disaster relief. The report finds that savings from reduced post-disaster spending could be many times the cost of upfront investment in resilience and coping mechanisms. Adaptation to climate change would also benefit other development areas, such as resilience to pandemics, and ultimately boost growth, reduce inequalities, and sustain macroeconomic stability. Stepped up financial support from development partners, beyond disaster relief, targeting resilience building, and bolstering coping mechanisms, will be critical. Containing and managing the COVID-19 pandemic is taking a toll on an already limited fiscal space and is raising debt vulnerabilities in sub-Saharan Africa. A green recovery from the pandemic will ultimately boost economic growth and resilience but, in the interim, support of the international community will be paramount as securing other sources of financing can be challenging. Adapting to climate change is critical to safeguarding and further advancing hard-earned improvements in incomes and education and health outcomes in Sub-Saharan Africa over the past three decades. However, adaptation will be especially challenging, given countries' limited capacity and financial resources, political uncertainty, and security issues. Policy recommendations include social safety nets and strengthening institutions and frameworks to foster structural transformation.

The regional economic outlook report examines in Chapter 3 the situation of digitalization in Sub-Saharan Africa; it indicates that the diffusion of digital technologies and knowledge will create new opportunities for progress and inclusion—greater resilience and efficiency, more access to global markets, improved public service delivery, increased transparency and accountability, and the creation of new jobs. However, digitalization also brings new challenges, including the risk of traditional job losses, the need to revisit policy design, and cybersecurity and data piracy concerns, among others. The report explains in Chapter 3 the effects of digitalization on economies and policies in Sub-Saharan Africa, and the role of digitalization to respond to COVID-19 crisis. It also explains the measurement of digitalization, the evolution of digitalization in Sub-Saharan Africa compared to other regions, the main drivers of digitalization, the impacts of digitalization, including economic outcomes and macroeconomic policies adopted by countries to foster digitalization, to capitalize on emerging opportunities, to manage associated risks, and to guide policymakers in planning countries' digital strategies.

The report indicates in Chapter 3 that in many respects, Sub-Saharan Africa is closing the digital gap with the rest of the world. Internet penetration is expanding rapidly, especially through mobile connectivity. Connectivity is associated with stronger economic growth, with an increasing share from the services sector. Sub-Saharan Africa is rapidly becoming digitally connected; digital connectivity has increased rapidly in Sub-Saharan Africa. While the global digital divide is still large, the gap with the rest of the world is narrowing fast. There are large differences in connectivity among countries within the region, with higher-income countries experiencing greater connectivity. IT infrastructure appears to be a main driver of variation, as indicated by differences in the amount of fixed-line connections and the share of population covered by higher speed mobile services (at least 3G). Differences in knowledge and quality also play a role, but to a lesser extent. Digital depth in Sub-Saharan Africa is still relatively low; the overall level of e-commerce remains low compared to other regions but is growing rapidly. Countries in the region have embraced digital tools to respond to the crisis, building on existing strategies. The future path for economies is incredibly uncertain, but as attention turns to policies for the recovery, it seems likely that the pandemic will have served to accelerate the digital transformation. As countries move in this direction, four broad pillars can help guide policy efforts: investing in infrastructure; policy frameworks; people and skills; and resilience to risks.

The Chapter 3 explains that many Sub-Saharan African countries are deploying digital policy responses to cope with and to cushion the effects of the COVID-19 pandemic. Many governments have actively turned to digital policy solutions to cushion the socio-economic impacts of the pandemic and to take advantage of the region's leadership in mobile money. This early experience offers some insights into how digitalization can help build more resilient economies for the future. For instance, mobile money has been used to effectively deliver much-needed support while promoting social distancing. Yet, the connectivity gap between Sub-Saharan Africa and the rest of the world also suggests that greater digital readiness could have given the region more opportunities. Digitalization helped businesses in the region to continue a part of their operations amid COVID-19, but gaps in connectivity have limited the extent to which countries are benefiting from online activities. Some governments turned to digital tools to help adopting containment measures and raise public awareness.

The regional economic outlook gives information on how the negative effects of COVID-19 could be contained and on how the positive effects could be strengthened. Therefore, the report is not a pessimistic one, but also giving hope to overcome the crisis through leapfrogging strategies.

9 Regional African Economic Reports

African Development Bank/AfDB, 2020, African Economic Outlook 2020. Developing Africa's Workforce for the Future. 206 pages. Abidjan: African Development Bank (AfDB) Group, 2020; Bibliographic Information: ISBN 978-9938-882-92-6 (print)/ISBN 978-9938-882-95-7 (electronic), and: African Development Bank (2020), African Economic Outlook 2020, Supplement: Amid COVID-19, Abidjan: African Development Bank (AfDB), 2020, 116 pages, Identification: ISBN 978-9973-9848-7-6 (print), ISBN 978-9973-9848-8-3 (electronic); Access for Download: <https://www.afdb.org/en/documents/african-economic-outlook-2020>; and, <https://www.afdb.org/en/documents/african-economic-outlook-2020-supplement>

The *African Economic Outlook 2020* is divided into three chapters. Chapter 1 is on Africa's growth: performance, outlook, and inclusiveness; chapter 2 is on Education and skills for the workforce of the future, and chapter 3 is on Financing education and skills development.

The first chapter on Africa's growth analyses that African economic growth now seems to be stabilizing at around 3 %. As a result, the high growth rates from the beginning of the Millennium do not appear to be currently continuing. Overall, the economic dynamics on the African continent is very diverse. A regional analysis or differentiation is therefore required. East Africa and Egypt are among the "success stories" with high economic growth rates. Six African countries are among the fastest growing economies in the world, including Rwanda, Ethiopia, Côte d'Ivoire, Ghana, Tanzania, and Benin. It is analysed that various drivers are gradually shifting towards investments and net exports and away from private consumption. For the first time in ten years, investment spending in 2019 will account for a larger share (more than half) of GDP growth than consumption. In addition to the importance of human capital, the accumulation of physical capital is particularly important for long-term growth. But despite a few years of relatively high economic growth, there is a high level of social inequality. Economic growth can therefore not be described as inclusive.

The second chapter is on education and skills for the workforce of the future. In recent years and decades, the educational offerings in many African countries have been significantly expanded. In connection with population growth, however, it must be stated that, despite this progress, Africa is still falling behind in international comparisons. Investments in the expansion of the education system and to broaden the educational offerings are therefore still necessary. In particular, the area of technical and vocational education and training needs to be expanded. This is important so that young people learn the skills that are needed for the job market. But this also applies to the higher education, so that Africa does not miss the connection to the networks of the global knowledge economy and society. Innovations

in education must therefore be promoted (as is the case, for example, in Kenya, especially in the field of new technologies), to improve both the quantity and the quality of education and to align education policy with labour market needs.

The third chapter is on financing education and skill development. In this context, the financing of corresponding investments in the education sector plays an important role. Although the countries of Africa are investing an average share of 5% of GDP in education, per capita investments are the lowest in the world. Therefore, more funds need to be invested in the educational infrastructure and the quality of the educational offerings. In addition, access to educational opportunities must be simplified. This can be done by reducing the amount of school fees. Many households can only afford to send their children to school when they receive remittances from friends or family members from abroad.

The African Economic Outlook 2020 sets very important priorities. The focus on education and inclusiveness to overcome the social inequalities should be mentioned as a great achievement. With its clear structure, the summaries in the form of key messages, and the excellent illustrations, the African Economic Outlook 2020 is an extremely helpful source of information and a tool for policymakers. It clearly shows that previous efforts in the field of education were too far from being sufficient. Furthermore, greater efforts are required to increase the number of educational offers, but also their quality. Important are also the Country notes and the Annexes. The Country Notes relate to the main subject but give also basic information on the countries. However, because of the COVID-19 pandemic which unfolded in the early months of 2020, a Supplement had to be released by the editors.

The *African Economic Outlook 2020, Supplement: Amid COVID-19* has three parts. The supplement was necessary because of the foreseen impacts of the COVID-19 crisis. Part 1 is on Macroeconomic performance and prospects. It is argued that Africa's economic prospects will be weak amid the COVID-19 pandemic, that growth may reverse sharply for all economic groups, but with major variations, that the outlook for recovery remains uncertain and vulnerable to COVID-19, Locust-19, and to other compounding factors, and that the macroeconomic environment and fundamentals are deteriorating. In Part 2 there is an analysis of the socioeconomic impacts of COVID-19 on Africa. It is argued that Africa is inadequately prepared to contain the spread of the virus, that there are main transmission channels of COVID-19 impacts on African economies, that the social welfare impacts of COVID-19 may be severe, as well as the impact of COVID-19 on employment and labour markets. In Part 3 the Policy options for a COVID-19 environment and beyond are presented. It is argued that public health responses, fiscal policy responses, monetary policy responses, labour market and informal sector responses are possible and necessary. It also stated that structural reforms will be important, as well as sustainable strategies for reopening economies and accelerating recovery in Africa. It can be seen at the third quarter of 2020

that African countries have reacted with great diversity, but with ambition and skill to the COVID-19 crisis. Some countries like Kenya have reacted strongly by innovative measures. Their Innovation Challenge is a chance to speed up the digital transformation of the country. The Supplement to the African Economic Outlook 2020, as presented from the African Development Bank, is useful as a reminder that it is necessary to rethink all the development strategies for Africa to avoid the harsh consequences of COVID-19 and to move to a more resilient future.

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African Development Bank/AfDB, 2019, African Economic Outlook 2019. 214 pages. Released 17 January 2019. Abidjan: African Development Bank (AfDB) Group, 2019; Bibliographic Information: ISBN 978-9938-882-87-2 (print), ISBN 978-9938-882-87-2 (electronic); Access for Download: <https://www.afdb.org/en/documents/document/african-economic-outlook-aeo-2019-107319>

This report contains three major issues (in chapters 1-3): Macroeconomic performance and prospects (Chapter 1); Jobs, growth, and firm dynamism (Chapter 2); and Integration for Africa's Prosperity (Chapter 3). Also, Country Notes, Infographics and Annexes are also of interest. Starting from the first African Economic Outlook report, all the other reports were reviewed in various issues of the African Development Perspectives Yearbook. The methodology was discussed in earlier reviews. These reports are of great value for policymakers as focus is on policies and strategies, and on successful projects and programmes. For the policymakers and the media, the Highlights (in the form of an Executive Summary) are a useful guide to the report.

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African Development Bank/AfDB, 2018, African Economic Outlook 2018. 200 pages. Released 24 January 2018. Abidjan: African Development Bank (AfDB) Group, 2018; Bibliographic Information: ISBN 978-9938-882-43-8 (print); ISBN 978-9938-882-46-9 (electronic); Access for Download: <https://www.afdb.org/en/documents/document/african-economic-outlook-aoe-2018-99877>

The African Economic Outlook 2018 contains two parts and four chapters. Part I has the title "Macroeconomic Developments and Structural Change". Chapter 1 is on Africa's Macroeconomic performance and prospects, while Chapter 2 is on Growth, jobs, and poverty in Africa. Part II has the title "Financing infrastructure: strategies and instruments". Chapter 3 is on Africa's infrastructure: Great potential

but little impact on inclusive growth. Chapter 4 is on Financing Africa's infrastructure: New strategies, mechanisms, and instruments. Country Notes, Annexes and Infographics are added for further information. Starting from the first African Economic Outlook report, all the other reports were reviewed in various issues of the African Development Perspectives Yearbook. The methodology was discussed in earlier reviews. These reports are of great value for policymakers as focus is on policies and strategies, and on successful projects and programmes. For the policymakers and the media, the Highlights (in the form of an Executive Summary) are a useful guide to the report.

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10 Development Finance and Development Aid for Sustainable Development in Africa

OECD/Organization for Economic Cooperation and Development, 2020, Global Outlook on Financing for Sustainable Development 2021: A New Way to Invest for People and Planet, Paris: OECD Publishing, 178 pages; For Identification: ISBN 978-92-64-34486-0 (print) and ISBN 978-92-64-65243-9 (pdf); Access for Download: https://www.keepeek.com/Digital-Asset-Management/oecd/development/global-outlook-on-financing-for-sustainable-development-2021_e3c30a9a-en#page1.

The Global Outlook on Financing for Sustainable Development 2021 calls for collective action to address both the short-term collapse in resources of developing countries as well as long-term strategies to build back better following the outbreak of the COVID-19 pandemic. The financing gap to achieve the Sustainable Development Goals (SDGs) in developing countries was estimated at several trillions of dollars annually before the pandemic. The report demonstrates that progress to leave no one behind has since reversed, and the international community faces unprecedented challenges to implement the holistic financing strategy set out in the Addis Ababa Action Agenda (AAAA).

The report finds that trillions of dollars in financial assets held by asset managers, banks and institutional investors are contributing to inequalities and unsustainable practices. It highlights the need to enhance the quality of financing through better incentives, accountability, and transparency mechanisms, integrating the long-term risks of climate change, global health, and other non-financial factors into investment decisions. The report concludes with a plan of action for all actors to work jointly to reduce market failures in the global financial system and to seize opportunities to align financing in support of the 2030 Agenda for sustainable development.

The report is organized in four parts. The report starts with an overview; Part 1 discusses commitments to Sustainable Development Goals (SDGs) in the aftermath of the global crisis, Part 2 shows the financing of the sustainable development landscape in the Coronavirus (COVID-19) crisis; Part 3 explains the next frontier to finance sustainable development; and finally, Part 4 shows actions for alignment. The report is important to guide the OECD countries in their strategies to finance the SDGs at the level of the planet. A great number of actions are proposed to increase the quantity and the quality of finance to increase the sustainable development impact (Building Block 1), and to raise the integrity and the efficiency of the financial markets and the involvement of new financial actors (Building block 2).

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11 African Studies

Newfarmer, Richard S., Page, John & Tarp, Finn (Eds.), 2018), Industries Without Smokestacks. Industrialization in Africa Reconsidered. UNU-WIDER (United Nations University World Institute for Development Economics Research) Studies in Development Economics. 472 pages; Oxford University Press, Oxford. First Edition published in 2018. Identification: ISBN 978-0-19-882188-5; 452 pages; download of the open access title: <https://www.wider.unu.edu/publication/industries-without-smokestacks-2>, and for direct access: <http://fdslive.oup.com/www.oup.com/academic/pdf/openaccess/9780198821885.pdf>

Not least because of the immense population growth in the African countries, creating jobs for younger generations is an important challenge. Relatively high growth rates in African economies have not yet led to the creation of sufficient jobs.

For this reason, the focus of the reviewed book proves to be highly relevant. More than 40 authors, mainly from the fields of economics and consulting, have contributed 20 chapters to this book on aspects of economic development on the African continent. In a comprehensive introduction, the editors give an overview of the main topic of structural transformation in the context of so-called industries without smokestacks.

The book is structured in three parts. Part I presents seven essays that survey core aspects of tradable services and agro-industrial value chains at the global level. Part II consists of nine country-level studies from Africa. Part III examines the opportunities for and the constraints on more rapid growth of industries without smokestacks which are offered by Africa's regional communities. A quite

large number of focal points are taken up in the individual contributions. These include the areas of agro-industrial and horticultural value chains, tourism, and business and trade services, including information- and communications-based (ICT) services and transport and logistics services. In a few chapters, the development dynamics in relation to selected countries, such as Mozambique, Rwanda, and Burundi, is analysed to prove the main hypothesis. Other articles have a broader regional focus and analyse the situation for countries in East Africa. In addition, further analyses refer to developments in the agricultural and tourism sector across the continent. Some case studies present analyses of phenomena such as the potential of agro-processing for a structural transformation in Ghana and the impact of establishing mobile money transfer systems in Kenya.

The starting point of the analyses is the *Agenda 2063: The Africa We Want*, published by the African Union in 2015.¹⁵ It is contemplated that structural change as the movement of workers from lower to higher productivity employment has contributed far less to growth in Africa than in other fast-growing developing regions. Nevertheless, it is argued that four global trends present new opportunities for Africa: first, a revolution in trade in services; second, the marked change toward 'servicification' of manufacturing production; third, the rise in global value chains; and fourth, major developments in technology markets may permit Africa to leapfrog to transformative technologies. Case studies show that, in each of these four areas, major progress in technology and rapid reductions in costs are creating new opportunities for Africa.

In summary, it is stated that the focussed tradeable services have the potential for strong within-sector productivity change and will contribute to raising productivity in other sectors of the economy. There is optimism that these industries have the capacity to absorb large shares of Africa's growing urban labour force. The possibility of industries without smokestacks to offer the potential for a new path towards structural transformation is underlined. As an outlook, the editors mention that the current economic dynamics on the African continent can hardly be compared with the developments in East Asia. Rather, diverse development paths are recognized in terms of spatial and sectoral dynamics.

With its large number of case studies, this volume offers a broad overview of economic dynamics on the African continent. Therefore, it proves to be a valuable addition to current debates. Most of the analysis, however, is based on a belief in an economic growth paradigm. Based on the demographic challenges outlined above, further economic growth in the African countries, in the context of pro-poor growth strategies, is certainly necessary. However, the volume would have won significantly if, in addition to the existing perspectives, even more alternative development impulses and development paths had been considered. This also applies to the role and the importance of the informal economy. The digitalization

¹⁵ See on the Agenda 2063: <https://au.int/en/agenda2063/overview>

has already an impact on the informal sector and on the employment markets in Africa, as we can see since the COVID-19 crisis. To be able to analyse the medium-term effects of economic development more broadly, it would also be desirable to specifically investigate the ecological effects as part of such an analysis; this will decide about whether sustainable development can be achieved in Africa. Especially in relation to the Sustainable Development Goals (SDGs), it seems imperative to put economic dynamics in the context of social, cultural, and especially ecological effects and climate change conditions. With this expanded perspective, the volume could have won significantly.

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Klingholz, R., Sütterlin, S., Kaps, A., Hinz, C. (2020). Schnell, bezahlbar, nachhaltig: Wie in Afrika große Entwicklungssprünge möglich werden. Berlin: Berlin-Institut für Bevölkerung und Entwicklung, Juli 2020, 92 Seiten; Identifizierung: ISBN: 978-3-946332-56-5. Download: https://www.berlin-institut.org/fileadmin/Redaktion/Publikationen/PDF/BI_SchnellBezahlbar-Nachhaltig_2020.pdf

Many studies have been written on obstacles to human development on the African continent, and many alleged solutions have been proposed. Arguably reflecting a certain disenchantment with macro-level development theories, recent years have seen approaches focusing on small-scale solutions to day-to-day development problems. The award of the 2019 Nobel prize in economics to A. Banerjee, E. Duflo, and M. Kremer symbolizes the relevance of new micro-level and experimental economics approaches to development that seek to find pragmatic insights on what really works. Without diving deeply into deductive theoretical considerations, such experimental investigations have gained in importance. Notwithstanding the need to better understand the challenges of human development on the theoretical level, there is a rationale for an inductive approach to development economics. However, an inductive approach requires seeking generalizable conclusions derived from individual cases instead of simply mapping ideas that seem to work somewhere in a peculiar context.

The study was published by the Berlin Institute and, according to the study's imprint (p. 2), it was supported by Bayer AG. The approach in the study reflects the currently popular micro-level approach by mapping instances of innovations which the authors enthusiastically term "leapfrogging" (p. 6). The authors present various examples of innovations in African countries that are understood to have contributed to human development in the fields of agriculture, education, and health.

In the introductory chapter 1, the study defines leapfrogging as a form of development that skips economically or ecologically inefficient steps (p. 8), but the study does not dwell on how precisely these inefficiencies are defined or measured

and, hence, what conceptually qualifies as leapfrogging and what does not, thus running the risk of regarding anything that looks remotely original or innovative as beneficial for human development. The examples for leapfrogging offered are highly diverse and it remains largely unclear what these examples have in common. Consequently, the conceptual basis of the study can be questioned. Is the advent of the mobile phone comparable in scale to cheap measuring devices for the humidity of agricultural produce? Can both really be understood as the same phenomenon (leapfrogging), and even if so, how is it conceptualized? Can this phenomenon be said to contribute to across-the-board democratization, as the authors claim it does (p. 8)?

In chapter 2, the study discusses the correlation between economic growth and demographic trends, and it suggests that young populations with declining fertility rates provide countries with a “demographic dividend” (p. 16); that dividend, however, does not seem to materialize, mostly because of the weak employment prospects. At the end of the chapter, the authors justify their choice by focussing on three fields: agriculture, education, and health. The study’s basic assumption is that these three fields are crucial because promoting them is seen to stimulate employment creation and will lead to a qualification in a virtuous cycle (p. 6, 18-19). However, assuming such a virtuous cycle seems oversimplified, given that some critical questions are not sufficiently answered. Does better (formal) education automatically lead to more jobs? Do technological advances in agriculture necessarily improve farmers’ livelihoods? How do macro-level patterns, such as industrialized countries’ agricultural protectionism or the power of multinational enterprises, impact on how farmers benefit from innovations? And to what degree is ensuring basic healthcare a complex institutional question beyond technological innovations? Even if innovations might help, are they sufficient to stimulate the fast leaps in development what the study postulates? While the authors acknowledge the importance of framework conditions (p. 7) and the adaptation to the local context (e. g. p. 61), the fundamental questions, of what precisely local institutional and political framework conditions are and how precisely they enable or constrain leapfrogging, are not discussed in further detail.

Chapter 3 provides a useful overview on the major health-related challenges that countries on the African continent face and lists some technological innovations such as text-messaging services and social-media campaigns that are supposed to enable development leaps. Unfortunately, the authors do not discuss the institutional and behavioural assumptions implicit to the effectiveness of these solutions, and neither do they address associated risks and possible ways of mitigating them. The implicit assumption seems to be that technological innovations are accepted by local populations simply because they work, but such an uncritical assumption can be questioned. Can local populations across the African continent really be expected to deem the same technological innovations to be desirable? If not, how relevant are the examples introduced, and for which contexts? Even more

importantly, the issue of how to create the wider conditions for technological innovations to succeed in improving public health is not laid out. Sure enough, changing institutional, political, or infrastructure-related conditions in the health system faces considerable challenges that are not amenable to simple solutions, but this is precisely why the study's enthusiasm for small-scale innovations seems exaggerated.

In chapter 4, the study addresses challenges and proposes solutions in education. Referring to the OECD, the authors list various skills which are relevant to education today, such as entrepreneurial and management skills (p. 45), but they do not explain why precisely these skills are supposed to be relevant for education on the African continent, let alone for which African economies they may be so important. Furthermore, the study maps various educational initiatives but the match with the authors' own definition of leapfrogging remains unclear. For example, among the cases introduced are initiatives supported by international donors and, thus, rather conventional development aid interventions (p. 48, p. 53).

Chapter 5 summarizes the challenges for the agricultural sector in countries on the African continent and discusses the use of hybrid and genetically modified seeds (GMSs). However, while farmers' scepticism against hybrid seeds is briefly referred to (p. 70), a broader discussion on how to consider societal discourses on the desirability of hybrid or genetically modified seeds and on the commodification and privatization of basic agricultural resources is missing. As in the preceding chapters, various technological innovations such as smartphone apps that are supposed to enable leapfrogging are presented (pp. 74-75).

Every thematic chapter closes with a menu of largely generic recommendations. For instance, the recommendations on health policy in chapter 3 include recommendations for creating the conditions for a healthy life, such as sufficient nutrition or access to clean water (p. 39), preventing specific health risks for women and girls (p. 40), and strengthening the education of health practitioners (p. 40). Recommendations on education include investing in early childhood education, enrolling all children in school, and eliminating gender-based discrimination in education (p. 60). Recommendations on agriculture include making peace, clearly defining property rights, and safeguarding the rule of law (p. 79). Some recommendations are more concrete by referring to idiosyncratic examples, but it remains unclear what precisely there is to learn from these isolated examples. While generic recommendations are easy to accept, the critical question is how precisely to implement them, and presenting isolated examples of what may work in one place is not enough to answer this critical question.

While some of these examples for innovations in African countries are certainly interesting to read, there is the fundamental question about how relevant these idiosyncratic examples are. The critical point is not that a given peculiar case is perceived as a success, but knowing which conditions contributed to success and which ones enabled or constrained it. Only when looking at the underlying

socio-economic context can we understand the chances for generalizing the insights gained. Unfortunately, the study largely neglects contextualization. Consistent with the negligence of the socio-economic context of countries or sub-national spaces, the study's general framing can be questioned. On the one hand, the study presents highly specific cases at the micro level, while on the other hand it follows the implicit assumption that these cases are *a priori* relevant for the African continent as such, as the title of the study with its reference to "large development leaps in Africa" makes abundantly clear.

Some further questions are relevant: How should we account for socio-economic differences on the African continent, for example between North African countries with their strong economic alignment with the EU on the one hand and Sub-Saharan Africa on the other hand, within Sub-Saharan Africa between countries with vast differences in economic development and political stability, and even within countries accounting for differences between prosperous urban regions and peripheral rural regions? And beyond the spatial dimension, how do the innovations presented affect different social strata or milieux? For example, could it be that some of the cases (and interventions) presented might reproduce existing social inequalities? What are the social consequences of the technological innovations presented? And on a theoretical level, why does the study not address the insights of experimental approaches that use randomized control trials to find out how local populations react to policy interventions (e. g. A. Banerjee, E. Duflo)? These approaches offer ample insights for how to design development policies beyond the project level. Insofar as the examples presented are development aid interventions supported by international donors, how do they relate to the long-standing aid effectiveness debate (e. g. W. Easterly, D. Moyo)? Given that the study basically addresses innovation, how are the critical perspectives offered by science and technology studies (e. g. S. Jasanoff, S. Pfotenhauer) accounted for? Such an eclectic theoretical perspective would add important questions such as, for example, which political logic do technological innovations follow or promote? What role do international donors or multinational enterprises play in these innovation processes? And how are preferences and values held by the local population considered, instead of pursuing a purely technocratic rationality? While the authors acknowledge that what they call leapfrogging should not be considered as a panacea and can engender undesired effects (p. 13), these considerations are largely left unaddressed.

Fundamentally, the authors attempt to transfer idiosyncratic stories of what works in one place at the micro level to the macro level on the African continent as such. Consistently, at times the study reads more like a newspaper article than a scientific paper, for instance when a short interview is inserted (pp. 34-35), or when an anecdote of a primary school student is told (p. 41). The study is rife with success stories and testimonials of policymakers, researchers, farmers, and entre-

preneurs, but what do these isolated stories and statements teach us? Is development a question of individual agency only that can be isolated from structural conditions that vary from country to country and even within? The study's enthusiastic stance about the development perspectives afforded by leapfrogging is difficult to share, at least if one is not convinced by the assumed transferability of context-dependent micro-level solutions to different contexts and to the macro level.

What the study does reasonably well is the mapping of various cases that may provide some preliminary inspiration to practitioners and policymakers. However, when drawing inspiration from the study, the caveats discussed above should be kept in mind. There is a fine line between surrendering to the complexity of development on the one hand and zooming in on individual cases while ignoring the larger questions about context on the other hand. There is no scarcity of studies and reports that enthusiastically present (alleged) "best-practice" approaches but neglect if, how, when, where, and under which conditions these approaches actually work, what outcomes they may generate in a different context, and whether and to what degree these outcomes correspond to local needs and citizens' preferences. What is needed is a thorough and critical debate on these questions.

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The Politics of Uncertainty: Challenges of Transformation, Pathways to Sustainability Series, edited by Ian Scoones and Andy Stirling, First Edition, Bibliographic information: ISBN 978-0-367-90337-4 (hbk); ISBN 978-0-367-90335-0 (pbk); ISBN 978-1-003-02384-5 (ebk); First published 2020, 197 pages, Earthscan from Routledge; Download via Open Access: <https://www.taylorfrancis.com/books/politics-uncertainty-ian-scoones-andy-stirling/e/10.4324/9781003023845>

The book 'Politics of Uncertainty: Challenges of Transformation,' explains 'Why is uncertainty so important to politics today?'. To explore the underlying reasons, issues and challenges, this book's chapters address finance and banking, insurance, technology regulation and critical infrastructures, as well as climate change, infectious disease responses, natural disasters, migration, crime and security, and spirituality and religion. The book argues that uncertainties must be understood as complex constructions of knowledge, materiality, experience, embodiment, and practice. Examining specifically how uncertainties are experienced in contexts of marginalisation and precarity, this book shows how sustainability and development are not just technical issues but depend deeply on political values and choices. What burgeoning uncertainties require lies less in escalating efforts at control, but more in a new – more collective, mutualistic, and convivial – politics of responsibility and care. If hopes of much-needed progressive transformation are to be realised, then currently blinkered understandings of uncertainty need to be met with renewed democratic struggle.

The book is illustrated by multiple case studies from across the world; it is useful for a wide cross-disciplinary audience in fields ranging from economics to law to science studies to sociology to anthropology and geography, as well as to professionals working in risk management, disaster risk reduction, emergencies, and wider public policy fields. The book is organized in 12 Chapters. Chapter 1 discusses uncertainty and the politics of transformation. Chapter 2 explains the assault of financial futures on the rest of time. Chapter 3 examines sharing risks or proliferating uncertainties, insurance, disaster, and development. Chapter 4 discusses the unravelling of technocratic orthodoxy in contemporary knowledge politics in technology regulation. Chapter 5 focuses on control, management and coping as a politics for risks, uncertainties, and unknown unknowns. Chapter 6 shows expanding cities in living, planning, and governing uncertainty. Chapter 7 investigates uncertainty in modelling climate change looking at the possibilities of co-production through knowledge pluralism. Chapter 8 discusses disease outbreaks through navigating uncertainties in preparedness and response. Chapter 9 explains disasters, humanitarianism, and emergencies in the context of a politics of uncertainty. Chapter 10 focuses on intertwining the politics of uncertainty, mobility, and immobility. Chapter 11 discusses disputing security and risk by looking at the convoluted politics of uncertainty. Chapter 12 examines unsettling the apocalypse viewing at uncertainty in spirituality and religion.

As uncertainty is a phenomenon we need to live with, the 17 SDGs require in realization that a new understanding of uncertainty is found by policymakers, by media and by the researchers of all fields.

*Samia Nour, University of Khartoum, Khartoum, Sudan and
Karl Wohlmuth, University of Bremen, Bremen, Germany*

Cramer, C., Sender, J., and Oqubay, A., 2020, African Economic Development: Evidence, Theory, Policy, Oxford University Press, Oxford, United Kingdom. First Edition published in 2020. 334 pages. Identification: ISBN 978-0-19-883233-1; Open Access for Download: <http://fdslive.oup.com/www.oup.com/academic/pdf/openaccess/9780198832331.pdf>

The aim of this book is to discuss African economic development by evidence, theory, and policy. The book provides a significant contribution because it proposes six broad strategic priorities of economic development including a high investment ratio; national champion firms; a rapid rate of increase in imports and in exports; promoting investment in specific types of economic activity; developing the capability for monitoring and disciplining; and protecting welfare, profitability, and political stability through grain market management. The book offers practical suggestions about how to argue against fashionable policies that are not

rooted in evidence or are theoretically incoherent. It also offers a guide to implementing some other and less discussed economic policies, it is assuming that this guide may only prove useful in specific political conditions.

The importance of the book also appears from emphasizing two important arguments. First, that variation matters and that identifying variation in policies and in performance is crucial to analysis and is often smothered in averages. Closer attention to variation reveals, for example, that there is usually more variation within Sub-Saharan African countries—in undernutrition, in wealth, in access to education, and so on—than there is between African countries, while, nonetheless, the variation between countries is itself more significant than often acknowledged. Much poverty analysis, for example, focuses on categories—simple geographical distinctions like rural/urban or categories such as ‘female-headed households’—that can be misleading. The book argues that these analyses obscure ‘intra-category’ variation; for example, the inequality within areas classified as rural or the huge diversity of living standards which is found among ‘smallholders’ or ‘female-headed households’ in Africa. The book argues that variation can then become a source of policy possibilism. The book argues that, for example, the variation in the incidence of insecticide-treated bed nets or in the equity of their distribution cannot simply be ‘read off’ from indices of endowments but reflects purposive policy design and implementation. Similarly, the fact that some farms have managed to generate far higher agricultural yields than others within the same agro-ecological zone suggests a clear role for officials to identify why and to pursue policies that can clearly secure higher yields on a much larger area. And differences between African countries in the rate of adoption of high-yield variety seeds reflect variation in an important policy choice: public spending on agricultural research. The book also emphasizes that some African countries have adopted policies to achieve much higher and more sustained levels of public sector investment than others.

Second, the book not only criticises the mainstream economic analysis and the resulting policy advice, by showing that it is empirically unfounded, that it has deep theoretical weaknesses, and has not produced the results insistently claimed, but also provides a coherent (and possibilist) alternative to a non-mainstream critique, and tries to offer an alternative to the most widespread forms of critique of the mainstream analysis: these forms of critique oscillate between stifling impossibilism and fanciful expectations of capitalism with a human face, South–South solidarity, homogeneous and mutually supportive rural societies, and the triumph of small-scale capitalism.

The book is organized in 4 parts and 10 chapters. Part I presents the context and includes Chapter 1, 2, and 3. Chapter 1 presents an introduction and provides a fresh outlook on evidence, analysis, and policy for economic development in Africa. Chapter 2 explains the existence of an uneven, contradictory, and brutal

economic development process in Africa. Chapter 2, on the contradictions of development in Africa, provides contextual evidence from a range of countries, as well as a wide array of socio-economic indicators. Going beyond this, however, the chapter makes two closely related arguments. First, capitalist development is everywhere, and always has been, a messy, non-linear, and often brutal process. Many of the things that people point to as being peculiar problems of African economic development closely resemble historical experiences that have occurred in many places across the globe. Urban slums or abusive exploitation of mine and child workers are not pathologies of African development but have been at the heart of capitalist development everywhere. While this does not mean that African economies will evolve in the same way as other parts of the world, there are important features worth abstracting and highlighting from global experiences of economic change. The second argument put forward in Chapter 2 emphasizes the extraordinary variety and contradictory characteristics of recent economic experiences both across and within African countries. And beyond mere diversity, the book argues that capitalist development in African countries, as elsewhere, has been contradictory: all good things do not go together. Chapter 3 shows varieties of common sense. The ideas surveyed in Chapter 3 echo many of the ideas and analyses examined throughout the book. For example, a critique of naive hopes for 'capitalism with a human face' picks up the argument developed in Chapter 2 about the way capitalist economic development is and has always been - messy, non-linear, and brutal, even as it produces historically unprecedented advances in welfare and human potential. Meanwhile, a critique of the pervasive 'small is beautiful' notion rehearses arguments developed in, for example, Chapter 6's discussion of mega-projects and Chapter 9's analysis of the productivity of small farms.

Part II focuses on strategies of economic development in Africa, addresses policy questions at the core of strategies for sustained economic growth, productivity improvements, employment creation, and foreign exchange generation. Part II includes Chapters 4, 5, and 6. Chapter 4 discusses investment, wage goods, and industrial policy; it focuses on investment and argues that African governments should as a matter of urgency raise their share of investment in GDP. Furthermore, they should pro-actively direct such investment towards activities that have the highest potential for increasing returns to scale and scope, for raising demand for labour, and for earning foreign exchange. Chapter 5 looks at the trade imperative; it deals with international dimensions of economic strategy, and discusses trends in Africa's net barter terms of trade and how these may affect policy choices, exchange rate policy, and the place of regional African trade (as opposed to broader international trade) within overall strategies of growth and development. It argues that sustained and broadly welfare-improving growth depends on maintaining a high growth rate of imports. It explains that regional integration among African economies may also have some positive consequences. It shows that African intra-

trade may be a complement to but is certainly not a substitute for an ambitious global trade strategy. Chapter 6 explains unbalanced development; it discusses Hirschman's approach and observation on how a country's prospects for economic development should be considered. Hirschman argued that a country's prospects are determined by what a country does, and by what it becomes, being a result of this.

Part III extends some of the arguments made in Part II and draws out their implications. Above all, it is concerned with the broad welfare of people in African countries, especially those living on low incomes, and especially the women. It focuses on labour, poverty, and agricultural productivity, and includes the Chapters 7, 8, and 9. Chapter 7 discusses wage employment in Africa; it brings together a range of arguments about wage labour markets and labour relations and argues that the prospects for rising productivity and poverty reduction are likely to improve in circumstances where strong trade union organizations can develop. Chapter 8 is working out the solution to rural poverty; it argues that the poorest people live in small, not large, households, and the poorest people depend for their survival on access to wage labour opportunities—much of the problem results from the fact that such opportunities are often rare and far away, and even when they are available the pay and the conditions for the work involved are pitiful. It argues that an overwhelming majority of the very poor people need to work for wages—casually, seasonally—to survive, but that their poverty is exacerbated if the demand for wage labour in rural Africa is not sustained. Chapter 9 discusses technical change and agricultural productivity; it is devoted to understanding the constraints on raising agricultural productivity in African economies, querying conventional arguments concerning the role of extension advice and micro-credit in raising yields, and to presenting arguments for what needs to and could be done. The book argues that raising agricultural productivity acts as a foundation for broader sustained economic development and should therefore be a priority for policy officials. First, most of the poorest people in Africa will, despite rapid rates of urbanization, continue to live in rural areas for some time to come. Both small- and medium-sized farms, as well as functionally landless people being reliant on wage incomes, depend for their welfare on rising agricultural productivity. Second, higher productivity in the output of food crops bought and consumed by African wage workers is a key part of a non-inflationary strategy to sustain profitability, investment, and growth (as well as political stability). Third, agriculture is central to securing foreign exchange earnings that can allow for the expansion of imports, thereby fuelling investment and growth. Fourth, there is increasingly scope for agricultural production and processing to reap productivity and other gains previously associated exclusively with manufacturing, and that have wider spill-over effects throughout the economy.

Finally, Part IV discusses possibilism in policymaking and includes Chapter 10; it shows high-yielding variety policies in Africa, it draws the policy priorities,

and emphasizes strategic policy priorities, and their rationale. The book justifies its many and robustly expressed criticisms to work on African policy issues by other social scientists because it makes a consistent effort to outline alternative theoretical and practical proposals. For example, it not only shows the limitations of the most popular approaches to rural labour markets and poverty, but constructively argues the case for a very different approach.

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Call for Papers (For Information, as the Call is closed)

Volume 23 (2022) of the African Development Perspectives Yearbook with the title “Business Opportunities, Start-ups and Digital Transformation in Africa”

Invited are contributions for Volume 23 (2022) of the African Development Perspectives Yearbook with the title **“Business Opportunities, Start-ups and Digital Transformation in Africa”**. 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.

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 proposed by the Editors for Volume 23 (2022). These proposed themes are only examples. The Editors are open to present and to accept further suggestions. The Festschrift at the occasion of “Thirty Years (1989-2019) of the African Development Perspectives Yearbook” was released recently and has approved this format of the Yearbook editions. Guest Editors and Contributors will get a copy of the Festschrift, as it contains valuable suggestions for further improvements of the African Development Perspectives Yearbook.

See the *Context* of the **African Development Perspectives Yearbook** and as well 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: <http://www.iwim.uni-bremen.de/africa/africanyearbook.htm>, and: http://www.iwim.uni-bremen.de/africanische_entwicklungsperspektiven_research_group/. The **African Development Perspectives Yearbook** is published since 1989. 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**. The volume 22 (2020/2021) is in print, and the title is “**Sustainable Development Goal Nine (Infrastructure, Industrialization, Innovation) and African Development – Challenges and Opportunities**“. It will be released early in 2021. The timetable for volume 23 (2022) is presented below.

The Editors also invite publishers and institutes to send books and issues of periodicals as well as research discussion papers and documents being of relevance to the theme of volume 23 for review and information in the *Book Reviews/Book Notes Section* of the **African Development Perspectives Yearbook**. The **Book Reviews/Book Notes Editor** is Prof. 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.

The theme for volume 23 (2022) on “**Business Opportunities, Start-ups and Digital Transformation in Africa**” is related to the ongoing global digital transformation, with impacts on productive sectors and the society also in Africa. African countries are differently advancing in the process of digital transformation, and some countries are even leading in this process by presenting digital solutions to current problems as we can see now in the COVID-19 crisis. The COVID-19 crisis reveals that health systems, education systems, government structures, financial services, and manufacturing processes are impacted by the digital transformation. Digital platforms give access to medical innovations, give information about hygiene advice, and provide for local availability of health protection utensils so that those living in remote rural areas and in semi-urban areas can also be reached. Those who are working in informal sector occupations get also access to digital media. In manufacturing sectors, we see a process of repurposing of industries towards basic goods for protecting people from COVID-19. We also encourage contributions along these lines.

The volume 23 (2022) of the African Development Perspectives Yearbook will cover three main issues:

First, *the new business opportunities created by the digital transformation* will be reviewed. Consumers, producers, traders, and entrepreneurs benefit from the new business opportunities. New products, new services, new forms of cooperation, and new supply chains emerge.

Second, *the digital transformation increases the number of start-ups and venture capital funds* in Africa. All types of start-ups are growing rapidly in Africa, and digital entrepreneurship is advancing not only in technology hubs but in all areas where Internet access is given. The many emerging start-ups (in all productive

sectors and in all branches of digital transformation) and finance institutions (from venture capital funds to impact, innovation and technology funds) are important for employment creation, structural transformation, poverty reduction, and the connection to local, regional and global markets.

Third, there are *longer-term implications of the digital transformation for the productive sectors*, mainly for manufacturing sectors and for agribusiness. But there are also strong impacts on services and administration sub-sectors.

It is an intention to publish in volume 23 country-specific, company-specific and sector-specific digital transformation cases, company success stories, but also analytic essays on the perspectives of the “fourth industrial revolution” for Africa and on the impacts of “globalization 4.0” on Africa. It is also of great interest to see how informal sectors can become part of the core economy in Africa through the digital transformation. COVID-19 is affecting the pace of the digital transformation in Africa, and this process needs to be documented.

Main Issues proposed by the Editors for the Thematic Units of Volume 23 (see below some suggestions of themes for Contributions and Units):

Digital Transformation and New Business Opportunities in Africa – Observable Trends, Driving Factors, and Important Actors

- *How is the digital transformation affecting countries and sectors, large public and private companies, medium-sized enterprises, and small industrial enterprises?*
- *In which sectors of the economy are new business opportunities created through the digital transformation?*
- *What do we know about the employment effects of the new business opportunities?*
- *Will the African Continental Free Trade Area (AfCFTA) accelerate the growth of business opportunities and the pace of digital transformation?*
- *Which African countries advance most rapidly in the process of digital transformation, and what do we know about their development paths?*
- *What is the role of the digital country development plans and agendas, and what are the outcomes in terms of implementation?*

Start-Ups and Venture Capital Funds in Africa – Impact of the Digital Transformation

- *In which countries and sectors is the establishment of start-ups and venture capital funds growing rapidly, and what do we know about the respective development paths?*
- *Are the new enterprises related to the emergence of technology hubs and science centres, and what is the role of pro-active national support policies?*

- *What is the role of digital platforms for the growth of start-ups and venture capital funds?*
- *Is the trend towards new social and solidarity economy enterprises sustainable, and what are the opportunities and perspectives?*
- *Is the observable growth of the impact investments pushing the establishment of start-ups?*
- *What do we know about the business models and the life cycle of ICT and software development start-ups in Africa?*

Digital Entrepreneurship in Africa – Towards new entrepreneurial drivers and actors

- *What do we know about the sources, the growth patterns, and the structures of digital entrepreneurship in Africa?*
- *Are the new digital enterprises mostly dependent on large and multinational mobile operators, or can they also develop independently and autonomously?*
- *What do we know about the foundations of entrepreneurship – by class, group, ethnic identity, region, status, and the readiness to adopt new and digital technologies?*
- *To what extent is digital entrepreneurship in Africa becoming part of global and regional networks and platforms?*
- *Which country cases are of special interest for analysing the role of digital entrepreneurship – often cited are Kenya, Senegal, South Africa, Egypt, and which other countries can be mentioned?*

Informal Manufacturing Sectors in Africa - Responding to the Digital Transformation

- *New technology trends of manufacturing in informal sectors – is a mapping possible?*
- *How can digital platforms contribute to the accumulation of technological capabilities in informal sector manufacturing?*
- *What is the role of informal ICT enterprises for the digital transformation?*
- *How can public Infrastructure Policies and public STI Policies contribute to an improvement of Informal Sector Enterprises Support Systems?*
- *Country Cases of Digital Support Policies for Informal Manufacturing Enterprises – which countries are leading in policy design and implementation?*

Innovative Firms in Africa and Digital Infrastructure – New Patterns, Drivers and Actors

- *How is the quality of the digital infrastructure and the innovation capacity of high-growth corporations in Africa?*

- *How can innovative firms in Africa use the public digital infrastructure for regional and global networking and marketing?*
- *What is the contribution of digitalization to the innovation processes and the R&D strategies of high-performing enterprises in Africa?*
- *What do we know about the digital infrastructure of industrial zones/technology zones/export processing zones in Africa?*

Industrial Production, Digital Infrastructure, and Open Innovation in Africa

- *How does the provision of digital infrastructure speed up the spread and use of open innovations?*
- *For which production and services sectors can open innovation platforms be a key development factor?*
- *How to evaluate the benefits of open innovation processes for manufacturing corporations – What do comparisons of country, company and sector cases reveal?*
- *Cases of open innovation in selected manufacturing and services sectors*
- *How are the innovation partners cooperating and sharing the available resources?*
- *Towards more inclusive and equitable business models – to what extent are they based on open innovation solutions?*

The “Fourth Industrial Revolution” and “Globalization 4.0” – The next steps towards restructuring Africa’s Productive Sectors

- *How can we assess and measure the progress in African countries towards the Fourth Industrial Revolution?*
- *How are African enterprises and Foreign Investors in Africa responding to Globalization 4.0?*
- *Small African Manufacturing Firms are partners in Global Value Chains*
- *Is their integration into the value chains contributing to Technological Upgrading, to Digital Learning, and to Human Resources Development?*
- *How will Digital Infrastructure and STI Infrastructure deepen the integration of small firms into global and regional value chains?*

COVID-19, Digital Platforms, and the Restructuring of the Health Systems in Africa - Repurposing the Pharmaceutical Industry, the Medical Equipment Industry, and the Health Sector Infrastructure

- *Will COVID-19 have a long-term impact on the health-related industries and services in Africa?*
- *To what extent are workers in informal sectors and people in rural and semi-urban areas impacted by digital health platforms?*
- *What are the long-term consequences of the repurposing of local industries for basic health and hygiene products?*

- *Is the digital mapping of Grassroots Medical Innovations and of Traditional Health Knowledge making progress – and what do we know about uses?*
- *Will the digital transformation of the higher education, research and university systems contribute to a greater resilience of the African health and social safety systems?*

Further Information for Contributors, Reviewers, and Guest Editors:

To the Contributors of Volume 23:

Please send an **Abstract** and a **short CV** not later than **March 15, 2021** 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 23:

Please send a **short CV** and a **Proposal** for one of the **Thematic Units** mentioned above or chosen by yourself not later than **March 15, 2021**. If you have already contributed to a former volume of the Yearbook, please send only the Proposal.

To the Reviewers of drafts, books, and other material for Volume 23: Please send your material to the **Book Reviews/Book Notes Editor**.

Timeline for Volume 23 (2022):

Deadline for Abstracts/Proposals for Thematic Units: March 15, 2021

Acceptance or Rejection of the Proposed Contributions: April 15, 2021

First Draft of the Contributions submitted: August 15, 2021

Final Draft of the Contributions submitted: October 15, 2021

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African Development Perspectives Yearbook
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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
Human Skills Development and Country Cases
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Reuben A. Alabi; Achim Gutowski; Nazar Mohamed Hassan; Tobias Knedlik;
Samia Satti Osman Mohamed Nour; Karl Wohlmuth
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