EDITED BY
PADMASHREE GEHL SAMPATH
BANJI OYELARAN-OYEYINKA

SUSTAINABLE INDUSTRIALIZATION IN AFRICA

Toward a New Development Agenda

Foreword by
Ms. Amina J. Mohammed, UN Special Advisor, Post-2015 Development Planning

"The book is set at the junction of two agendas, raising pertinent questions related to the need for integrating economic transformation, sustainable management of natural resources, social inclusion, sustainable agriculture and industrial development, sustainable urbanization and rural prosperity. It also suggests the need to calibrate the post-2015 SDGs agenda according to the needs of specific regions and countries. The book and its content could not have been timed better."

– Amina Mohammed, United Nations Special Advisor on Post-2015 Development Planning

"This book not only deepens our understanding of the sustainable development goals but it is also persuasive in its argument for redirecting our collective efforts in Africa to the central role of industrialization as an engine of economic development. It is well researched and refreshing in the techniques it deploys to make the case. I fully recommend it to academia, political players and policy actors."

– Professor Yemi Osinbajo, Professor of Law and Vice President, Federal Republic of Nigeria

"The book is a collection of eight excellent chapters written by nine African and non-African specialists addressing the general theme of sustainable industrialization and development of Africa. The lead authors are authorities in the field who give insightful definitions for 'sustainable development,' profound analysis of the status and potential of Africa's services sector, linkage dynamics and natural resources, diversification and catch-up, and a thorough treatise on sustainable development and inequality of opportunity in Africa. I would consider the book as essential reading by all the stakeholders of development – economists, policy makers, development partners, university professors in the developmental sciences and graduate students."

– Professor Berhanu Abegaz, Executive Director, African Academy of Sciences

"Too much emphasis on trade in the last 20 years has overlooked that industrialization is key to fostering economic and social development. This book must be welcomed not only because it stresses this notion but also for many other reasons. It analyzes in-depth the situation and industrialization prospects for Africa, often seen as condemned to be a mere supplier of raw materials; emphasizes the role of the states in leading the transformation of national economies; advocates an environmentally sustainable and equity-based policy, adapted to the reality of each country; recognizes the importance of innovation (including by imitation and learning); and brings the discussion of these issues in the context of the Sustainable Development Goals that were elaborated pursuant to the World Conference on Sustainable Development – Rio+20. The quality and coverage of the research conducted for this book provide a unique set of materials valuable to academics, policy makers and the broader public interested in the future of African societies and sustainable development."

– Professor Carlos Correa, Director, Center for Interdisciplinary Studies on Industrial Property and Economics, University of Buenos Aires

"A key aspect of Sustainable Development Goals is building the productive capacity of developing countries. This book offers a most comprehensive and balanced approach to this issue, which has been rarely available so far. It analyzes the 'three main alternatives' of manufacturing, service, and resource-based paths toward development, besides the roles of the GVCs, and thereby provides evidence-based policy suggestions."

– Professor Keun Lee, Professor of Economics,
Seoul National University

"This book 'Sustainable Industrialization in Africa: Toward a New Development Agenda' promises to re-open the debate on the role of industrialization in Africa and its contribution to economic growth. The book is well focused with definitive policy recommendations drawing on the MDGs and anchored on the 2030 Agenda for Sustainable Development.

I fully endorse and recommend this novel book to policy practitioners, academics as well as industrialists."

– O. Ibidapo-Obe, past president, Nigerian Academy of Sciences
and Fellow African Academy of Sciences; Distinguished Professor;
Vice Chancellor University of Lagos (2000–2007)

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Toward a New Development Agenda

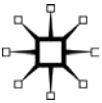
Edited by

Padmashree Gehl Sampath

and

Banji Oyelaran-Oyeyinka

palgrave
macmillan



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Foreword

Over the two decades, the international community has been engaged in an intense debate to agree upon new, common global milestones to guide long-term development efforts of countries worldwide. The first effort that began shortly before the year 2000 culminated in the adoption of the *Millennium Development Goals* (MDGs), which are set to expire this year. The process of finding a worthy successor to this framework has been ongoing from 2012, coming out of the World Conference on Sustainable Development – Rio+20. This widely inclusive global process has engaged diverse actors within the international development debates in order to build consensus around the proposed *Sustainable Development Goals* (SDGs).

Both sets of goals have some similarities, but differ substantially in their core philosophies and proposed outcomes. Both focus broadly on the long-term agenda of ending poverty and attenuating vulnerabilities in developing countries in its multi-dimensional forms such as the lack of income, equality, education, water, sanitation and the right to political participation among others that became the capstone of the Millennium Development Goals. But at the same time, there are large differences. For example, the developmental vision advanced by the Millennium Development Goals for eradicating poverty and attenuating multiple vulnerabilities that are widespread in developing countries was far less sanguine about the prospects of endogenous productive capabilities in poor countries. However, not much emphasis was placed on the drivers of wealth creation such as innovation (broadly defined), industrialization, and ultimately sustainable production and consumption and equitable development. Perhaps a more robust engagement with these issues in MDGs may well have triggered greater investment into more appropriate knowledge-driven programs and solutions.

On the contrary, at the heart of the Sustainable Development Goals for all countries is an emphasis on productive activities represented by four core goals, namely Goal 2: "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture"; Goal 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"; Goal 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization

and foster innovation". Lastly, Goal 12: "Ensure sustainable consumption and production patterns."

Hand-in-hand with the notion of sustainable economic growth, the SDGs enshrine the concept of environmental sustainability that was widely adopted after the Earth Summit in Rio de Janeiro in 1992. Broader discussions on sustainability in all its dimensions, including climate action, was equally central to the deliberations at the Rio+20 summit in 2012 and were key to a redefinition of the goals, initially a parallel concept to the MDGs that evolved into the new Sustainable Development Goals.

I want to congratulate the authors of this excellent book, which has deployed completely new statistical and conceptual methodologies to raise pertinent issues on what has usually been presented as two competing agendas with detrimental trade-offs. The book is set at the junction of the two agendas, raising pertinent questions related to the need of integrating economic transformation, sustainable management of natural resources, social inclusion, sustainable agriculture and industrial development, sustainable urbanization and rural prosperity. It also suggests the need to calibrate the post-2015 SDGs, agenda according to the needs of specific regions and countries. The book and its content could not have been timed better.

Drawing broadly from the premise that sustainable industrialization is the basis for overall well-being of countries and peoples, the book proposes that countries articulate a framework for dynamic industrialization policies at the national level drawing on the Sustainable Development Goals that closely coordinate industrial policy with social policy objectives and the protection of the environment, and to prioritize industrial policy mechanisms that reduce unemployment and poverty. It specifically uses issues related to industrial dynamism in sub-Saharan Africa (such as clustering) to propose how industrial policy outcomes can be directly linked to improved human development indicators. The findings show that African states – working toward the goal of employment creation, increased productivity and poverty eradication – can spearhead the development of new developmental paradigms that integrate the social, the economic and the environmental challenges in a more wholesome way, building on the Agenda 2063, the Common African Position on the 2030 Agenda for Sustainable Development and on existing mechanisms such as NEPAD.

In eight succinct chapters, the book presents the case for placing strong emphasis on sustainable industrialization in African countries; it equally lays out the mechanisms for securing human living conditions

and bridging the inequality gap. The chapters are coherently linked to one another, in an effort to propose a framework that articulates the nexus of production and sustainable consumption in ways that raise the living standards of citizens, by combining a rich mix of country case studies with theory and new statistical approaches.

Lastly and very importantly, the book brings together the African voice on these issues, wherein the authors have articulated the long-term multidimensional impacts of industrialization on countries given the right institutional policies and practices. The book advocates a coordinated policy approach that draws on the global goals while being underpinned by specific contextual and historical realities at the local level. The 2030 Agenda for Sustainable Development will be fraught with challenges, as well as opportunities. Engaging with the process of contextualizing the SDGs therefore will be essential to achieve suitable outcomes. A Data Revolution will be needed for ensuring that no one is left behind, through an appropriate monitoring and follow-up.

It is my hope that the policy recommendations of this book will support African governments in aligning national plans with the global goals and foster coordination and coherence with all other relevant stakeholders toward actions that increase national income as well as quality of life. Again, within the framework of sustainable development strategies, governments will do well to accelerate investments that drive inclusive growth through industrialization. I am persuaded that this book will be a very useful resource for students, academics, policy makers and practitioners in advancing the development agenda through sustainable industrialization.

Amina J. Mohammed
United Nations Special Advisor to the Secretary General
on the Post-2015 Development Planning

Preface

The 2030 Agenda for Sustainable Development has an ambitious aim: creating prosperity for all. The core idea underlying the agenda is that global prosperity calls for integrated and common solutions in which all countries assume a common responsibility to enable sustainable development. The Sustainable Development Goals (SDGs) therefore are framed as a shared objective of mankind which, if properly implemented, has the potential to fundamentally foster an equitable global future for all.

This book is inspired by our decades of work in Africa, contextualizing policy concepts and solutions to local and regional needs. As we stand at the cusp of the new development agenda, we believe it is highly relevant to place the SDGs debate against the background of what the national realities of African countries are, and what their challenges have been in implementing inclusive development approaches.

Our effort has been to put together the African voice on the debate by way of contributors whose expertise represents as much a theme of relevance for this debate as they personally stand testimony to the African spirit.

We believe that the timing of this book could not have been better. This book details the multifaceted dimensions of sustainable industrialization by combining the conventional industrial policy literature and approaches with new methodologies and data that link it directly to social outcomes.

It is our hope that the policy recommendations of this book will be a useful and relevant contribution both leading up to the discussions and finalization of the post-2015 Sustainable Development Goals, and also to inform policy making on what the difficulties and challenges are in linking industrialization to sustainable outcomes in the African continent for the decades to come.

Notes on Contributors

Donatus Ayitey works at the United Nations Conference on Trade and Development (UNCTAD), Geneva, Switzerland. He holds a PhD in Innovation Economics from the University of Maastricht, the Netherlands and a MSE in Applied Statistics from the University of Oxford, UK. His research interests include trade, development and statistical methods. He has also written numerous papers on related topics, and worked as a consultant for various international organizations, including the World Intellectual Property Organization (WIPO) and the International Trade Centre (ITC).

Padmashree Gehl Sampath is Chief of the Technology and Innovation Report Series at the United Nations Conference on Trade and Development (UNCTAD) in Geneva, Switzerland. Prior to this position, she was Assistant Professor of International Development and Innovation at the Open University, UK. Her research interests include trade, industrial policy and development issues. She is the author of four books as well as journal articles and book chapters. She has served on advisory panels and boards of numerous initiatives, including the Swiss Development Council's Board on Knowledge For Development (K4D). She is a member of Academia.net, a portal for outstanding women scholars worldwide, has been the recipient of a Bellagio Residency and an award from the Rotary International in India.

Dominique Haughton is Professor of Mathematical Sciences and Global Studies and Graduate Coordinator for Business Analytics at Bentley University in Waltham, Massachusetts, Boston and an affiliated researcher at the Université Paris 1 (Pantheon-Sorbonne) and Université Toulouse 1, France. He holds a PhD from MIT (1983), and his research interests include applied statistics, business analytics, global analytics, data mining, and model selection. He is Ecole Normale Superieure Graduate and a fellow of the American Statistical Association. Haughton's work concentrates on how to best leverage modern analytics techniques in order to address questions of business or societal interest. He is the co-editor of *Case Studies in Business, Industry and Government Statistics (CSBIGS)* and author of three monographs and over 60 articles which have appeared in journals such as *The American Statistician,*

Computational Statistics and Data Analysis, Journal of Interactive Marketing, Telecommunications Policy, Economic Development and Cultural Change, Studies in Family Planning, Journal of Population Economics, *Journal of Biosocial Science, Annals of Statistics, Sankhya, Journal of Statistical Computation and Simulation, Communications in Statistics, Statistica Sinica*.

David Kaplan is Professor Emeritus of Business Government Relations, Department of Economics, University of Cape Town, South Africa. He has worked extensively on industrial policy as first Chief Economist of the Department of Trade and Industry, Chief Economist of the Department of Economic Development and Tourism, Provincial Government of the Western Cape. He is currently a member of the board of the Technology Innovation Agency, the Global Network for the Economics of Learning, Innovation and Competence Building Systems and its Africa chapter, Africalics.

Rasmus Lema is an associate professor in the Department of Business and Management, Aalborg University, Denmark. He holds a PhD in Development Studies from the University of Sussex. He conducts research in the intersection between innovation studies and development studies, with a particular emphasis on policies regarding technological learning, innovation and competence building.

Bengt-Åke Lundvall is Professor of Economics in the Department of Economics and Management at the Aalborg University, Denmark. His research is organized around innovation systems, learning economies and economic development. He has coordinated major empirical projects on the Danish economy and initiated a global network for innovation research (Globelics).

Banji Oyelaran-Oyeyinka is Director of the Monitoring and Research Division, UN-HABITAT, Kenya, a Professorial Fellow in Innovation and Development, United Nations University, MERIT, the Netherlands, and Visiting Professor of Innovation and Development at the Open University, UK. His research interests are in science, technology, innovation policy and systems in late development, innovation systems in industry, small- and medium-size enterprises, industrial clusters in developing countries and latecomer industrialization and economic development. He is the author of several books in addition to journal articles and other works. He is a board member of several academic journals and programs, including the STEPS-IDS, Sussex, UK. He is a fellow of the Nigerian Academy of Engineering.

Oyebanke Oyeyinka is an associate consultant at Dalberg Global Development Advisors and holds a PhD in Urban Planning from Columbia University's School of Architecture, Planning and Preservation, New York. She is interested in industrial clusters, industrial and social policies, the informal economy, and the dynamics of poverty and inequality in developing countries. She has worked as an intern and subconsultant with the United Nations.

Olumayokun Soremekun is a business development manager for a global online classifieds company with footprints across the emerging markets. She recently worked as a senior quantitative researcher with a marketing agency in Boston, Massachusetts. She holds a PhD from Bentley University, a Master of Science from Western Carolina University and a Bachelor of Arts from Tusculum College. She has worked on consulting projects with the World Bank and the United Nations.

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Sustainable Industrialization in Africa: Toward a New Development Agenda

Padmashree Gehl Sampath

This book is about developmental choices. Its main argument is that countries and regions face individual dilemmas and trade-offs in promoting sustainable development, even when the choices to be made begin from a definitional standpoint. Despite the social sciences' rich scholarship and the benefits of pluralism, a great vice still afflicts it, in that we engage in debates on critical notions that are potentially path altering without actually aligning ourselves on what they may mean for different contexts. Sustainable development is one such notion that holds a different appeal to all who seek to operationalize it. Sustainable development can denote simply the ability to grow at a high rate for the next two decades or more. The term is often also used to denote development that is more equitable, and encompasses the ability to be inclusive and lift people out of poverty in urban and rural areas. Sustainability can also simply refer to growth and development that focus on being environmentally sustainable or intergenerationally conscious. Yet for many others, the term "sustainable development" can be multifaceted, denoting various means of eliciting sustainable outcomes – environmental, developmental and equity based – the so-called holy trinity of development.

In this book, we argue that, however important it may be to agree on the different aspects of sustainable development, in the context of the 2030 Agenda for Sustainable Development, eliminating poverty and attaining equitable outcomes for the majority by promoting industrialization remain the core national prerogative, both in terms of agenda setting and problem solving for countries. It is well known that in the current context, globalization, rapid urbanization, free trade and the ongoing fragmentation of production

are the main factors that determine economic outcomes globally, and often the role of a nation state is heavily circumscribed (UN-Habitat, 2013; Breznitz, 2007). Despite this, in our view, the nation state has never been more important than it is now in steering the paths of individual countries in the ways they interact with other actors within the globalized community. Equally, and more importantly, states are critical to determining how economic gains can be captured and translated into social outcomes, in a manner that is sustainable at the national level, vis-à-vis the global community and the environment at large.

Today's Africa in its variegated hues is a statement of promise: the region has witnessed growing trade relations and a substantial increase in real GDP growth rates in the 2000s, making it the fastest-growing continent worldwide. And yet, poverty and inequality remain the largest hindrance to channeling developmental outcomes. Over 70% of the world's poorest people live in Africa, including the ten countries that have the highest number of people living in extreme poverty. Similarly, of the 1.3 billion people who lack access to energy, approximately 700 million live in Africa and African states lose roughly 5% of their GDP on ensuring access to water and sanitation as a result of weak national infrastructure. Viewed from these standpoints, lauding international trade or multilateralism for delivering greater access to international markets to African countries seems premature: up until now, there has been not much data to support the claim that increased trade and openness contribute to poverty reduction in general (Bhagwati and Srinivasan, 2002) and in Africa in particular (Le Goff and Singh, 2014).

The growing trade relations between African countries with the rest of the world presents opportunities but these, in fact, need to be punctuated with concern that it is concentrated mainly in extractive or low-technology sectors of the economy, and restricted to some countries more than others. On these topics, however, consensus is hard to come by. Academic and policy scholarship is split on the question of whether trade openness is unfavorable and whether such concentration in some sectors is development friendly. Views oscillate between those who espouse a commodities-based industrialization pathway to development (Lin, 2011; Morris and Fessehaie, 2014) and those who vehemently criticize the overdependence on commodity rents, arguing that it leads to entrenching countries in product spaces that are not conducive to upgrading in general (Hausmann and Rodrik, 2005; Hausmann and Klinger, 2006; Hidalgo et al., 2007).

Recently, the academic scholarship has laid claim to the fact that the region's history is crucial to understanding some of its challenges of

underdevelopment (Jerven, 2009; Austin, 2008). A long list of explanations has been proposed to explain the region's developmental challenges – a lack of institution building as a result of historical political instability, structural adjustment, a low focus on industrial development in a historical context, and colonization and slavery backed by accounts that span back millennia. Such studies try to connect today's developmental issues to shortcomings of the past. In the process of creating potential trajectories between the past and current circumstances to draw conclusions, several simplifications are often made to fit certain conceptual categories and to justify particular patterns of data and analysis.

One such simplification that is found in a large part of the economic growth literature is related to the relationship between economic growth and income. This highly critical link is assumed to be relatively straightforward. As Jerven (2009) points, low income today must be the result of a lack of income growth in the past (p. 78). If we were to accept this relationship as factual, one simply has to delve into how best to identify the causes of the lack of income growth in the past in Africa as the starting point to finding solutions. In fact, there is a lot of literature that does begin with such an assumption (see, for instance, Collier and Gunning, 1999). On this basis, scholars have argued that what Africa needs today is a set of pro-growth institutions that can tackle the challenge of income growth that has arisen due to decades of sluggish industrial development, its specific population characteristics, political instability, inflation and unemployment, lack of skilled labor, or even factors such as slavery and racism.

Even if we were to accept the relatively straightforward assumption between low income in the current context and a lack of income historically, attaining higher income growth will depend on (1) structural change, especially a faster transformation from agriculture to industry; (2) higher export shares; (3) lower inflation; and (4) decreases in inequality and dependency ratios (Bulman et al., 2014, p. 2). Not only are these issues interconnected but they suggest that there are differentiated yet important roles to be played by a series of extenuating factors. These factors include not only higher education strategies for a wider skills base, research and development (R&D) infrastructure and techno-logical change. There can also be a large number of barriers to achieving equality are simply associated with marginalization and the lack of opportunities of large sets of people within countries as associated with basic access to health, education, social exclusion or simply the lack of creative space. The key question, therefore, is much more profound: how do we achieve these outcomes simultaneously in a way to channel the current

economic growth toward a process of sustainable industrialization in Africa?

The comparative political economy literature on industrialization has yet to address itself to accommodate the possible synergy between the economic and the social interfaces in the growth process that together contribute to the process of sustainable development. The post-2015 agenda deliberations that were conducted under the auspices of the United Nations embarked upon the rich and complex task of finding a go-between for the economic and social domains of development in the context of all countries worldwide. The fundamental idea underlying the 2030 Agenda for Sustainable Development is the creation of prosperity for all. It is embedded in the notion that global prosperity calls for integrated and common solutions in which all countries assume a common responsibility to enable sustainable development. The, recently adopted Sustainable Development Goals (SDGs) are expected to be framed as a common objective of mankind, which if properly implemented has the potential to fundamentally foster an equitable global future for all. The adoption of the SDGs is a first step of the long road that faced the global community. While devising means to further the SDGs agenda, it seems especially important to take on board the lessons learned from the Millennium Development Goals (MDGs) era. Fundamentally, what stands out from the MDGs experience is that, despite the level of success achieved in implementing several of the social goals, the goals in their entirety were insufficient for addressing local challenges in some countries, mainly because they were not closely coordinated with the overall economic development of countries themselves. To a certain extent, although the goals and the progress achieved thereunder were laudable, they were targeting the consequence of social and economic inequalities, rather than addressing their causes. For example, the processes that underlie education or health exclusion are embedded in socio-cultural patterns and the economic division of opportunities. Seeking to achieve access to health or universal primary education without addressing these underlying causes was perhaps a major failing in the older approach. Another critical failure was the inability of the MDG social goals to closely connect with and contribute to the overall industrialization processes of countries. As a result, lives were saved and health was improved, but at the same time, the countries have not been able to guarantee livelihoods along with a chance for everyone to prosper equitably.

The developmental vision advanced by the MDGs also did not also accord due attention to several cross-cutting themes that were important for the achievement of the individual goals and also for contributing to overall sustainable development. These include the acquisition

of technological capabilities and innovation, dynamic industrialization and, by extension, productive capacity and equitable development.

In contrast to this, at the heart of the SDGs is an emphasis on productive activities in all countries, as represented by three core goals: Goal 8, Goal 9 and Goal 12. Goal 8 calls for "[p]romot[ing] sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all," whereas Goal 9 reads, "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." These are complemented by Goal 12, which specifies the need to "ensure sustainable consumption and production patterns." The focus, therefore, in the SDGs is the emphasis on national-level capability development, through the goals specified therein, in a holistic way. This is evident also in the way many developmental concerns are coded in the 2030 Agenda for Sustainable Development, such as the treatment of multidimensional poverty: the SDGs differentiate the various vulnerabilities to set a zero-goal for poverty over the next 15 years. Goal 10, which calls for reducing inequality within and among countries is a goal that guides how these other goals should be directed. In sum, the SDGs take a more robust view of national-level development in place of the donor-driven approach in the MDGs, which took a relatively narrow notion of development with an explicit emphasis on and preference toward socially, economically and ecologically sustainable objectives.

This book, while acknowledging the importance of an overall effort of that nature, argues that developmental solutions are ultimately rooted in contextualization and that choices matter. Most of all, these choices relate to how sustainable development is defined and implemented. Given that development is an ultimate outcome of the process of industrialization, the critical choices for nations as we see it are related to two key issues: how to perceive equitable, sustainable industrialization, and how countries can begin to devise means to foster it. Despite the ambitious tone of the 2030 Agenda for Sustainable Development, it would be naive to believe that different countries and actors can be bound to a common framework on economic and social prosperity, given the vast hinterlands of poverty and inequality that plague some regions of the world much more than others. The SDGs themselves recognize the need for local solutions. In fact, as Breznitz (2007) notes, a most essential shortcoming up until now has been the inability of social science theories to explain how different countries, each with a discrete set of policies on industrialization and development, can be expected to meet a similar set of targets over time, on whether to attain industrial growth, catch-up growth, technological progress or to achieve a common set of socio-economic goals. This last point is perhaps not just the omission of the comparative industrial economists but also of development economists in general.

From this standpoint, it remains an imperative for any development agenda, if it is to have any success, to create the bases as producers of goods and services for wealth creation that can be channeled to finance social goals and to recognize that different regional and national contexts may require differentiated treatments.

If countries are to succeed in eradicating poverty, generating opportunities for their people, fostering business and taking responsibility in devising a sustainable future for all, nuancing options, opportunities and challenges at a regional context is highly relevant.

1.1 Comparative industrialization: insights and pitfalls

Contemporary notions of industrialization can be traced back to the experience of Great Britain, Western Europe and North America during the 19th and early 20th centuries (Nzau, 2010). The literature that reviews the experiences of these countries seems to agree that, although the early-industrializing countries started out at different stages of growth, they followed more or less a similar format of change that led to their transformation. Marked by the shift from a subsistence/agrarian economy to more industrialized/mechanized modes of production, hallmarks of industrialization include technological advance, widespread investments into industrial infrastructure and a dynamic movement of labor from agriculture into manufacturing (Lewis, 1978; Todaro, 1989; Rapley, 1994). Agreement exists that a dynamic process of industrialization is fundamental to the overall economic development of countries, given that it promotes growth-enhancing structural change, which is the gradual movement of labor and other resources from agriculture to manufacturing, as accompanied by productivity increases. Manufacturing is construed as critical in most such expositions because of the empirical correlation between the degree of industrialization and the per capita income in countries (Szirmai, 2012). Given that productivity is higher in the case of manufacturing than agriculture, transfer of resources into manufacturing should normally provide a basis for higher rates of productivity-induced growth structures.

While the role of the state is not clearly elaborated in early industrialized countries, Gerschenkron (1962) was one of the first scholars who revisited the notion that state plays a critical role in helping latecomer countries to catch-up. His thesis has been fundamental in shaping our understanding of what forms of support structures latecomer countries might put in place to facilitate the process of industrial change, and by extension, achieve economic development. Analytical constructs of

latecomer development that have been extensively advanced to understand the process of industrial and economic catch-up of countries are mostly based on the notion that a large number of technological developments that are needed for the latecomers to embark on industrialization are already available (Gerschenkron, 1962). Based on this, a spectrum of activities characterizes the essential "catch-up" route: assimilation of existing knowledge to imitative innovation, to incremental innovation, to state-of-the-art R&D, to frontier innovation (Amsden, 1994; Kim, 2003; Amsden and Chu, 2003). This sort of industrial catch-up focuses on the development of industrial sectors as such, with local firms at the center of technological activity.

Despite the richness of such studies, there are several old and new pitfalls in the literature on comparative industrialization. The first of these is the relationship between economic growth (as measured by rising GDP growth rates) and industrial development. Industrialization in the more recent past in developing countries, particularly in Africa, has defied conventional wisdom: while one sees a rise in GDP growth, there is often not a clear correlation between this growth and the rate of structural change. The large gaps in labor productivity between the traditional and modern sectors of the economy have not only been productivity declining in terms of structural change but there is also evidence that a large amount of labor is shifting into services directly from agriculture, or inversely, from agriculture into the commodity-based sectors (McMillan and Rodrik, 2011; Tregenna, 2009). Numerous changes that have taken place in the global political and industrial landscape are the main factors that could account for these unconventional shifts, and the comparative political economy literature of industrialization is yet to emerge with a consensus on how best to account for them, or leverage them for development.

Particularly, industrial systems and structures have changed drastically in the past two to three decades, not only in the high-innovation intensity sectors (Breznitz, 2007) but also in other sectors of production. Global trade and industrial production have become increasingly fragmented, with 80% of all total trade in 2014 being conducted through value chains or production networks (UNCTADStat). There is an ever-reducing emphasis on assembling products and processes within any specified geographical space, as was the case in all the sectors that have been the hallmarks of previous analyses of industrial catch-up in economic studies, such as semiconductors and electronics, pharmaceuticals, and manufacturing, among many others (see Wade, 1990; Odagiri et al. 2010; Kim, 2003). Instead, in the current context, competitiveness

is determined by those firms that specialize in a set of activities per se, although not necessarily operating within a wider sectoral context in the country in question.

Industrial economists and political scientists are gradually coming to terms with this new reality, in which the focus of industrialized competitiveness is not dependent on the sectors that are being fully developed for production *in situ* within a country, but rather on the sets of activities that can be honed as expertise to beneficially tap into existing opportunities, local, regional or global. In the context of Africa, therefore, although there has been a lot of comparative work on how latecomer industrialization experiences (particularly from Asia) can be applied to policy and practice, the emergence of newer industrial structures and systems calls for framing industrial development as a new set of questions.

A second point at which the conventional political economy literature leaves us bereft of explanation is on the role of the state in promoting industrialization. It has been argued that the less of a role the state plays, the better, since it will enable markets to dictate outcomes in an uninterrupted manner. Concerned that this would not be able to achieve the economic outcomes of the kind needed for low-income countries (let alone social outcomes), scholars have time and again articulated the need to combat market failures through state and governmental action. In one of his recent books, Stiglitz (2010) calls for stronger government to combat all the market failures that we see in modern financial capitalism. He argues that finance needs deep structural change – and that "the too-big-to-fail banks need to be broken up – and more and better regulation." This is not a new call: concerns about withdrawing governmental intervention under the guise that the markets need space to function have been expressed for decades or even centuries now (see List, 1885; Young, 1928; Abramovitz, 1956; Kaldor, 1976; Stein, 1992; Greenwald and Stiglitz, 1986; Stiglitz, 2002; Chang, 2007).

To understand how countries have countered markets, Low and Tijaja (2013) review industrial policies that governments have deployed in countries to support market functions and conclude that these consist of four different kinds of policies: (i) import-substitution industrialization (ISI) policies; (ii) export-oriented industrialization (EOI) policies, which include variants such as export-processing zones (EPZs), special economic zones (SEZs), and industrial clusters; (iii) resource-based industrialization (RBI) policies; and (iv) industrialization through innovation strategies. However, it still remains a fact that despite the ideological biases that cloud this debate, and regardless of the positive experiences

of some countries in this regard, there are at least twice as many that did not manage to achieve the kinds of results anticipated. Furthermore, even in a large number of countries that are regarded as exemplars of success, social outcomes have remained difficult to achieve.

This is not a call to question the role of the state or the market, but to point to what is perhaps the largest shortcoming of comparative thought on the topic, namely, our inability to articulate clearly how industrialization feeds into fostering the social development of countries. There are several layers to this debate that, up until now, have not been considered at all. There is the inevitable link between industrial development, income growth and distribution effects, which is perhaps the aspect to which the literature has paid the most attention. But at the same time, the industrial patterns of countries, that is, the policy frameworks, instrumentalities and incentives, all have specific social implications. For example, when a country chooses to specialize in low-technology sectors that call for large-scale employment as opposed to higher-technology sectors, which pool the skilled into specialized niche areas of work (with few inter- and intra-sectoral effects), it has a tremendous impact on employment generation, wage differentials and overall prosperity. In the same way, when industrial policy dictates the growth of specific large-employing sectors – such as ready-made garments or agro-processing – without clear social protection, it often leads to the proliferation of large numbers of rural workers in urban areas, with typical implications for urban resources, spatial spread and congestion, as is being witnessed in a large number of cities in the developing world today.

1.2 Sustainable industrialization for Africa: envisioning a future

The African debate on how to foster industrialization and the role of the state has mirrored the developmental triumphs and failures of other countries to a large extent. The successes of the East Asian economies and now the BRICS (Brazil, Russia, India, China and South Africa) have served as the main touchstone of the discourse. Drawing on their experiences, there has been a wide-ranging discussion on the role of the state in economic growth, the ways in which the state can minimize or take risks and how it could champion industrial development.

We take this as our starting point, but suggest that the questions of sustainable industrial development for Africa are mainly those that the contemporary literature on the topic has not been able to answer, up until now.

A fundamental issue for industrialization in Africa is that it is *yet to happen* as a general phenomenon. Although African countries have had rich and important experiences in promoting industrial development and they have tried out a wide variety of developmental state constructs, ranging from the state-led developmental model, to the private-sector oriented developmental model, and not least, the free-market oriented, minimalist state, many of them still await real industrial development of the kind that changes society en masse. As opposed to the images of the African states that have been caricatured over time (as corrupt, rent-seeking, lacking in political vision), a large number of African countries, in reality, enacted detailed industrial strategies to foster economic development almost immediately after their independence between the 1960s and the 1980s.

The comparisons between Ghana and South Korea are relatively well known and have been repeated often in the developmental literature. In 1957, both countries had the same per capita GDP growth rates, and yet their industrial and economic growth trajectories diverged in such stark contrast that they lent fodder to several important economic analyses by the World Bank and other scholars over the past 50 years. These analyses have traced the rise of South Korea and the concomitant decline of Ghana to several reasons, including political insecurity, authoritarianism and corruption (Jackson and Rosenberg, 1982). But Ghana was not the only country that went from being highly promising to highly constrained in fostering economic development. For instance, the per capita GDP growth of Mozambique and Senegal were equally as large as that of Ghana in 1957, and yet those countries were unable to promote industrial development in the decades that followed.

In fact, casting the net a bit wider, one finds that Nigeria, the Central African Republic, Burkina Faso and Gambia are some of the other countries (there are many more, if one were to list them painstakingly) that had per capita GDP growth rates similar to several of the BRICS economies today, particularly China and India. Given the largely differential developmental pathways of each of these countries, would it suffice simply to bundle their failures under the headings of corruption, state inaction, weak institutions and totalitarianism? Pae (1992), tracing Korea's rise, notes that corruption, political instability or weak institutional infrastructure existed in South Korea as well. In fact, as some other scholars observe, Ghana had more liberal, less-corrupt and less-tyrannical leaders (for example, Ghanaian president Jerry Rawlings) than South Korea in the late 1980s and the 1990s, which was headed by Rhee Syng-man, Park Chung-hee Park and Chun Doo-hwan (Werlin,

1994; Jeffries and Thomas, 1993). Yet Ghana's sought-out developmental trajectory was hard to influence by then. Similar anomalies can be found in comparing Senegal or Nigeria to India, for instance, where despite the current economic successes, the latter country still suffers from issues of corruption. In segregating the experiences of these countries, what seems to matter for successful industrial strategies are not just longer-term visions or the ability to coordinate but also the ability to pool resources for industrial and innovation capacity simultaneously, and to use them in the process of development. There are many developing countries that have managed to synergize industrial and innovation policies, while having the same shortcomings that are advanced as arguments concerning Africa – political vision, corruption or even rent-seeking (Khan et al., 2000).[1] Fundamentally, what stands out that much more than other factors, in the African context, is that technological learning has not been part and parcel of industrialization, and this has impeded the ability of firms to learn, expand and increase productivity in the past.

A second issue for Africa is that African industrialization is much more affected by and perhaps even determined through globalization and the internationalization of trade. These impacts of trade on national industrialization processes call for a more thorough review. Due to the low levels of productivity in many African sectors, trade openness has had devastating impacts on local firms. A large number of these local firms have been subject to a process of natural elimination or pushed into informality, not being able to withstand the pressure of competition from foreign firms (Mahutga and Smith, 2011; IADB, 2010). As a result, an increasing share of African industrial activities actually occur in the informal sectors of the economy, and how these are factored into future policy will remain a key issue for sustainable industrialization. Associated with this is the current debate on the rise of value chains and their impact in terms of concentration of exports into specific categories, leading to a low rate of diversification (Gui-Diby and Renard, 2015) or the movement of labor into productivity-declining structural change. There is a need for more open debate on whether these forms of specialization could have some potential for the creation of linkages and expertise (Morris, Kaplinsky and Kaplan, 2012; Morris and Fessehaie, 2014; see also Kaplan chapter in this volume) and how this could be strategically motivated. Especially, it remains to be seen what options exist to shift or travel between existing product spaces, and what could be the role of policy in promoting such upgrading (Hidalgo et al., 2007). At the same time, there is also a need to understand whether national

policies can play a role in harvesting some gains from existing value chains for local learning and how these gains could be promoted.

A third, somewhat related issue is that African growth and structural change do not seem to follow the traditional pathway from agriculture to manufacturing, but there is a movement toward services as well. In fact, data show that services are the largest sector of the economy in many African countries presently. This calls for a more open-minded assessment of the merits of services growth for African economies, and what the implications of these shifts could be.

Finally, we arrive at the highly nebulous linkages between industrialization and poverty reduction. The classical assumption in this regard has always been that differences in experiences of countries in attaining poverty reduction might be due to their differentials in economic growth rates. However, a growing number of studies indicate that pre-existing inequality plays a crucial role in determining how growth can lead to poverty reduction. In other words, the greater the pre-existing levels of inequality, the more difficult it will be to ensure that economic growth leads to poverty reduction (Fosu, 2011; Adams, 2004; Ravallion, 1997). Drèze and Sen (2013) observe rightly in this context that growth of GDP (among other economic indicators) should generate resources to expand public and private spending on the fundamental requirements of all in society such as health, education and other social necessities that underscore a fuller human life, so that these pave the way for the development of human capabilities for the next generations. It is therefore as important to understand inequality of opportunities as it is to analyze unequal outcomes.

There are some path-defining moments in the history of nations, and although historical accounts may shed some light on why countries are embedded in particular challenges, only developmental choices will play a key role in shaping real-world alternatives. A large number of political scientists argue that alternatives selected at the national level play a smaller role in determining outcomes, but industrial development experiences show otherwise – that outcomes are dictated by the individual choices of nations. Whether to rely on the market, and to what extent, which industries need protection, when to open up markets, how to promote technology transfer and how to leverage the social benefits of industrial growth are all national policy-driven choices. Moving ahead, therefore, there is a need to differentiate the challenges of sustainable industrialization in countries and to calibrate mechanisms and outcomes based on a clear identification of the developmental context of nations and regions.

This book seeks to contribute to this urgent task. The book is organized in three parts. The first part comprises this chapter and a chapter that reviews the MDGs, with lessons for SDGs for the future. The second part delves deeply into the current challenges of African industrialization, whereas the third part raises some relevant issues in linking industrialization to social outcomes. In doing so, the book aims to bring forth the African voice in the debate on the developmental agenda for the future. Almost all of the chapters employ entirely new data sources and new methodologies to shed light on the opportunities and challenges that lie ahead for Africa in the post-2015 era.

1.3 Structure and contributions

The book begins by looking at the MDGs framework, which has had its inherent implementation and monitoring challenges as well as successes, in Chapter 2. It looks at the MDGs from a very specific perspective, namely the complementarities between the MDGs and the overall development of countries. Given the limited number of studies on this topic, this chapter tries to fill an important vacuum in the literature on the subject, using new and interesting methodological tools. It argues that for African countries with scarce resources, it is important to prioritize how resources should be allocated, and this process is only viable when it is based on a clear articulation of the developmental goals and national growth challenges. Looking back at the ways in which the MDGs could have been strengthened by focusing on the complementarity, the chapter analyzes issues in policy prioritization toward the SDGs.

In the African context, while contextualizing the SDGs development agenda, the book argues that a first set of challenges will be to take note of the current drivers of growth and structural change, and to draw relevant conclusions for industrialization. Three chapters (Chapters 3 to 5) each assess the current processes underlying African growth to identify the challenges and opportunities, particularly in terms of progressing into manufacturing and services simultaneously, creating linkages from the natural resources sectors into the local economy and linking global value chains to learning. The second set of challenges relate to making industrialization socially inclusive and equitable. Chapters 6 to 8 deal with specific questions of how industrialization can be made to go hand-in-hand with reduction of poverty and inequality.

1.3.1 Issues particular to African growth and industrialization

Chapter 3 assesses a very important issue confronting African industrialization. African countries, particularly since 2000, have shifted labor into the services sector. On the whole, the trend has been toward less labor concentration in agriculture (which still remains the largest employer), but greater labor toward services (which increased by 12% between 2000 and 2012). This raises two related questions – is Africa bypassing the traditional route to structural transformation and is this sustainable? Or is Africa's increasing role in the services sector a means to channel industrial growth? In this chapter, the authors use empirical data from the African region to show that many of Africa's services are concentrated in low-cost, low-value telecom and other minor retail segments, which offer very little productivity rents. They also indicate that a lot of the expansion is concentrated in the construction sector, rather than training, capacity building or advanced knowledge services. The analysis then moves on to identify the challenges in making the services sector an engine of growth.

Chapter 4 examines linkages from natural resource activities with other sectors of the economy. The chapter outlines these linkages in general, and then, utilizing recently collected data on eight African countries, discusses the potential to expand and deepen linkages, and the policy implications of such a process. The chapter contests much of received wisdom to make the point that while there is considerable variation, in a number of African countries, commodity-producing sectors, notably mining, have considerable linkages with local economic activities, and there is evidence that these are increasing. Moreover, with appropriate policies, the potential to enhance such linkages is significant. The chapter argues that the greatest potential for enhancing linkages is with respect to backward linkages, since developing forward linkages from mineral production (beneficiation) has a much more limited potential. A much-neglected area of study is how skills and competencies move laterally from one sector to another – and, in this case, from mining to other sectors. This chapter traces several pathways by which this occurs and outlines policies that can further promote such movement.

Chapter 5 looks at how current global production networks and value chains, particularly in the natural resources and low-technology sectors, impact industrial growth in the African context. Using the newest data on global value chains for over 50 African countries, this chapter shows that current patterns of trade are, in fact, in the low-technology and natural-resource sectors in most countries. However, the chapter also

shows that innovation policy (or similar emphasis on increasing value-added) in the local national contexts can have much impact on how such business can create learning effects and backward linkages into the local economy. The chapter concludes with several important questions for industrial development for the African region, many of which are explored for the first time in the literature.

1.3.2 Linking industrialization with inclusive development

A second set of challenges for Africa relates to how industrialization can be made to work in favor of inclusive development. In this second part, Chapters 6 to 8 seek to link structural change and GDP growth patterns to social indicators, to assess where the region stands with respect to developmental challenges.

Chapter 6 discusses opportunities and policy options for African countries that are seeking innovation- and learning-based development strategies, with a view to promoting industrialization. What kind of policies and institutions are necessary in order to transform the current increase in rents from commodities exports into industrial investment and upgrading of agriculture and agroindustrial development? This question is raised in the context of competing theories about economic development. On the basis of empirical patterns and theoretical considerations, the chapter discusses policy options in relation to the African reality, so that business and industry relations can be mutually beneficial for the future of the region.

Chapter 7 attempts to decode some of the important issues in industrial development pathways and social outcomes. It takes productive industrial clusters as an embodiment of industrial dynamism, productivity and growth, and explores how these clusters alleviate poverty among employees of cluster-based firms in the current context, as evidenced by an improvement in employee living standards in small- and medium-size enterprises in Africa. Drawing on the concepts of industrial clusters and multidimensional poverty to guide the study, the chapter uses new empirical data collected in the Otigba Information and Communications Technology cluster in Lagos, Nigeria, to understand the nature and depth of deprivations. The chapter uses multidimensional poverty and slum household indicators as standardized measures of living standards to see if these assumptions can be defended in the African context. The results show the need to better coordinate industrial policy with social policy objectives in order to (a) prioritize industrial policy mechanisms that have a greater and faster impact on reducing employment and poverty,

within national economic agendas, particularly industrial policy and (b) provide institutional support through social policy instruments to ensure that their social benefits are harnessed while enhancing industrial productivity.

Finally, Chapter 8 sets out to understand inequality of opportunity in the African context by systematically examining the issue of access to basic services and opportunities for all, within an equal opportunity framework. In particular, it questions how circumstances over which a child has no control, such as ethnicity, gender, parents' education, income and area of residence, affect his/her access to basic services and opportunities (education, clean water, effective sanitation, electricity and habitability), which are necessary for his/her growth and development and which influence his/her prospects for a high standard of living in the future. We calculate an human opportunity index (HOI) for Kenya, Uganda, Nigeria, Ghana, Zambia and Egypt, using demographic and health study data from 2006 to 2008. Our findings reveal that parental education matters with regard to access to electricity, sanitation and education, while area of residence is an important factor in determining access to electricity, water and sanitation. This study is innovative as it applies HOI within the African context and provides a tool for policymakers to assess how to more equitably distribute existing national resources.

1.4 Some caveats

This book argues that sustainable development of countries is a direct result of their achieving dynamic industrialization, of a kind that works for people and holds the key to making their economies independent and responsive to the needs of all citizens. Sustainable industrialization as a key driver of this process is a means of raising living standards and quality of human life. Such industrialization is not just a long-term goal but is also important in the shorter- and the midterm, for business development, entrepreneurship, technological change and growth. If countries are to succeed in eradicating poverty, generating opportunities for their people, fostering business and taking responsibility in devising a sustainable future for all, the starting point would be to promote such sustainable industrialization.

The chapters presented in this book and the analysis therein make a contribution to elaborating upon the key issues in a future developmental agenda for Africa. In most of the chapters, the data and research presented deals directly with sub-Saharan Africa, but the issues analyzed are pertinent to the entire region. While acknowledging that this debate

is perhaps one that needs much more thorough contributions and research in the years to come, the aim of the book and its chapters is to help nudge scholarship and policy thinking in the direction of contextualizing the 2030 Agenda for Sustainable Development for Africa.

Note

1. Khan and Jomo et al. (2000) use the examples of Malaysia, the Philippines, Thailand and Indonesia to show that rent-seeking is endemic both in developed and developing countries and has several positive impacts on the growth process.

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2

Revisiting the MDGs in an African Perspective: Lessons for the Sustainable Development Goals

Olumayokun Soremekun and Banji Oyelaran-Oyeyinka

2.1 Introduction

Fifteen years have elapsed since the declaration of the Millennium Development Goals (MDGs) by the United Nations (UN) in September 2000. The MDGs were signed by leaders of 189 countries, and since 2002 have represented the policy of 192 UN member states. The declaration also set out a number of specific targets that were expected to be met by 2015. Therefore, as a basis for a more detailed structure of the MDGs, 8 goals, 18 targets, and 48 indicators were constructed to constitute the MDGs' framework. Following the UN summit in 2005, this framework was updated to incorporate 20 targets and 60 indicators.

This chapter reviews the MDGs with a view to carrying out a systematic analysis of some of the lessons learned, to enrich the new Sustainable Development Goals (SDGs). While the MDGs have received commendation from several quarters, there have been inevitable criticisms. Two types of criticism seem particularly relevant, moving ahead. The first is the notion of collective targets. The idea that all countries will achieve the MDGs uniformly is in itself at best a misconception. Clearly, countries are at different levels of development and possess different capacities to implement the goals at the level of policy, and this might explain why the MDGs were crafted with different numerical goals. For example, the aim of the poverty goal was to cut poverty in half within 15 years, whereas for infant mortality it is by two-thirds. The difficulty has been in the ways in which some analysts and national-level policymakers have interpreted the goals, presuming that all countries must achieve these same goals at/around the same target date.

A second relevant point has been that the MDGs are not clearly tied to a focus on sustainable development, particularly in the way in which they complement each other. Over time, several studies did set forth guidelines to monitor and assess the progress of the MDGs (Salai-i-Martin, 2006; United Nations, 2008; United Nations, 2011). However, there are few studies on how the MDG goals complement each other. Larson, Minten and Razafindralambo (2006) pointed out that limited empirical analysis exists in identifying the complementarities among these MDG targets. There was also little coordination in the resources and efforts required to implement the goals. For example, for many countries with scarce resources in Africa, trying to achieve all the goals and targets of the MDGs resulted in the countries, unfortunately, not attaining any at all.

Drawing from these two sets of shortcomings of the MDGs, this chapter discusses how the SDGs could be made to reflect these learnings. The proposed SDGs address what the MDGs tend to have omitted, notably, an emphasis on sustainable development, which focuses attention on broader measures of human development as a counterweight to pure economic growth measures (GPD/capita) alone. As with the MDGs, the success of the SDGs should be based on clear and concise measurable figures. While the MDG process has assisted countries in raising the capabilities of national statistics offices through its focus on specific, measurable targets, we need to examine optimum pathways for maximizing the emergent capacity especially of African countries.

However, there is a long way to go for most developing countries in terms of the data needed to measure performance, as many of them lag three years behind. For example, Varad Pande and Molly Elgin-Cossart, both of whom were closely involved with the UN high-level panel on post-2015 development, observed that over 40 developing countries suffered a paucity of useful data for monitoring progress on extreme poverty and hunger (High-Level Panel, 2013). Ironically, countries that suffer high levels of maternal mortality, malaria and tuberculosis often do not have reliable data to track these goals. In this regard, one of the UN Secretary-General's high-level panels suggested a "data revolution" to monitor progress post-2015. One of the ways to do this is to examine the convergence of the goals and how best to maximize the capacity of relatively poor countries after 2015.

But at the same time, the success of the SDGs will depend on identifying what are the precise synergies between the goals that are being set out. This chapter argues that success will depend on the identification of some important goals and their implementation, which will in turn have a cascading overall effect on promoting the other goals. In

an effort to demonstrate this point, the chapter analyzes the synergies and complementary relationships among the MDGs to show the goals that should have been prioritized in order to have had a cascading effect on other goals. This chapter applies the techniques of directed acyclic graphs and partial least squares (PLS) in order to better understand the links between the eight MDGs in the African context.

Given the interrelationships among the goals, it is likely that one economy's/region's competitive advantage in achieving one or more goals may not be another's prerogative. Therefore, our analysis investigates the synergies between the MDGs in order to facilitate the achievement of an effective and efficient best outcome in Africa. We analyze all eight MDGs and the 18 indicators for 48 African countries that represent their corresponding targets (Table 2.1). Our choice of indicators and targets is based on comprehensive data availability. Following a special summit session held by the UN General Assembly in September 2010 to review the progress of the MDGs, other global conferences, notably the Rio+20 conference, and the "World We Want" global debate that was jointly organized by the UN with the civil society helped gather views from people around the world to build a collective vision on priorities for a post-2015 framework.

This chapter examines the synergy between variables. Only a few studies have considered the interdependencies among the MDG goals (Larson et al., 2006; Fielding, McGillivray and Torres, 2005; Wiebe, 2009). Economists have long been aware of the importance of links between the various well-being dimensions and their implications for poverty. Studies have examined ways in which material wealth or the income of a population is linked to standards of education and health, and also to fertility (Becker, 1981). These findings indicate that average standards of education and health are elements of human capital that are likely to determine a region's overall productivity level, and hence its per capita income. However, due to lowering returns to scale, higher fertility and population growth lead to lower labor productivity. Yet, other things being equal, a household's decision about human capital investment and the number of children to produce may depend on its current income level, especially with imperfect capital markets.

For example, Larson et al. (2006) found that poverty reduction, education and drinking water targets are not independent endeavors. These studies show that reducing poverty and improving education will alter household choices related to water access. Improving access to water could lead to the intended result of expanding actual water use by households. Increasing quantities of potable water used by households

for hygienic purposes could then lead to a reduction in under-five mortality rates. Others found that higher levels of sanitation and education are associated with lower mortality rates, and that increasing the net primary enrollment rate is complementary to reducing the under-five mortality rate and to increasing the proportion of the population with access to improved water sources (Fielding et al., 2005; Wiebe, 2009). Given these interdependencies, it is surprising that few empirical analyses exist to identify the complementarities among these MDG targets. This is what the chapter seeks to address, particularly in the face of limited resources in African countries. It is important for governments to realize the need to prioritize actions in the design of policies to achieve the stated targets.

We believe that this analysis is timely and invaluable not only in understanding the progress of the MDGs, especially with regard to Africa, but also in applying lessons for the 2030 Agenda for Sustainable Development. We seek to contribute to the growing literature on the MDGs and the post-2015 debate by examining how Africa can best maximize the gains of the MDGs through the effective prioritization of specific goals of the SDGs.

2.2 MDG progress in Africa

The pledge by all members of the UN to meet the eight MDGs by the year 2015 gave rise to a considerable amount of literature. For example, Hulme (2009, p. 47) regarded the MDGs as a "product of intense political negotiation informed by analytical work," a product of global public policy rather than a result of technical and empirical analysis. Further, he refers to them as the "world's biggest promise," intended to reduce poverty and human deprivation collaboratively. The UN declaration is simple and ambitious. It aims at reducing the poverty rate by half compared to its 1995 level; attaining universal primary education enrollment by 2015; achieving gender equality; reducing by two-thirds the child mortality rate; lowering by three-quarters the maternal mortality rate; fighting HIV/AIDS, TB and malaria; reducing the proportion of people without clean water by half; and increasing global partnership for development (United Nations, 2008).

Progress, or lack of progress, in achieving the MDGs by member countries can sometimes be obscured by a number of factors. Studies by Fukuda-Parr and Greenstein (2010), Leo and Barmeier (2010), Easterly (2009), and Clements, Kenny and Moss (2007) note that the MDGs were unrealistically ambitious for some regions and countries. They are seen as a setup for failure for most sub-Saharan countries because they start

off at a low base, and achieving that goal would be a monumental task. It would take, for example, 41 percentage points, on average, by a low-income country to achieve the MDG goal on education. Easterly (2009) is one of the more consistent critics of the MDGs, particularly with regard to their implications for sub-Saharan Africa. Citing several accounts of the region's "failure" to meet the goals, he points out that the methodology of analysis is problematic and unfair to Africa. He criticizes the benchmark year, linearity of data, absolute versus percentage changes, and the relative nature of targets and indicators as arbitrary and inconsistent across the goals. He goes on to review what he calls a "bias against Africa" in the case of each of the goals, adding that bad press portraying the continent as a failed region does not help Africa's prospects for development. Much of Easterly's (2009) paper is informed by the underlying criticism of international development policy laid out in more detail in his 2006 book.[1]

The emergent consensus is that, given what we now know about the dynamics of global goal setting, SDGs, as with the MDGs before them, should be used more as benchmarks of progress rather than fixating on attaining a specific level of output. Progress should be evaluated by monitoring the implementation at national levels, such as whether the pace of poverty reduction has accelerated along the dimensions of the MDG goals, for instance.[2]

Notwithstanding the divergent perspectives, and given the realities of limited capacity in relatively poor countries, we suggest that countries consider ways in which the convergent goals could be efficiently framed. Clearly there are considerable interdependencies among the MDG and the SDG targets that would lend themselves to such analytical framing. In this chapter we carry out the analysis regarding the impact on the progress of achieving the MDGs as an example of what could be done with the SDGs. Therefore, to identify the complementarities that exist among the MDG targets, we develop the following research questions (RQ):

RQ1. Are there significant positive linkages that exist among the MDG targets in Africa?

RQ2. Based on these linkages, what goals can we identify as priority goals in Africa that would have a cascading effect on other goals?

2.3 Dataset

Our dataset, presented in Table 2.1, represents the official yardsticks set forth by the UN to assess the eight MDGs. The MDGs were officially declared in the year 2000, but for the purpose of our analysis,

Table 2.1 MDGs – selected targets and indicators in our model

Millennium Development Goals (MDGs)	
Goals and targets (from the Millennium Declaration)	**Indicators for monitoring progress**
Goal 1: Eradicate extreme poverty and hunger	
Target 1.A: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	Poverty gap ratio[a]
Target 1.B: Achieve full and productive employment and decent work for all, including women and young people	Employment-to-population ratio
Target 1.C: Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Prevalence of underweight children younger than five years of age
Goal 2: Achieve universal primary education	
Target 2.A: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	Net enrollment ratio in primary education Proportion of pupils starting grade 1 who reach last grade of primary Literacy rate of 15–24-year-olds, women and men
Goal 3: Promote gender equality and empower women	
Target 3.A: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	Ratios of girls to boys in primary and secondary education
Goal 4: Reduce child mortality	
Target 4.A: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality rate Infant mortality rate
Goal 5: Improve maternal health	
Target 5.A: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio	Proportion of births attended by skilled health personnel
Goal 6: Combat HIV/AIDS, malaria and other diseases	
Target 6.A: Have halted by 2015 and begun to reverse the spread of HIV/AIDS	HIV prevalence among population aged 15–24 years
Target 6.C: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Incidence, prevalence, and death rates associated with tuberculosis

(*Continued*)

Table 2.1 Continued

Millennium Development Goals (MDGs)	
Goals and targets (from the Millennium Declaration)	**Indicators for monitoring progress**
Goal 7: Ensure environmental sustainability	
Target 7.C: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation	Proportion of population using an improved drinking water source
	Proportion of population using an improved sanitation facility
Goal 8: Develop a global partnership for development	
Target 8.F: In cooperation with the private sector, make available the benefits of new technologies, especially information, and communications	Fixed telephone lines per 100 inhabitants
	Mobile cellular subscriptions per 100 inhabitants
	Internet users per 100 inhabitants

Note: [a]Poverty gap ratio is defined as the average poverty gap in the population as a proportion of the poverty line.

Source: United Nation (2010) MDG dataset: http://mdgs.un.org/unsd/mdg/Data.aspx. Accessed April 20, 2013.

we examine the years with the most complete datasets available to us (2008–2010). For each country, we average the data for each variable from 2008 to 2010. In order to avoid the elimination of a whole country's data due to missing values of one or two observations, we use multiple imputation models in PASW statistics (SPSS 19) to handle missing values in the dataset, specifically the fully conditional specification (FCS). The FCS is an iterative Markov Chain Monte Carlo (MCMC) method that can be used when the pattern of missing data is arbitrary. For each iteration and for each variable in the order specified in the variable list, the FCS method fits a univariate (single dependent variable) model (linear regression) using all other available variables in the model as predictors, then imputes missing values for the variable being fit. The method continues until the maximum number of iterations is reached, and the imputed values at the maximum iteration are saved to the imputed dataset. The FCS method uses the default number of ten iterations unless otherwise stated. We refer to *PASW Missing Values* (2011) for a detailed description.

2.4 Unraveling the synergies between the Millennium Development Goals and directed acyclic graphs

In evaluating the above objective, we consider the following research questions: What linkages exist between the eight MDGs? How are the goals linked in the African context? In this section, we use directed acyclic graphs (DAGs) and subsequently PLS to attempt to identify and assess the linkages between the MDGs. DAGs allow us to identify potential directions of association (linkages) between variables in our dataset, while also identifying variables that have common antecedents (or latent causes), even if these antecedents are not known or present in the dataset.

DAGs as a technique has been applied in a number of related studies. Haughton, Kamis and Scholten (2006), and Haughton and Haughton (2011) emphasize that DAG modeling is a powerful analytic tool to consider in conjunction with, or in place of, path analysis, structural equation modeling and other statistical techniques. Here we employ DAG modeling in conjunction with PLS. Eshghi, Haughton and Topi (2007) investigated the determinants of customer loyalty among wireless service providers by applying DAGs to derive causal models under restrictive conditions. Similarly, Bessler (2003) and Bryant et al. (2009) used DAGs to sort out causal patterns among sets of measures deemed relevant to the incidence of world poverty and disprove causal relationships using observational data, respectively. It is important to note here that categorically establishing causality relations using DAGs is quite hard, if not impossible, to accomplish given a number of strong assumptions that need to be satisfied (one of which is that the dataset is a causally sufficient set of variables, that is, all causal variables are included in the data). For the purpose of this chapter, though, we expect that DAGs will give us some useful insights into the directed linkages that might exist within the MDG goals. We therefore first investigate the directional relationships among the MDGs in Africa using DAGs. We then build upon the results of the DAGs to estimate structural equation models that will confirm the linkages that we have identified among the MDGs.

Simply put, a DAG is a picture representing the directional links among a set of variables, where the variables are represented by nodes, and the edges represent the conditional dependence among the variables (Haughton et al., 2006; see also Haughton and Haughton, 2011, chapter 5). It is a path diagram that shows the path between variables.

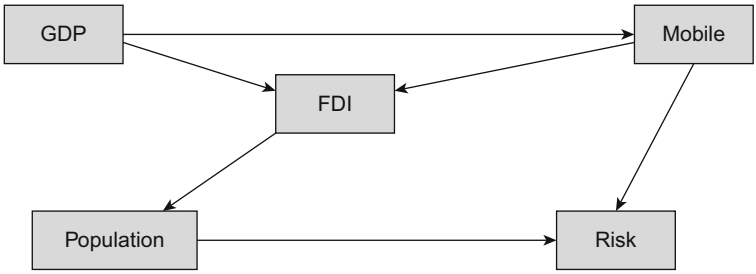

Figure 2.1 DAG pattern by PC algorithm

Consider a set of variables, X, Y and Z. The variables are called vertices in the graph, while the linkages between the variables/vertices are known as edges. The symbols attached to the ends of the edges are called marks. A directional fork, where X is an antecedent of both Y and Z, can be shown as Y ← X→ Z. A graph contains an ordered triple <V, M, E>, where V is a nonempty set of vertices (variables), M is a nonempty set of marks (symbols attached to the end of undirected edges), and E is a set of ordered pairs, where each member of E is called an edge (Bessler 2003; Zhang, Bessler and Leatham, 2006).

Vertices (variables) linked by an edge are considered adjacent. Given a set of vertices, {Primary Education (P.E), Water (H2O), Sanitation (SAN)}, an undirected edge, that is, P.E–H2O indicates that either variable causes the other or they share a common latent cause or both. A directed edge, that is, H2O → SAN, represents an edge where water has a directed effect on sanitation. A DAG is different from a directed graph in that it has no directed cyclic paths. That is, a DAG has no path that leads away from a variable only to return to that same variable.

An example of a DAG is in Figure 2.1. A directed edge from gross domestic product (GDP) to Mobile indicates that GDP is an antecedent of Mobile.

For each DAG, a set of conditional independence relations is associated among the variables in the dataset. Let $V_1 \ldots V_n$ be the set of variables in the dataset and let antecedent (V_i) represent the set of antecedents of each variable V_i, that is, variables with an arrow leading directly to each V_i. A DAG represents conditional independence relations f among the variables:

$$f(V_1 \ldots V_n)\ \prod_{i=1}^{n} (V_i | antecedent\ (V_i)) \qquad (1)$$

where on the left hand side, f is the probability of events for each variable $V_1, \ldots V_n$ and on the right side, each term represents the conditional probability distribution function of each variable V_i given its antecedents (Bessler, 2003; Eshghi et al., 2007; Haughton et al., 2006; Zhang et al., 2006; Haughton and Haughton, 2011). This implies that each variable is dependent only on its immediate antecedents (Pearl, 2000). For a simple example of DAGs (adapted from Haughton and Haughton, 2011), consider three variables {Primary Education (P.E), Water (H2O), Sanitation (SAN)} and three cases:

1. $P.E \rightarrow H2O \leftarrow SAN$: Primary education is linked to water and sanitation is linked to water, but primary education and sanitation are not directly linked, that is, they are unconditionally independent because water blocks the paths from primary education to sanitation. Water in this case is a collider, and we can only infer that primary education and sanitation are dependent given water.
2. $P.E \leftarrow H2O \rightarrow SAN$: In this case, primary education and sanitation have a common cause – water. This implies that they are not independent. If we condition on water, though, then primary education and sanitation are independent given water.
3. $P.E \rightarrow H2O \rightarrow SAN$: Primary education and Sanitation are independent if we condition on water. Water is dependent on primary education, while sanitation is dependent on water, but primary education and sanitation are independent.

We can also consider a simple illustration of Equation (1) above using case 2. We can verify that primary education and sanitation are independent if we condition on water:

$$P(P.E, H2O, SAN) = P(P.E|H2O)P(SAN|H2O)P(H2O)$$
$$= P(P.E|H2O)P(SAN, H2O).$$

However, by the definition of conditional probability, $(A|B) = \frac{P(A \wedge B)}{P(B)}$, we have

$P(P.E, H2O, SAN) = P(P.E|H2O, SAN)P(SAN, H2O)$, where $P.E$ denotes A and $H2O$ and SAN *denotes* B.

Therefore, $P(P.E|H2O, SAN) = P(P.E|H2O)$.

Thorough introductions and discussions of the DAG methodology and case studies can be found in a variety of papers (Pearl, 2000; Bessler, 2003; Haughton et al., 2006; see also Haughton and Haughton, 2011, chapter 5).

2.5 Directed acyclic graphs using TETRAD

The software package TETRAD IV (TETRAD Project, 2012) is used in this analysis to construct DAGs from data. Tetrad IV provides a number of different search algorithms, which allow us to determine the directional linkages between variables in a dataset. Most of these search algorithms are based on underlying assumptions about the structure of the data. Such assumptions include (i) normality of the dataset, that is, the distribution of each variable is normal, and (ii) if the dataset consists of continuous variables, it is assumed that the causal relation between any two variables is linear. TETRAD indicates that many of the different search algorithms often succeed even when these assumptions do not strictly hold. TETRAD allows us to investigate and discover these linkages between variables, but we cannot categorically infer that we can establish causality, which requires strong assumptions that in most cases are impossible to satisfy. One such assumption is that the set of variables is a causally sufficient set of variables, that is, all the causal variables are included in the dataset. In most cases it is impossible to truly determine this. The program is given no prior knowledge or hypothesis about which variables are causes or which are effects, and thus the results are driven by the structure of the data. TETRAD IV can be accessed at no cost from http://www.phil.cmu.edu/projects/tetrad.

TETRAD contains a suite of different search algorithms such as the PC (Partial Correlation), GES (Greedy Equivalence Search), PC Pattern, PCD algorithms, and so forth. For the purpose of our study, we focus on the PC algorithm because, in the absence of theory, we need guidance to potential directed links among the variables to enable us build a SEM model. Other algorithms are conservative with respect to providing directed links (Bessler, 2003; Zhang et al., 2006). The PC algorithm begins by creating a complete undirected graph, where each variable represents a vertex, and undirected edges connect all the variables. Edges between the variables are removed on the basis of significance tests of zero correlation or zero conditional correlation (Haughton et al., 2006; Zhang et al., 2006; Haughton and Haughton 2011, chapter 5). The undirected edges that remain in the graph are now "directed" by taking each triplet x, y, z, where pairs (x, y) and (y, z) are linked but (x, z) is not linked. Conditional

correlation is tested, and if y is not a part of a set of variables, which, when conditioned on, make x and z independent, then the triplet *x*, *y*, *z* is oriented as $x \rightarrow y \leftarrow z$, and *y* is identified as a *collider*.

After identifying all colliders for all triplets, the algorithm proceeds by looking at triplets x, y, z with a directed edge between x and y, that is, if $x \rightarrow y$, where *y* and *z* are linked but *x* and *z* are not linked. If there is no arrowhead at y from z, then (*y*, *z*) is oriented as $y \rightarrow z$. Thus the final link between the triplet would be constructed as $x \rightarrow y \rightarrow z$ (Eshghi et al., 2007; Haughton and Haughton, 2011, chapter 5). The algorithm is discussed in further detail in Spirtes et al. (2000). Studies have identified that the PC algorithm may make mistakes of edge inclusion and edge direction, especially with small sample sizes (Demiralp and Hoover, 2003; Spirtes et al., 2000; Zhang et al., 2006). However, Sprites et al. (2000) suggest that higher significance levels may improve performance for small sample sizes. They argue, however, that edges that are included at the lower significance levels can be regarded as conservative. Despite our small sample size, we chose to use the lower significance level of 0.1 so that we can trust the edges that are included in the DAG model.

2.6 Partial least squares

PLS models are often visualized by drawing a path diagram, which consists of boxes and circles that are connected by arrows. Figure 2.2 shows an example of a simple path model. Measured variables are represented by a rectangular or square box, while latent or unmeasured factors are represented by an ellipse. A single-headed arrow is used to define a directed relationship in the model, while double-headed arrows indicate covariances or correlations between the two variables without a causal interpretation.

PLS models include and assess both a structural model and a measurement model in the same analysis. The structural model reflects the assumed causation among a set of dependent and independent constructs, while the measurement model shows the loadings of observed items on their expected latent variables. This results in a more rigorous analysis of the proposed research model and thus provides results with regard to the extent to which the research models are supported by the data.

In PLS, we must specify a model before we can start the analysis. The model specification is usually guided by a combination of theory and empirical results from previous research. For our purposes, our model is based on the results of the DAG analysis. The PLS process consists of two sequential analyses – the measurement model and the structural

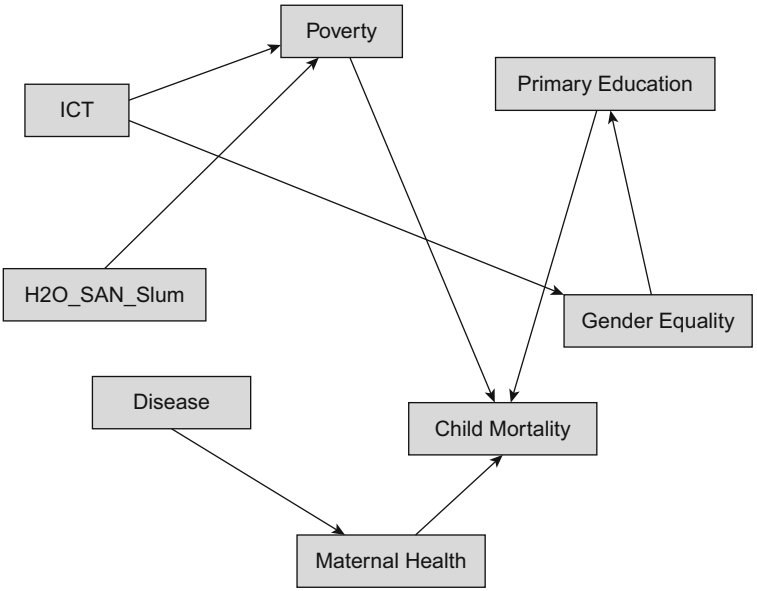

Figure 2.2 PC DAG model

model. The first step is to validate the measurement model by representing the relationship between the model's constructs and their indicators. The next step is to perform a path analysis to determine the fit of the structural model by determining the relationships between the latent constructs (Kline, 2005). PLS was chosen because it is more robust, with fewer identifiability issues. See Pavlou and Gefen (2004) and Hair, Ringle and Sarstedt (2011) for a more detailed discussion of identifiability issues. Sample size requirements are less demanding (in our case, we have 48 countries), nonnormal data are acceptable and PLS is valuable in the analysis of large complex models (Pavlou and Gefen, 2004). PLS is appropriate for both formative and reflective models. PLS is also viewed as more appropriate for exploratory work in which theory is less developed. Specifically for our purposes, we chose to use PLS because of the sample size, formative constructs and exploratory nature of our model. The PLS algorithm will be discussed in more detail in the next section.

One important point to consider here is the use of the PLS for causal interpretation. The PLS model can be used to identify linkages between constructs, which can in turn lead to an interpretation of the final

model as a causal model. We should be cautious that correlational data and identifying directions of association do not imply causality. We can assume that we have identified directions of association and that the PLS model has been corroborated by the data, but we have not established causality.

The two methodologies – DAGs and PLS – enable us to determine whether linkages exist between the MDGs. Our first approach is to estimate a DAG using TETRAD. Since TETRAD is given no prior knowledge or hypothesis about which variables are potential causes or which are potential effects, the results will be driven by the structure of the data. The directional links that we find between different pairs of goals will be used to build the PLS. The PLS model specifications are guided by our empirical results from the DAG estimation. This enables us to answer our research question of whether there are positive and significant linkages that exist among the MDG targets in Africa and in so doing identify which goals can be prioritized by African countries. In the case in which we have an undirected link, we can try both directions in a PLS model and see which link is more viable.

PLS path modeling is a component-based approach to structural equation modeling that was originally developed by Wold (1975). Unlike covariance-based path models, which attempt to reproduce the covariance matrix, PLS aims to maximize the amount of variance observed within the dependent variable that is explained by the independent variables (Haenlein and Kaplan, 2004). Instead of estimating the measurement and structural models simultaneously, PLS follows a two-stage approach. In the first stage, the algorithm estimates the latent constructs' scores in the measurement model through a four-step iterative process.

The second stage calculates the final estimates of the outer weights and loadings as well as the structural model's path coefficient using the ordinary least squares method for each partial regression in the PLS model (Tenenhaus et al., 2005; Hair et al., 2011). The path-modeling process is called partial because the iterative PLS algorithm estimates the coefficients for the partial ordinary least square regression models in both the measurement models and the structural model.

Model evaluation and assessment in PLS follows a two-step process that involves separate assessments of the measurement model and the structural model. We examine the measures' reliability and validity according to certain criteria as a first step. It is important to determine that the measures represent the constructs of interest. If the measures prove to be adequate, then the second step involves an assessment of the structural model estimates.

Hair et al. (2011) argue that there is a need to distinguish between reflective and formative measurement models in order to evaluate them. While reflective measurement models can be assessed using traditional statistical evaluation criteria, this is not the case for formative models. Formative measurement models are judged by examining the weight and loading of each indicator (Hair et al., 2011). Bootstrapping allows for testing the significance of an indicator's loading and weight on its construct. When both weight and loading are significant (critical t-value for a two-tailed test at the 5% significance level is 1.96), there is empirical support for the indicator's relevance in providing content to the formative index. However, if both weights and loadings are nonsignificant, there is no empirical support to retain the indicator.

To assess the structural model's explanatory power, we consider the R^2 measures and the level of significance of the path coefficients. The goal of the PLS approach is to explain the variance in the endogenous latent variables. This suggests that the level of R^2 should be high. The judgment of what level of R^2 is considered high depends on the specific area of research. R^2 values of 0.2 are considered high in areas of research such as consumer behavior, while 0.75 is high for success driver studies. In marketing research, 0.75, 0.50 or 0.25 can be described as substantial, moderate or weak respectively. For the purposes of our study, we adopt the guidelines from marketing research.

PLS also uses bootstrapping to test the significance of the estimated coefficients. PLS applies nonparametric bootstrapping, which involves repeated random sampling with replacement from the original sample to create a bootstrap sample to obtain standard errors for hypothesis testing. The procedure creates a large number of bootstrap samples by randomly drawing cases with replacement from the original sample (e.g., 5,000 samples). Each bootstrap sample should have the same number of cases as the original sample. The PLS algorithm estimates the PLS results from each bootstrap sample (e.g., 5,000 PLS estimations). The resulting path model estimations form a bootstrap distribution, which can be viewed as an approximation of the sampling distribution. Standard errors of each measurement item can then be computed from the generated collection of samples. A t-test can be performed to measure the significance of path model relationships. Critical t-values for a two-tailed test are 1.96 (significance level of 5%). The effectiveness of the bootstrap depends on the sample being representative of the population (Hair et al., 2011).

For the purpose of our analysis, we use the SmartPLS software to analyze the PLS model, which is available for free at http://www.

smartpls.de (Ringle, Wende and Will, 2005). SmartPLS is stand-alone software specialized for PLS path models. SmartPLS supports bootstrapping methods and also allows for the specification of interaction effects. Extensive discussions of the PLS algorithm can be found in Tenenhaus et al. (2005) and Hair et al. (2011).

2.7 Analysis and results

The time period under consideration for our analysis is 2008–2010. We transformed each of the variables with the natural logarithm to ensure we satisfy normality requirements. TETRAD tests for normality using the Kolmogorov Smirnov test. All transformed log variables were found to be normal at the 5% significance level. We begin our analysis by using the PC algorithm in TETRAD IV on our dataset. Zhang et al. (2006) suggest that higher significance levels may improve performance at small sample sizes. Despite our sample size of 48 countries, we analyze results for the PC algorithm at the 10% significance level. The graph that is produced using the PC search algorithm is the algorithm's estimate of the dependency structure that generated the data (TETRAD Tutorial, 2012). It is important to remember that the resulting DAG that is produced is data driven without a priori knowledge of the directed links among the MDG goals.

The PC algorithm yields a DAG graph that only has directed edges (Figure 2.2). Primary education, poverty and improvement of maternal health all have directed edges leading into child mortality. Water and sanitation (H2O_SAN) and ICT have directed effects on poverty. Achieving gender equality has an edge leading to universal primary education, and combating disease has an edge that goes into improving maternal health.

TETRAD has enabled us not only to deduce the existence of these directional links but also to identify pairs of goals that are linked to each other or dependent on each other, given all the goals within the MDG goals framework. This is only the first step in our analysis. The second step is to confirm these linkages using PLS. The PLS model to be estimated is displayed in Figure 2.3. We estimate a formative model for our latent constructs. That is, MDG goals represent composite variables that summarize the common variation in a collection of indicators. Specifically, the causal action flows from the independent variables (indicators) to the composite variable. As an example in our model, the ICT goal has three indicators – mobile subscriptions, fixed telephone lines and Internet users. If the number of Internet users increases, then

the level of the ICT goal increases, even if the number of mobile subscriptions and fixed telephone lines remains the same. An increase in the ICT goal does not imply a simultaneous change in the other indicators.

2.8 Partial least squares results and analysis

The initial linkages between the MDGs from our earlier analysis of the DAGs are further analyzed using SmartPLS. A PLS model (Figure 2.3) is used to test the DAG model (Figure 2.2). We examine the estimated links between the goals in the PLS model. HIV/AIDS had a path leading to skilled health births with a path coefficient of 0.283. This implies that high prevalence rates of HIV and TB would have a positive effect on skilled health births. This result is not expected, as it does not make sense. We checked the relationship between HIV and skilled health births using a scatter plot. We found outlier countries, such as South Africa and Botswana, which had high rates of disease with high rates of HIV and TB while on the other hand having a high rate of maternal health with a high number of skilled health births. Southern African countries have an HIV epidemic, but they are also much more developed than other African countries in terms of the other MDG goals and indicators (Deichmann et al., 2013). We also checked the significance of the link and found it to be insignificant. Given that none of the other goals have a link into the HIV construct, we choose to eliminate it from the model and see if its exclusion makes a significant difference to the model. Our

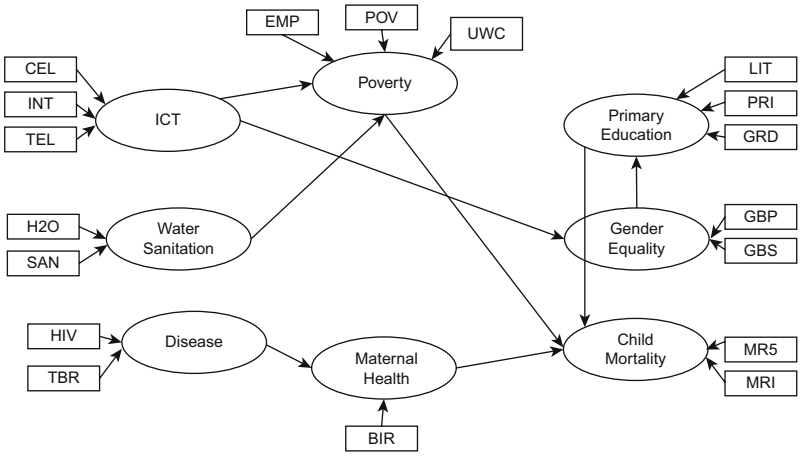

Figure 2.3 Research model

results indicate that the model results remain unchanged. We thus decide to keep the new model, which does not include the HIV/AIDS construct (Figure 2.4). Figure 2.4 shows the weight of each indicator on the link for the appropriate latent construct, and the R^2 values for each endogenous variable are located in the middle of each construct. The figure also shows the estimated path coefficients for each link between constructs.

We examined the loadings of the indicators. We found that all the loadings of all indicators on their respective constructs were significant, with the exception of the skilled health births indicator on the skilled health birth construct (Table 2.2 – the skilled health birth construct has only one indicator).

The model finds a positive link between ICT and gender equality, with a coefficient of 0.5. This is a strong indication that an increase in ICTs positively influences gender equality in primary and secondary school enrollments and that an increase in gender equality positively influences school enrollments. Younger generations are particularly high adopters of the Internet, especially through their mobile phones. Higher adoption of ICTs leads to a higher awareness, particularly in populations that have traditionally suffered exclusion in these communities, such as women. There is a higher awareness of the girl child's right to education and also an awareness of the ability to access information that was largely unavailable before. ICT can itself be a goal to be achieved, but it can also be used as a tool to achieve other goals.

Based on our model, we see that primary education has a negative effect (–0.4) on child mortality rates, while poverty has a positive effect (0.4) on child mortality rates. This implies that higher levels of education ultimately reduce infant mortality and higher levels of poverty increase child mortality. ICT and availability of water and sanitation also have negative effects on poverty, with –0.4 and –0.5 respectively.

According to recommendations in the literature on this point, a bootstrapping procedure using 5,000 sub-samples was performed to evaluate the statistical significance of each path coefficient. Table 2.3 shows estimated path coefficients along with their bootstrap values and T values. All paths are significant, with the exception of the effect of skilled health births on child mortality, which had a path coefficient of –0.165 and a t-statistic of 1.1905. This is surprising, as one would expect that higher skilled births would have a significant effect on child mortality because over 70% of all child deaths occur in Africa and Southeast Asia (WHO, 2012). Closer examination reveals that globally, the leading causes of child mortality include pneumonia, preterm birth complications, diarrhea, birth asphyxia and malaria. We note that 96%

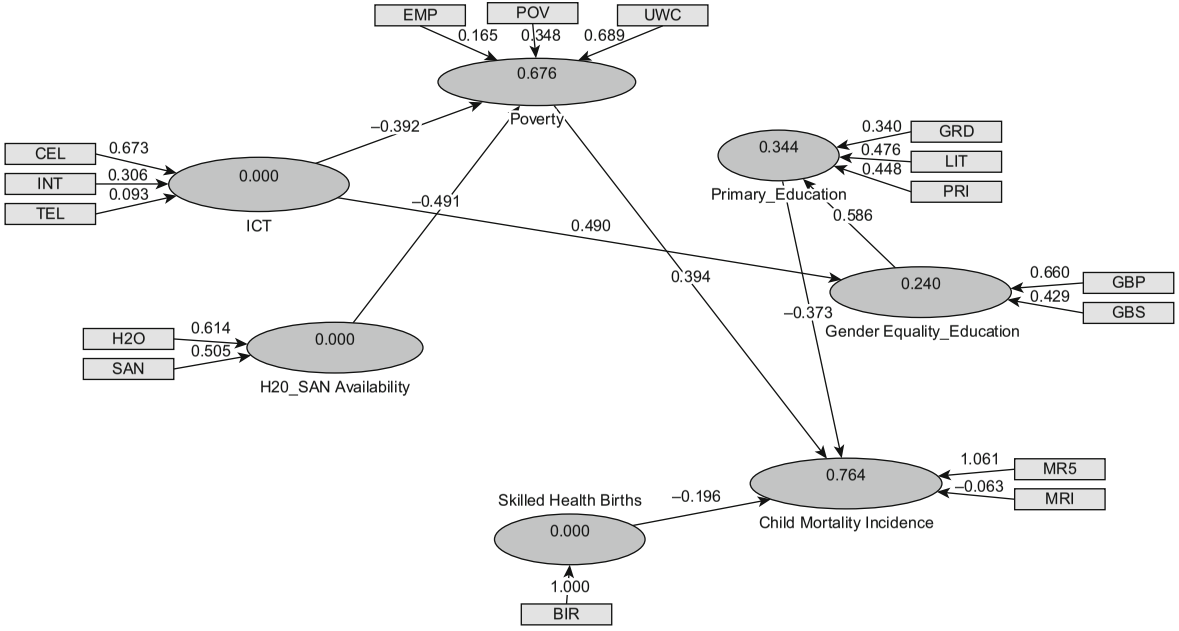

Figure 2.4 PLS formative model

Table 2.2 Indicator loadings and bootstrap results

Outer loadings	Original sample (O)	Bootstrap sample mean (M)	Bootstrap standard error (STERR)	Bootstrap T statistics (|O/STERR|)
BIR → Skilled Health Births	1	1	0	0
CEL → ICT	0.9667	0.9358	0.0592	16.3168
EMP → Poverty	0.6362	0.6204	0.1226	5.1904
GBP → Gender Equality_Education	0.9484	0.9184	0.0841	11.2795
GBS → Gender Equality_Education	0.873	0.8269	0.1696	5.1473
GRD → Primary_Education	0.6634	0.6505	0.1399	4.7427
H2O → H2O_SAN Availability	0.914	0.9135	0.0505	18.0997
INT → ICT	0.8777	0.8682	0.0562	15.6081
LIT → Primary_Education	0.8439	0.83	0.0649	12.993
MR5 → Child Mortality Incidence	0.9999	0.9957	0.0061	163.2961
MRI → Child Mortality Incidence	0.9651	0.9625	0.0315	30.6727
POV → Poverty	0.7359	0.73	0.0727	10.1163
PRI → Primary_Education	0.832	0.817	0.0809	10.2903
SAN → H2O_SAN Availability	0.8699	0.8489	0.0861	10.0987
TEL → ICT	0.8621	0.8576	0.0574	15.0165
UWC → Poverty	0.9276	0.9223	0.0329	28.1737

Table 2.3 Path coefficients with bootstrap values, T values

	Original sample (O)	Bootstrap sample mean (M)	Bootstrap standard error (STERR)	Bootstrap T statistics (|O/STERR|)
Gender Equality_Education → Primary_Education	0.5864	0.6225	0.0863	6.7932
H2O_SAN Availability → Poverty	–0.4915	–0.4676	0.1365	3.5999
ICT → Gender Equality_Education	0.4899	0.5193	0.1091	4.4891
ICT → Poverty	–0.3917	–0.4334	0.1338	2.9273
Poverty → Child Mortality Incidence	0.3939	0.4022	0.1314	2.9974
Primary_Education → Child Mortality Incidence	–0.3729	–0.382	0.1137	3.2812
Skilled Health Births → Child Mortality Incidence	–0.1963	–0.1848	0.1368	1.4351

of all under-five deaths due to malaria worldwide occur in the African region (WHO, 2012). In the African region, a relatively modest proportion (30%) of child deaths occurs during the neonatal period (less than 28 days of life). This may explain the insignificant effect of skilled health births on child mortality in Africa. In order to reduce child mortality in Africa, a major objective should be the elimination of malaria. Given

that none of the other goals have a link into the Skilled Health Births Construct, we eliminated it from the model to see if its exclusion makes a significant difference to the model. Our results indicate that the model results remain unchanged. We chose to include the skilled health births construct in the model, as its inclusion enhances our discussion and opens up contexts that would otherwise have gone unnoticed.

An analysis of the R^2 values for the endogenous variables is done in order to evaluate the structural model's explanatory power. The model explained 68% of the variance in poverty, 34% of the variance in primary education, 24% of the variance gender equality and 76% of the variance in child mortality. The R^2 values for poverty and child mortality can be described as substantial, while the R^2 values for primary education and gender equality are weak.

One of the objectives of our study is to identify both linkages and priority goals. Based on the path coefficients of our links, we find that an investment in ICTs has an effect on both lowering poverty (–0.4) and increasing gender equality in education (0.5). This effect of ICT on gender equality also implies a positive effect on primary education (0.6). Lowering poverty rates in turn has an effect on lowering child mortality rates, as our model currently indicates that high levels of poverty translates to high levels of child mortality incidence (0.3). Therefore, we can identify ICT as a priority goal for African countries based on the paths from ICT that we have identified in the PLS model. An increase in ICT translates into significant effects on other MDG goals.

2.9 Learning from the MDGs to optimize the SDGs

This chapter fills an important gap in analyzing the interdependencies between the goals, but the more important objective for our purpose is how to optimize the lessons for the SDGs.

This chapter provides systematic analytical examination of the synergies between the MDGs in an attempt to provide a framework for a better policy and operational system for the emergent SDGs. Although officially, we must await the final determination of the General Assembly (GA) when the governments of member states finalize agreement on the SDGs in September 2015, over the past two years and more, the broad outline of the SDGs has emerged and has taken good shape. To be sure, there is an explicit agreement to keep the underlying philosophy of the MDGs, namely that they be clear, concise, time bound and measurable. In addition, given the focus of the SDGs that emphasizes production and sustainability, this chapter provides a framework that will assist

developing countries in getting the best out of the new development agenda as the focus shifts from a donor assisted to national ownership.

To recall, there were 8 MDGs, and for the SDGs, the High-Level Panel recommended 12 Goals, while the Open Working Group final report recommends 17 "Focus Areas" that broaden the agenda of the previous framework, such as cutting poverty in half and issues of peace, stability, human rights and good governance. However, the distinctive character of the SDGs is the emphasis on sustainable production and consumption, as exemplified by Goal 12, "Ensure sustainable consumption and production patterns."

To underpin the Goals synergy that we examined in this chapter and to attain the SDG sustainable production objective, there is a need to pay greater attention to the quality of implementation of the targets, unlike the MDGs, which focused on quantity, as the SDGs advocate, given the growing competitiveness of the global economy. For example, if we are focusing on education, the imperative would be to ensure good quality educational institutions for secondary and tertiary education, rather than on ensuring higher enrollment rates, as was the case in the MDGs framework. For the poor and emerging economies to overcome endemic poverty, greater autonomous industrial capabilities would be required at the domestic level, and the SDGs in our view correctly focus on the quality of education – of learning – and the role of education in achieving human agency in an inclusive world: "education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development." We therefore conclude that the SDGs will rely on and continue to put a high premium on information and knowledge creation that is data driven.

Our analysis also shows the real and potential interlinks among the various goals and targets.

By employing DAGs and PLS modeling to investigate these linkages between the eight different MDGs, we investigated the existence of these links over a three-year period (2008–2010). The review shows, for instance, that the achievements of poverty reduction and education goals are not independent endeavors. Our analysis reinforces the argument that the goals are synergistic in general. For example, we find that reducing poverty and improving education will alter household choices related to a basic need such as water access. While our results also indicate a link between improving household choices related to water access and sanitation, and the reduction of poverty, we find that increasing the

availability of water has an effect on reducing poverty. There are other studies that corroborate our findings, for example, that higher levels of education are associated with lower child mortality rates (Fielding et al., 2005; Wiebe, 2009). These results agree with our findings that indicate that primary education has a negative effect on the incidence of child mortality, meaning that poor investment in the most basic education is related to human well-being exemplified by higher weights at birth.

We find that within the African context, advances in digital development, that is, the ICT goals, Internet users, cell phone subscribers and telephone lines, had a positive effect on gender equality, that is, the ratio of boys to girls in primary and secondary schools. This is a strong indication that investment in ICTs influences both school enrollments and also gender equality in school enrollments. We also found that primary education had negative effects on child mortality rates, that is, reduced child mortality rates. Equally, poverty in African countries is closely related to child mortality. Higher levels of education ultimately lead to less hunger and reduced infant and maternal mortality. We therefore identify closing the digital divide as a major goal to be achieved in itself, but it is equally an important tool for achieving the other developmental goals.

Given the innovative nature of this analysis with regard to the global goal-setting exercise in the African context, we have highlighted the linkages between goals and identified priority MDG goals and progress paths (from ICT to poverty and then from poverty to child mortality) for Africa using, for example, PLS, but our study goes a step further by applying a more holistic approach to considering the linkages between all the goals.[3] Based on the approach elaborated here, we find the existence and significance of links by examining all the goals simultaneously rather than pairs of goals (Poverty and Education, Mortality and Education), as had been the case in previous studies. The methodology enabled us to go beyond identifying linkages between the goals to identifying paths that lead from one to goal to other subsequent goals. For example, we identified a path from ICT to poverty, and then from poverty to child mortality. We equally identified a second path from ICT to gender equality, and then from gender equality to primary education.

We propose that this methodology or its modified form should engage with the new Goals to assist African countries and at the broader level to apply the technique to other developing regions. This exploratory research establishes an important foundation for larger studies and gives

us the basis for better understanding how the different goals can be integrated to achieve the SDGs.

Going forward with the SDGs, we suggest that collective goals should not necessarily be set for all countries; otherwise, we are likely to inadvertently misinterpret national-level performance. We suggest that the 2030 Agenda for Sustainable Development should guard against this unrealistic expectation. In other words, the SDG goals, as with the MDGs, should be regarded as a global framework rather than as must-achieve goals for individual countries.

Notes

1. *The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done So Much Ill and So Little Good*, New York: The Penguin Press, 2006.
2. See Fukuda-Parr and Greenstein, 2010.
3. Previous studies have examined linkages between the MDG goals using regressions (Fielding et al., 2005; Larson et al., 2006; Wiebe, 2009).

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3

Challenges to and Opportunities for Structural Transformation: Africa's Service Sector

Padmashree Gehl Sampath and Donatus Ayitey

3.1 Introduction

The growing importance of services in the growth process of Africa has been a subject of considerable policy debate in the last decade. At first, the discussion was narrowly centered on the expansion of the services sector, but more recently, the focus has no longer been about whether the services sector is outgrowing other sectors in Africa but rather how sustainable the growth of the services sector is and whether it can contribute to the overall economic development of African countries (Young, 2012; McMillan and Harttgen, 2014; Rodrik, 2014a).

Such reflection is timely given that Africa has shifted large parts of labor to the services sector in the past three decades (see de Vries, Timmer and de Vries, 2015). Studies on the topic have viewed the services growth story as an "either-or" conundrum: one where the shift from agriculture to manufacturing (the traditional route) is considered the advisable option as opposed to a move from agriculture to services as the not-so-advisable path to undertake. Contrary to such academic deliberations, evidence seems to indicate that the shift from agriculture to services has not been the result of a keen, consensual choice of countries, particularly in Africa. Rather, movement of labor has been guided largely by employment possibilities (particularly for the low skilled in sectors such as construction), urbanization and the difficulties faced by the manufacturing sectors as a result of the crowding out of markets due to competition from emerging economies such as China, and to an extent, India.

While the shift of labor into services has generally been regarded as a positive development, concerns remain as to whether this form of structural change is growth reducing (shifting labor into less productive and informal activities in the services sector) rather than growth enhancing (see McMillan and Rodrik, 2011). Given the relevance of this question to sustainable economic growth and development, this chapter provides an empirical assessment based on two questions. Can Africa's route to structural transformation be defined by a progression to manufacturing and services? Accomplishing this is not just a task of moving labor to the services sector, but it also calls for ensuring that the services growth is productivity enhancing and sustainable. The chapter deals with this as its second question: are the current trends of services-led growth sustainable so that the sector can be a means for channeling industrial growth? The chapter relies on datasets drawn from UNCTADSTATS and the World Development Indicators (WDI) databases to investigate these questions.

3.2 Services-led growth: a brief summary of existing perspectives

Analysts have relied on theoretical insights from the industrial development literature to analyze economic growth and development, including the role of the services sector (Todaro and Smith, 2012). In fact, in early theories on economic development, which date as far back as the 1950s, structural transformation was conceptualized as a shift of labor from the traditional agricultural sector to a modern industrial sector to attain improved productivity growth in the latter (see Lewis, 1954).

As a result, theoretical models on industrial-led growth that have received much attention and been well researched in the last six decades, have focused mostly on growth driven by reallocation of resources away from agriculture to manufacturing as the source of real growth. These studies have often relegated the services sector to being a "residual sector", as a result of which there has not been that much interest accorded to research in and development of models on services-led growth. For example, Fuchs (1968) notes that, despite the enormous growth and economic contribution[1] of the services sector to the US economy as early as the 1950s, research interest in the area was not a priority. This two-sector classification of economies as agricultural and industrial sectors has resulted in a paucity of knowledge not only on whether the services sector could be a sustainable source of

growth over time for countries, but also on what policy strategies could be appropriate to harness these beneficial impacts.

Despite this, there is some underlying consensus on key facets. The first of these concerns the definition of services. A service is "a change in the condition of an economic unit that results from the activity of another economic unit" (Hill, 1977, p. 336). Further, services must be consumed, as they are produced based on the notion that a service cannot be kept or stored like a physical good. Finally, as Griliches (1992) states, services are "non-tangible and non-commodity: everything except agriculture, mining, construction, and manufacturing" (p. 6).

In earlier decades, the lack of good techniques to measure services expansion and growth was also attributed to a lack of data on the topic. However, since the1990s, this has changed. Many countries now have large services sectors, especially emerging economies, including India, Brazil and Chile and a wider variety of services data are available. This has been accompanied by studies that espouse different views on whether and how services can be an engine of growth and structural transformation. Three viewpoints on services-led growth are of relevance here. The first viewpoint is that services-led growth is likely to become the third industrial revolution, given that the first industrial revolution was attributable to growth that was agriculture-led and the second was manufacturing-led (Blinder, 2007). Studies concur that this may well be occurring because "globalization and electronic communication" are leading to a gradual relocation / offshoring of services to other countries with larger service bases (such as India) that are likely to exploit their comparative advantages in services to usher in sustainable service-led economic growth (see Ghani, 2010).

The second viewpoint is that services-led growth cannot be as self-sustaining as manufacturing-led growth, which provides a broader base for employment and productivity. The argument here is that, as opposed to manufacturing that provides employment to people with low-, medium- or high-level skills in an economy, highly productive services rely on skill-intensive resources. As a result, it fails to provide employment and wage opportunities regardless of the level of skills base in ways that manufacturing does, thereby limiting the ability of developing countries to exploit opportunities across tradable services (see Rodrik, 2014b). As a result, experts argue that services-led growth is self-sustaining only if developing countries can develop sophisticated knowledge infrastructure, including a highly skilled labor force that enables them to operate within high-wage, skill-intensive and highly productive service subsectors such as computer and information technology services, as well as

banking and financial/ business services. If not, the services sector may have the undesired effect of moving labor into unproductive sectors of the economy.

The third viewpoint seeks to walk the middle ground. Acknowledging that developing countries have constraints in knowledge infrastructure, studies argue that in order for services-led growth to be sustainable, it has to be complemented by growth in the manufacturing sector (see Hansda, 2005). Here, the role of services in industrial or manufacturing activities is considered as crucial. The importance of industrial activities as drivers of services-led growth is also underscored.

3.3 Theoretical and empirical review of services-led growth

The differential treatment of services, and its contribution to growth, is also reflected in the empirical studies, wherein econometric models have since long followed the two-sector classification of economic development (industrial and agriculture) as discussed in the previous section.

The need to move beyond two-sector models in recent times, has led to the development of multisectoral theoretical models in which structural transformation has been defined as "the state in which at least some of the labor shares are changing over time for some sectors" (Ngai and Pissarides, 2006, p. 471). These multisectoral models account for different types of development paths and are consistent with the 1) traditional view that sees structural transformation as shift of labor from agriculture to industry, and 2) more heterodox views that see structural transformation as shifts of labor among sectors, including the services sector, to achieve higher productivity growth and economic development.

Although the desired outcome of a services boom is to leverage its growth-enhancing effects, the expansion of the services sector can have reverse impact. That is, it can be growth reducing if labor shifts into less-productive sectors. Hence, there is a need for proper theoretical classification and definition of services sub-categories.

Among these, although some empirical studies have focused on structural change in developing countries, including sub-Saharan Africa (see Timmer and de Vries, 2015; McMillan and Harttgen, 2014; Badiane, Ulimwengu and Badibanga, 2012; Isaksson, 2009; Brown and Earle, 2008), few have examined the sustainability of services-led growth. Those that focus on sustainable services growth seem to agree that the services sector needs to be well integrated and balanced in the overall

economic growth paradigm of the countries in question. For example, an empirical analysis of intersectoral linkages based on input-output data covering 115 activities between 1993 and 1994 analyzed the sustainability of India's services-led growth (Hansda, 2005). The study found stronger linkages between industry and services than between agriculture and services, suggesting that, although services growth has been important for the overall economic development process of India, there is a need for such growth to be complemented by expansion in industry and agriculture to ensure its sustainability.

Similarly, a study on the growth patterns in sub-Saharan Africa suggested that the sub-region "has largely bypassed manufacturing" because agriculture and services have become the main drivers of growth (World Bank, 2014). The study projects that the region's economic growth will rise from 4.6% in 2014 to 5.6% in 2015/2016, and recommends investment in energy, skilled labor and transport to help boost manufacturing growth.

However, it would seem reasonable to conclude that the question of sustainability of services-led growth in sub-Saharan Africa has largely not been the focus of empirical research and policy implications of this issue have not been well addressed. This chapter seeks to offer insights based on empirical data on this relevant issue.

3.4 Data and methodology

The main sources of data employed here are UNCTADSTATS and the WDI databases. The analysis relies on two datasets constructed as follows: the first dataset covers the 1980–2013 period, and the second dataset covers the 1995–2013 period. The two data sets have been constructed to cover two time periods in order to deal with the limitations in availability of data.

Whereas data on real gross domestic product (GDP) per capita growth, services value-added, manufacturing value-added, industry value-added, agriculture value-added, services exports, manufacturing exports and agricultural exports employed are available from 1980 to 2013, data on low-skill and technology-intensive manufactures, medium-skill and technology-intensive manufactures, high-skill and technology-intensive manufactures, vocational training, educational expenditure, research and development (R&D) investments and scientific journal articles, as well as services sub-sectors are only available from 1995 to 2013 (see Table 3.1).

Table 3.1 Definition of variables

Variable	Definition
Real economic growth	
Real GDP per capita growth	(annual % growth)
Importance of services	
Services value-added	(annual % growth)
Manufacturing value-added	(annual % growth)
Industry value-added	(annual % growth)
Agriculture value-added	(annual % growth)
Services exports	(% merchandised exports)
Manufacturing exports	(% merchandise exports)
Agriculture exports	(% merchandise exports)
Contributors of services value-added	
Low-skill and technology-intensive manufactures	
Medium-skill and technology-intensive manufactures	
High-skill and technology-intensive manufactures	
Vocational training	
Educational expenditure	
R&D investments	
Scientific journal articles	
Services sub-sectors	
Financial services	(exports in US$)
Insurance services	(exports in US$)
Computer and information services	(exports in US$)
Construction services	(exports in US$)

Variables are constructed as yearly aggregates for 48 sub-Saharan African countries. For the indicators under the sub-groups on real economic growth and the importance of services in Table 3.1, the data cover almost all the 48 countries. For indicators under the sub-groups on contributors of services valued added and services sub-sectors, we account for some missing data points by eliminating countries for which data were not available. Correspondingly, the analysis in this chapter is in two parts, in line with the two datasets we constructed based on two different time frames.

The first part of the analysis is based on variables under sub-categories on real economic growth and importance of services in Table 3.1. This covers the time period between 1980 and 2013, and focusing on two questions: 1) How important are services in the growth process of sub-Saharan Africa? and 2) Is the sub-region bypassing manufacturing-led growth and moving straight to services?

The second part of the analysis focuses on variables under sub-categories on contributors of services value-added and services sub-sectors in Table 3.1. Here, data covering the period between 1995 and 2013 have been used to focus on two questions, namely, 1) What are the sources of services value-added? and 2) Are the sources of services value-added sustainable? The assumption here is that, for services growth to be sustainable, it must be driven by value addition, which could be measured by skill-based performance and investment in knowledge infrastructure and innovation, as well as exports of services.

The limitation posed by the data with a shorter time frame (1995–2013) is that not many explanatory variables were included in the modeling of a single estimate. However, this limitation is countered in the model by relying on variables with broad sub-categories such as low-skill and technology-intensive manufactures; medium-skill and technology-intensive manufactures; and high-skill and technology-intensive manufactures (see Table 3.1).

3.4.1 The main hypotheses

i. Services are important in order for Africa to generate real economic growth.
ii. In order to be sustainable, services growth has to be driven by value addition.

We define value addition as steps taken to improve the quality and/or price of a product or service with the help of better production and delivery techniques, including investment in medium- and high-technology activities, vocational training, education, R&D and innovation within the local context.

3.4.2 The methodology

The first goal is to empirically understand whether there is dependence between real economic growth (or real GDP per capita growth) and economic variables of interest, namely, services value-added, manufacturing value-added, industry value-added, agriculture value-added, services exports, manufacturing exports and agriculture exports (see the correlation matrix in Table 3.2).

The second goal is to estimate the effects of the services value-added vis-à-vis manufacturing and agriculture value-added on real economic growth in order to assess the importance of services as a driver of real economic growth. We therefore fit a structural model based on the theoretical importance of

variables as sources of real economic growth with real economic growth as the dependent variable (see Reiss and Walok, 2007):

$$\begin{aligned}(\textit{Real Economic Growth})_t = {} & \alpha + \beta_1\,(\textit{Servies value added growth})_t \\ & + \beta_2\,(\textit{Manufacturing value added growth})_t \\ & + \beta_3\,(\textit{Agriculture value added growth})_t \\ & + \beta_4\,\log(\textit{Serives exports})_t \\ & + \beta_5\,\log\,(\textit{Manufacturing exports})_t \\ & + \beta_6\,\log\,(\textit{Agriculre export})_t + \varepsilon_t \qquad (1)\end{aligned}$$

where parameter

α = overall mean,
β_k, K = 1, … ,q = regression coefficients, and
ε_t, t = 1, … ,T = the residual or error term.

The third goal is to establish the sources of services value-added to ascertain whether these sources are sustainable for real economic growth or not. Variables employed here include skill-based performance, knowledge infrastructure and services exports. Here, too, we fit a structural model with services value-added as the dependent variable:

$$\begin{aligned}\text{Log}(\textit{Servies value added})_t = {} & \alpha + \beta_1\,\log(\textit{Skill based performance})_t \\ & + \beta_2\,\log(\textit{Knowledge infrastructure})_t \\ & + \beta_3\,\log(\text{Experts})_t + \beta_4\,\log(\textit{Others})_t \\ & + \varepsilon_t \qquad (2)\end{aligned}$$

where parameter

α = overall mean,
β_k, k = 1, … ,q = regression coefficients,
ε_t, t = 1, … ,T = the residual or error term,

Skill-based performance = medium- and high-tech manufacture such as information and communication technologies (ICTs),

Knowledge infrastructure = investments in R&D, vocational training and all levels of education (primary, secondary and tertiary),

Exports = Services exports, manufacturing exports and agricultural exports, and

Others = Exports from services sub-sectors such as financial services, insurance services, computer and information services and construction services.

3.5 Empirical results

Tables 3.2, 3.3 and 3.4 present the empirical findings. Table 3.2 contains the correlation matrix of selected variables (see indicators of real economic growth and importance of services in Table 3.1). Table 3.3 shows four sets of statistical results based on Equation (1) above, and Table 3.4 contains five sets of statistical results based on Equation (2). While Table 3.2 seeks to analyze the strength of association between real economic growth and value addition by sector, Tables 3.3 and 3.4 shed light on the 1) importance of services value-added vis-à-vis manufacturing and agriculture value-added on real economic growth, and 2) drivers of services value-added and whether these sources are sustainable for real economic growth.

3.5.1 Linkages between real economic growth and value addition by sector

The correlation matrix in Table 3.2 provides insights into the linkages between real economic growth and services value-added, industry value-added and manufacturing value-added in sub-Saharan Africa by highlighting the level of dependence between these economic indicators.

Four variables, specifically services value-added, industry value-added, manufacturing exports and services exports have positive and statistically significant correlation with real GDP per capita growth. There is a strong and positive correlation between real GDP per capita growth and services value-added (0.71), and this is statistically significant at 1%. The correlation between real GDP per capita growth and industry value-added is also positive (0.46) and statistically significant at 5%. The results also establish a positive correlation between real GDP per capita growth and manufacturing exports (0.44), which is statistically significant at 5%. The correlation between real GDP per capita growth and services exports (0.42) is also positive, and is statistically significant at 5%.

Likewise, in Table 3.2, it is important to note that the correlation between real GDP per capita growth and manufacturing value-added is positive (0.26), but not statistically significant. Similarly, the correlation between real GDP per capita growth and agriculture exports is positive but weak (0.08), and not statistically significant. Finally, the correlation

Table 3.2 Correlation matrix

	Real GDP per capita growth	Services value-added	Manufacturing value-added	Industry value-added	Agriculture value-added	Agriculture exports	Manufacturing exports	Services exports
Real GDP per capita growth	1.00							
Services value-added	0.71***	1.00						
Manufacturing value-added	0.26	0.23	1.00					
Industry value-added	0.46**	0.4**	0.59***	1.00				
Agriculture value-added	0.35*	0.17	−0.10	0.05	1.00			
Agriculture exports	0.08	−0.21	0.20	0.00	−0.04	1.00		
Manufacturing exports	0.44**	0.37**	−0.34	0.17	0.02	−0.09	1.00	
Services exports	0.42**	0.57***	−0.02	0.51**	0.12**	−0.35	0.64***	1.00

Note: ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Table 3.3 Estimated output

Dependent variable: Real GDP per capita growth				
	(1)	**(2)**	**(3)**	**(4)**
Intercept	–2.73***	–2.99***	–6.71***	–12.56***
Services value-added (annual % growth)	0.65***	0.59***	0.58***	0.58***
	(0.1287)	(0.1321)	(0.146)	(0.1442)
Agricultural value-added (annual % growth)	0.22**	0.21*	0.23**	0.19**
	(0.1059)	(0.1022)	(0.0923)	(0.095)
Manufacturing value-added (annual % growth)	0.12		0.25**	0.25**
	(0.1075)		(0.1107)	(0.1089)
Industry value-added (annual % growth)		0.22*		
		(0.1313)		
Log (agriculture exports)			0.8715	0.71
			(0.6793)	(0.678)
Log (manufacturing exports)			2.33**	2.14**
			(0.8926)	(0.888)
Log (services exports)			–0.52	0.09
			(0.5849)	(0.7279)
Total factor productivity				0.085
				(0.0612)
Multiple R-squared	*0.5724*	*0.5943*	*0.7091*	*0.7289*
Adjusted R-squared	*0.5296*	*0.5537*	*06445*	*0.656*

Note: ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Number of observations is 34.

Standard errors are in parentheses.

between real GDP per capita growth and agriculture value-added is positive and weak (0.35), but statistically significant at 10%.

These results can be interpreted as follows. The dependence between real GDP per capita growth and services value-added has been the strongest in sub-Saharan Africa in the past three decades. The linkages between services exports and manufacturing exports have been similarly strong. The dependence between real GDP per capita growth and manufacturing value-added, as well as that between agriculture value-added and agricultural exports has been positive but weak. In other words, services value-added have been more important for GDP per capita

growth in sub-Saharan Africa, when compared to manufacturing value-added and agricultural value-added.[2] This leads us to the next section of the analysis, which investigates the actual effects of these variables on real economic growth.

3.5.2 How important are services in generating real economic growth?

We address this question based on the results in Table 3.3 as follows. First, we analyze the effects of agriculture and manufacturing value-added on real economic growth. We also examine the effects of both agriculture and manufacturing exports on real economic growth. Second, we focus on the importance of services value-added in real economic growth to try to ascertain the importance of the services sector as a driver of real economic growth, compared to the agriculture and manufacturing sectors in sub-Saharan Africa over the last three decades.

3.5.2.1 Effects of agriculture and manufacturing on real economic growth

The empirical findings in Model 1 (see Table 3.3) show that the effect of the agriculture value-added on real GDP per capita is positive and statistically significant at 5%. Specifically, we establish that a 1% growth in agricultural value-added accounts for 0.22% growth in real GDP per capita. However, in Model 1, the effect of manufacturing value-added on real GDP per capita is not statistically significant, which implies that growth in manufacturing value-added has not contributed much to real economic growth in the past three decades. Overall, services value-added, agricultural value-added and manufacturing value-added in Model 1 account for 53% of the variation in real economic growth over the period (see Adjusted R-squared is exactly 0.5296).

In Model 2, we substitute manufacturing value-added with industry value-added to ascertain its effect on real economic growth. Results indicate that a 1% growth in industry value-added also accounts for 0.22% growth in real GDP per capita, and this is statistically significant at 10%. However, it is important to note that growth in industry value-added captures growth in the mining and construction sub-sectors as well.

In Model 3, the effects of agricultural value-added on real GDP per capita are also statistically significant at 5%, meaning that a 1% growth in agriculture value-added accounts for 0.23% growth in real GDP per capita. Also in Model 3, both manufacturing value-added and

manufacturing exports are statistically significant at 5% when we control for agriculture and services exports. A 1% increase in manufacturing exports results in a 0.02% increase in real GDP per capita. Similarly, in Model 4, manufacturing exports is also statistically significant at 5% and is an important driver of real economic growth when we control for agriculture and services exports. On the whole, variables in Model 4 account for 66% of the variation in real economic growth over the period (see Adjusted R-squared equal 0.656).

We conclude that both agriculture value-added and manufacturing value-added, as well as their exports can be key drivers of real economic growth, but the results suggest that the effects of manufacturing value-added on real economic growth have been weaker than those of services. This seems to corroborate the assertion by the World Bank and our earlier question that sub-Saharan Africa might be bypassing manufacturing as an engine of development in its overall growth trajectory. (see Word Bank, 2014).

3.5.2.2 Importance of services in real economic growth

The effect of increases in services value-added on real economic growth is noteworthy in the findings presented in Table 3.3. Statistical estimates in Model 1 show that 1% growth in services value-added accounts for 0.65% growth in real GDP per capita, and this is statistically significant at 1%. Also, the empirical finding in Model 2 shows that 1% growth in services value-added accounts for 0.59% growth in real GDP per capita, and this is also statistically significant at 1%. However, in Model 2, we replace manufacturing value-added with industry value-added. The effects of services on real economic growth established in Models 1 and 2 are further validated by the results in Models 3 and 4. In Model 3, 1% growth in services value-added accounts for 0.58% growth in real GDP per capita, and this is also statistically significant at 1%, which is similar to the results in Model 4. This confirms the growing importance of services value-added in real economic growth.

The empirical evidence here suggests that growth in services value-added is the only variable that is statistically significant at 1% across all the four models. The strength of this result therefore corroborates the hypothesis that services value-added is important in order for Africa to generate real economic growth. We conclude that, when compared to other sources of growth such as agriculture and manufacturing value-added, services value-added has by far been the largest driver of real economic growth in sub-Saharan Africa in the last three decades.

3.5.3 What are the drivers of services value-added and how sustainable are these?

Having ascertained the role of services-led growth in Africa, we now move on to examine the sources of services value-added growth between 1995 and 2013 to derive implications for policy in Table 3.4. We first test for the effects of skill-based performance on services value-added. We then test for the effects of exports on services value-added. We conclude by examining the effects of knowledge infrastructure, such as R&D expenditure, investment in education and vocational training, and scientific output on services value-added in order to ascertain the sustainability of a service-led growth.

3.5.3.1 Effects of skill-based performance on services value-added

Model 1 in Table 3.4 presents the results of the effect of exports of low-skill and less technology-intensive manufactures on services value-added. Low-skill manufactures are those that are categorized as less knowledge based and less technology intensive, and they include office and stationery supplies, musical instruments and parts, records, tapes and similar low-value telecommunications products. The effect of exports of low-skill manufactures on services value-added is statistically significant at 1%. Statistical estimates show that a 1% increase in exports of low-skill manufactures accounts for a 0.54% increase in services value-added. Exports of low-skill manufactures alone account for 64% of the variation in services value-added over the period (see Adjusted R-squared equal 0.6395).

The effects of exports of medium- and high-skill manufactures on services value-added are not statistically significant (see Model 3 in Table 3.4). Medium-skill manufactures include sound recorders or reproducers, radio broadcast receivers and cinematographic and photographic supplies, while high-skill manufactures include telecommunications equipment, office machines, automatic data processing machines and television receivers. What Models 1 and 3 suggest is that services value-added in sub-Saharan Africa has been driven largely by exports of low-skill and less technology-intensive manufactures and not by exports of knowledge-intensive medium- and high-technology manufactures, including telecommunications equipment.

This empirical evidence indicates that services value-added is not driven by skill-based performance and that services are concentrated in low-cost, low-value telecommunications and other segments, which suggests that services value-added and its effects on real economic growth might not be sustainable.

Table 3.4 Estimated output

Dependent variable: Log (services value-added)					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Intercept	18.14***	20.15***	17.97***	19.83***	18.36***
	(0.6957)	(1.270)	(0.5841)	(0.9343)	(0.7272)
Log (low-skill)	0.54***				
	(0.0942)				
Log (medium-skill)			0.15		
			(0.3625)		
Log (services exports)		0.42***			
		(0.0649)			
Log (high-skill)			0.41		
			(0.3656)		
Log (agriculture exports)		–0.39**			
		(0.1385)			
Log (educational expenditure)				–0.077	
				(0.3011)	
Log (manufacturing exports)		–0.25			
		(0.1779)			
Log (financial services)					0.43**
					(0.1123)
R&D expenditure				–0.01*	
				(0.0078)	
Log (construction services)					–0.32**
					(0.1242)
Scientific journal articles				–0.007	
				(0.0072)	
Log (insurance)					–0.076
					(0.0808)
Log (vocational training)				0.31***	
				(0.0528)	
Log (computer and information)					0.46***
					(0.0995)
Multiple R-squared	*0.6595*	*0.949*	*0.8137*	*0.7091*	*0.9598*
Adjusted R-squared	*0.6395*	*0.9388*	*0.7904*	*0.6445*	*0.9419*

Note: ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Number of observations is 19.

Standard errors are in parentheses.

3.5.3.2 Effects of exports on services value-added

Model 2 (see Table 3.4) focuses on the role of exports in services value-added. Here, we estimate the effects of services exports, manufacturing exports and agricultural exports on services value-added. Statistical results show that, of these three components of exports (i.e., services exports, manufacturing exports and agricultural exports), only services exports that positively drive services value-added, and this result is statistically significant at 1%. A 1% rise in services exports accounts for a 0.42% rise in services value-added. In contrast, a 1% surge in agricultural exports accounts for a 0.39% drop in services value-added. One explanation for this could be that there is a trade-off between investment in agricultural exports and investment in low-value-added services activities in the current context. For example, we note in field interviews that a lot of local personnel alternate between construction services (in urban sites, where there is sporadic and unpredictable demand) and rural agriculture. Statistical results also show that the effects of manufacturing exports on services value-added are not statistically significant, implying that manufacturing exports cannot be contributing much to services value-added in the current context. In all, services exports, manufacturing exports and agricultural exports account for 94% of the variation in services value-added in sub-Saharan Africa over the last three decades (see Adjusted R-squared equal 0.9388 in Model 2).

We conclude that exports have been an important source of services value-added, given that a wide range of African telecommunications and computer services, despite being low tech, are being exported regionally (see data from Chapter 7 of this book, which corroborates this assertion).

3.5.3.3 Effects of knowledge infrastructure on services value-added

In Model 4 (see Table 3.4), we estimate the effects of knowledge infrastructure on services value-added. We specifically examine the effects of investment in knowledge generation on services value-added, using educational expenditure as a proxy. We also examine the effects of R&D investment on services value-added, relying on R&D expenditure as a proxy. Finally, we analyze the effects of scientific knowledge output and vocational training using the number of scientific and technical journal publications as well as the number of vocational trainees. Out of all these indicators, neither the current levels of investments in knowledge generation nor R&D investment contributed much to services value-added, as their effects are either weak or not statistically significant (see Model 4).

The current R&D investments, rather, account for a negligible drop in services value-added, as a 1% rise in R&D investments accounts for a 0.0001% drop in services value-added, and this is barely significant at 10%. The effects of the current level of scientific knowledge output on services value-added in sub-Saharan Africa are not statistically significant. It is only the effects of investments in vocational trainees on services value-added that is statistically significant at 1%. A 1% rise in investments in vocational training accounts for a 0.34% rise in services value-added. All the variables in Model 4 account for 64% of the variation in services value-added in sub-Saharan Africa (see Adjusted R-squared equal 0.6445).

We conclude that, despite the fact that vocational training is spurring growth in services value-added, more investment in vocational training is needed to advance this growth in the short run, and that in the long run, investment in R&D is also necessary for sustaining services growth.

3.5.3.4 Importance of services exports by component in services value-added

In Model 5 (see Table 3.4), we examine the effects of export of financial services, insurance services, computer and information services, and construction services on services value-added. Financial services cover financial intermediation and auxiliary services, except those directly related to life insurance and pension funds. Insurance services cover all types of insurance, reinsurance and related auxiliary services. Computer and information services include exports of hardware and software-related services and data processing, database conception, data storage and dissemination of data.

The effects of export of financial services on services value-added are positive and statistically significant at 5%. A 1% increase in financial services exports accounts for a 0.43% rise in services value-added. The effects of exports of insurance services on services value-added are not statistically significant. The effects of exports of computer and information technology services on services value-added have been by far the largest and are statistically significant at 1%. A 1% increase in computer and information services exports accounts for a 0.46% increase in services value-added. The effects of exports of construction services on services value-added are, however, negative and statistically significant at 5%. A 1% increase in exports of construction services accounts for a 0.32% drop in services value-added. The 94% of the variation in services value-added has been accounted for by financial services, insurance

services, computer and information services, and construction services (see Adjusted R-squared equal 0.9419). These results validate the importance of services exports in services value-added.

Overall, the hypothesis that in order to be sustainable, service growth has to be driven by value addition has been confirmed. However, for sub-Saharan Africa, the current levels of skill-based performance, exports growth and investments in the development of knowledge infrastructure have not been enough to drive services value-added, indicating not only the fragility but also the less sustainable nature of this services-led growth.

3.6 Articulating policy priorities for the future

This chapter has analyzed at length a very important issue in the sub-Saharan African region, namely the current role of services in economic growth, and the sustainability of such a trend. We present two important sets of concluding remarks with some policy implications.

First, there are strong linkages not only between real economic growth and services value-added but also between services exports and manufacturing exports. Our analysis shows that real economic growth has been more dependent on services growth than on manufacturing growth and that services has by far been the largest driver of real economic growth in the sub-region in the last three decades.

This suggests that greater long-term economic growth and development gains are likely to be experienced when both the manufacturing and services sectors are developed together in sub-Saharan Africa. The policy priority therefore should be to foster capabilities that can support both sectors for long-term benefits rather than focusing only on services for short-term gains. We also find that, in terms of contribution to real economic growth, it is only services and agriculture that currently matter.

We then move on to look at the factors that contribute to services value-added in Africa in the current context, in order to understand the underlying drivers of the growth. We check this against the services subsectors (finance and insurance, construction, computer, and ICTs). We find that current services value-added is being driven by low-tech, less knowledge-intensive activities in all of these sub-sectors.

Here, the chapter shows that in order for services-led growth to be sustainable, it has to be driven by knowledge and skill-based performance, which clearly is not the case at the moment. To address this, the chapter foresees short- and long-term policy choices that could be made

as a matter of priority. In the shorter term, there is a need for clear policy intervention that seeks to direct services activities across categories, to eliminate the risks of entrenching economies into low-value added sub-sectors of services alone. In the short term, more investment is needed to improve vocational training and the skills development requirements of the services sector. In the long term, it is vital to improve the overall skill-based performance of the sub-region through strategic investment in developing medium- and high-skill knowledge-intensive services to enhance exports and value addition in the services sector.

In the longer term, achieving this objective calls for industrial and innovation policy incentives, instruments and mechanisms that help strengthen technological and technical capabilities that are needed to engage in services sub-sectors with more knowledge-intensive skills. Therefore, investing in capabilities will also be important in harnessing the strong mutual complementarity between the manufacturing and services sectors in the African context.

Notes

The views and analysis presented in the chapter are the authors' own.

1. Half of the country's employment was attributed to services (Fuchs, 1968).
2. Our analysis does not include resource-based sectors.

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4

Linkage Dynamics and Natural Resources: Diversification and Catch-Up

David Kaplan

4.1 Introduction

There is very broad consensus to the effect that resource-rich countries cannot rely on natural resource products and exports for development. The structural change that underpins development requires economic diversification such that ever-larger shares of labor are located in higher value-added activities in manufacturing and services. What is far more contentious is whether resource-based products provide a base from which higher value-added activities can develop, and if so, what policies are likely to be most effective in this regard.

The first part of this chapter argues that resource-based products – here confined to energy commodities and minerals – have the potential to provide a base from which other high value-added activities can emerge. Moreover, a number of recent developments have increased that potential.

However, the realization of that potential is heavily dependent on deliberate policies on the part of government. One important dimension of policy is enhancing linkages between resource-based products and higher value-added activities such that the skills and technological capacities of local producers outside of the production of resource-based products are constantly raised. Linkages could be upstream of resource-based products – backward linkages; downstream of resources based products – forward linkages or lateral to resource-based products – lateral or horizontal linkages.

The second part of the chapter explores the nature of these linkages. It outlines the policies that governments that seek to maximize these

linkages might follow. Particular attention is paid to backward linkages since they represent the most promising prospects for diversification. While reference is made to other regions, the focus is on sub-Saharan Africa.

4.2 Primary product linkages and technological intensity

This section of the chapter explores, first, primary product linkages and their impact on broader development and, second, the technological intensity of resource-based activities and the content of these linkages. Although reference is made to primary product linkages more generally, the focus is on mining linkages. The geographical focus is Africa, but reference is also made to Latin America.

4.2.1 Linkages and the impact on development

There is a lengthy literature that argues that countries and regions possessed of abundant natural resources, and more particularly nonrenewable resources, minerals and fuels, will experience less growth in other sectors and consequently less development:

> unlike other sources of wealth, natural resource wealth does not need to be produced. It simply needs to be extracted. Since it is not a result of a production process, the generation of natural resource wealth can occur quite independently of other economic processes that take place in a country; it is in a number of ways, enclaved … without major linkages to other industrial sectors. (Humphreys, Sachs and Stiglitz, 2007, p. 4)

A recent and important example of this thinking is that of McMillan and Rodrik (2011). They argue that natural resource intensive economies are at a disadvantage in effecting the structural changes that underpin development – structural change being defined as the movement of labor from low- to high-productivity activities. Following a long tradition, McMillan and Rodrik similarly characterize natural resource-based industries as "enclave" industries:

> economies with a revealed comparative advantage in primary products are at a disadvantage. The larger the share of natural resources in exports, the smaller the scope of productivity-enhancing structural change. The key here is that minerals and natural resources do not generate much employment, unlike manufacturing industries and

> related services. Even though these "enclave" sectors typically operate at very high productivity, they cannot absorb the surplus labor from agriculture. (McMillan and Rodrik, 2011, p. 3)

The enclave character of natural resource products and hence the absence of linkages ensures that any rise in the share of natural resources exports will further constrain development elsewhere, particularly in modern manufacturing

However, the evidence that mining is "enclave" is not robust. Relatedly, the evidence that a rising share of primary products will constrain development elsewhere in the economy and advance structural change is also questionable.

In South Africa, important sections of high-productivity manufacturing and services sectors are deeply integrated with the mining sector. It is estimated that of the R437 billion expenditure on the part of the mines in South Africa, 89% was spent in South Africa.[1]

As a result, as and when mining booms, so do these activities. At the height of the recent natural resources boom, when South Africa enjoyed growth rates above 5%, and when the share of natural resources in exports was consequently rising as a result of higher prices, employment in manufacturing grew, that is, there was movement of labor into higher-productivity occupations, including modern manufacturing. Indeed, it was *only* in this period, 2006–2007, when commodity prices rose and South Africa enjoyed a natural resource-led boom and a consequent rise in the share of commodity-based exports, that employment in manufacturing grew and that the country experienced positive structural change. [2] Mining in South Africa can hardly be termed enclave.[3] Nor, consequently, does the evidence suggest that expansion of mining production and exports occurs at the expense of other economic activities. Quite the reverse: rising employment in high-productivity manufacturing is only in evidence when mineral production and exports increase.

Other countries also exhibit significant linkages. Chile's national copper company, Codelco, purchases over 90% of the goods and services it needs from local firms (IMF, 2012, cited in APP, 2014, p. 83). Brazil has combined local content with agreements between the state oil company and a national small business association. Local supply of inputs increased from 57% in 2003 to 75% in 2008 (Sigam and Garcia, 2012, cited in APP, 2014, p. 83).

Even in countries with a much less developed mining sector, there may be considerable linkages with domestic manufacturing. Mining is far from an enclave activity. In Nigeria, over 70% of extractives companies

reported sourcing over one-half of their inputs from Nigerian firms (Oyejide and Adewuyi, 2011). However, the local content is likely to be low – and there remains considerable potential for linkages to develop.

As mining output has expanded, so accordingly has the output of domestic manufactured goods and services for the mining sector in other, less-developed African countries. Ghana is a good example (Bloch and Owusi, 2012). Indeed, the gross domestic product (GDP) multiplier arising from an increase in mining production may be higher in Ghana than in South Africa.[4]

In Africa more broadly, there are indications that positive structural change is enhanced when commodity prices increase and consequently the share of primary products in output and exports consequently increases.

The recent African Economic Outlook draws attention to what it terms "Africa's remarkable turnaround." In the period 1990–1999, structural change made a negative contribution to productivity as workers moved out of higher-productivity activities. However, in the period 2000–2005, structural change made a positive contribution, as employment shifted from primary products to manufacturing and services. Structural change accounted for nearly half of Africa's overall productivity growth (African Development Bank, 2013, pp. 115–116).

As Africa's primary sector has performed better, and as its share of output and exports has risen, partly because of higher prices and partly because of increasing production, the sector has provided a positive spur to employment growth in manufacturing and services, thus enhancing structural change. As the African Development Bank report succinctly expressed it, "What has been holding back Africa is not the large share of its primary sector in itself, but the poor performance of this sector."

Better performance of the primary sector in the recent period has had widespread beneficial impacts on the domestic economy and on processed exports.

The recent boom in commodity prices has brought the expected growth effects, but exploration has also expanded much beyond previous efforts, largely driven by demand from emerging partners in the East and the South. Although exports of processed products have grown at a slightly slower pace than those of raw commodities, they have by no means been crowded out but gained significantly on the back of the trade boom in natural resources. At the same time, the massive inflows of foreign investment have helped job creation, particularly in the mining sectors, which are more labor-intensive than oil (African Development Bank, 2013, p. 35).

With higher prices for natural resources, the exports of processed goods also rose, albeit not as much as exports of natural resources. Between 2000 and 2011, Africa's exports of natural resources rose from $160billion to $350billion (2010 prices). Exports of processed goods rose from $110billion to $180billion. The share of processed goods declined, but there was no crowding out. Growth in processed manufactures increased side by side with growth of natural resource exports.[5]

It is clearly misleading to focus on the relative share of manufacturing in GDP and to see a decline as evidence that the expansion of natural resource production and exports is curtailing the growth in manufacturing.

An earlier study of the impact of commodity prices on economic growth in Africa similarly found a positive correlation "there is no obvious sign that high commodity prices are more of a curse than a blessing. African economies remain heavily dependent on exports of primary commodities and, as one might have expected from first principles, those economies do better when the prices of commodities are rising than when they are falling" (Deaton, 1999, p. 38).

Studies are admittedly patchy, and many other factors are at play. Nevertheless, the evidence does suggest that there are linkages from primary product industries to the rest of the economy such that rising global primary product prices and/or increases in output that result in a rise in the share of primary products in output and particularly exports is positive for growth and for structural transformation measured by output, employment and exports in manufacturing and services.

4.2.2 The technological intensity of resource-intensive industries

While, in the past, resource-intensive industries may have lacked technological dynamism, generated little innovation and accordingly had negligible knowledge linkages with the rest of the economy, there have been significant changes in the past few decades. In particular, the extractive energy and the mining industries have become significantly more technologically intensive. These sectors have seen large investments in research, new product and, more particularly, process technologies.

To take one example, as a result of significant and growing pressure on mining firms to "clean up their act," these firms have been investing heavily in new activities directed at limiting pollution or at managing waste. Moreover, this pressure and the consequent response of mining firms are not confined to industrialized countries. Mining operations in some developing countries have developed environmental technologies, which have significant applications in many areas of the economy.[6]

Another major area of technological development in mining is automation. Until very recently, the automation effort on the part of the mining companies and their suppliers has been concentrated on the component or sub-system level, and at a relatively small scale. Innovations in mining automation include automated surface haul trucks, automated underground load haul dumps (LHDs), and autonomous blast-hole drilling equipment. But the focus has now changed to full automation whereby machines control all aspects of their functions, including monitoring and correcting for defects. The end goal is robotics, whereby machines sense and reason about their environment.

Fully automated mining requires far heavier investments in research and development (R&D). It also relies on an array of new technologies in the fields of computing, signaling and sensing technologies, robotics, lasers and communications systems. This clearly requires extensive collaboration between experts and researchers from different scientific fields. It also requires mining companies and equipment producers to work together.

This collaboration – between mining and other disciplines and between mining companies and their suppliers, particularly equipment suppliers, but also service suppliers in areas such as software development – by definition consists of linkages, and linkages with a high level of knowledge content.

The new knowledge generated has positive spillover effects into other sectors of the economy. The knowledge intensity of the linkages between resource-based industries, particularly energy and mining, and other sectors has accordingly been increasing. Moreover, this is evident in countries at different stages of development.[7]

4.2.3 Conclusion

To conclude, while there are important variations, in most countries, the evidence strongly suggests that natural resource sectors are not enclave. While there is considerable variation, linkages exist. These linkages are generally more extensive where levels of local development generally are higher, and therefore where a wider range of inputs can be supplied by local producers. But even where levels of local development are far lower, linkages are evident and are sometimes extensive.

As a result, growth in natural resource sectors tends to exercise a positive impact on growth elsewhere in the economy. In particular, in sub-Saharan Africa, recent indicators strongly suggest that growth in primary product outputs and exports, notably mining, has had a positive impact on structural change and the growth of other sectors. This is evident for

the region, for more-developed economies such as South Africa and for less-developed economies such as Ghana and even Tanzania (see below). Moreover, the knowledge content of the natural resource sectors, notably energy extraction and mining, has been increasing significantly with spread effects to other sectors.

4.3 Enhancing linkages

However, the development of linkages, and the knowledge content of those linkages, is by no means "automatic." The development of linkages is heavily influenced by policy. The rest of this chapter explores the broad determinants and policy responses relating to linkages: backward, forward and lateral.

4.3.1 Backward linkages

In an attempt to cut their costs, mining firms, as with firms in other sectors, have increasingly focused on their "core competencies" – those activities that are essential and in which they have a distinctive advantage. The "mining company town" that traditionally characterized mining is no longer. Miners are engaged in mining. They outsource all other activities to a wide range of suppliers. These suppliers, in turn, acquire a specialization and develop competencies that can be applied across a large number of customers, hence further reducing costs.

Mines are faced with a choice of importing their inputs – products and services – or procuring the goods and services locally. In respect of many products and services, there is no choice. There may be no local capacity, and this is not likely to develop in the near future. But where there is currently local capacity or where this could be developed in the near future, mines will have an incentive to purchase locally. This is particularly so where transport and logistics are poorly developed and where consequently imported inputs are costly and subject to considerable delays and uncertainties. Moreover, mining companies are under pressure, particularly from host country governments, to contribute to development through procuring locally. Indeed, most large mining firms have signed on to international agreements to promote local development.

As a result, many lead mining firms have themselves initiated programs to procure locally and enhance local linkages.[8] A number of these linkage programs have been implemented in collaboration with the World Bank's International Finance Corporation.[9] Many of these projects report significant increases in local procurement.[10]

The initiatives of individual mines demonstrate some commitment to local economic development via procurement, and they illustrate that success is indeed possible to the benefit of all parties. However, in order to ensure scale at a national level, as well as provide the supports that local suppliers and potential local suppliers require to become effective, the active engagement of the host country government is essential. While at the rhetorical level, many governments in Africa advocate such programs, few have implemented comprehensive and sustained programs to develop backward linkages.

Policy to enhance linkage development can build on the basis of a degree of shared interest as between the three major players – mines, local firms (suppliers and potential suppliers) and government. While mines will require of their suppliers that they reliably provide the right quality product at the right price, they are prepared, for reasons outlined earlier, to accord a significant "premium" to local production. This is particularly so where local suppliers have the potential, in a relatively short space of time, to become fully competitive. Local suppliers and potential suppliers, in turn, have a strong incentive to become effective suppliers. Doing so will require that local firms with the potential to meet the requirements of the mines will have to enhance their technological capacities and their skills. Moreover, since the competition for imports is also evolving, local firms will be under pressure to continue to upgrade their skills and technological capacities in order to remain effective suppliers. There is accordingly a significant role for government in providing the support – particularly the skills and access to technological knowledge and resources – that firms require to initially attain and then to sustain their positions as effective suppliers to the mines.

What is entailed is in effect an industrial policy whereby government, mines and local producers collaborate in a joint effort in order to "produce" effective suppliers. The processes of collaboration and engagement allow the different parties to learn what are the opportunities and constraints, and the resources available to upgrade local suppliers. This collaborative process is in accord with the perspective on industrial policy that has been advanced by Rodrik and others, with the caveat that the "market" is, at least initially, not global but domestic, namely the local mining industry.

As linkages increase and as local firms acquire advance their capabilities, there may be considerable potential for exports. Mining equipment and specialist services constitute some 8.5% of total South African exports and 55% of all capital equipment exports. Moreover, South Africa has a significant surplus on the trade account in respect of mining capital

equipment (Kaplan, 2012, p. 428). A recent commission on the future of the mining industry in Chile envisages that by 2035, "250 suppliers exporting world-class technology and knowledge intensive services have come on stream" (Commission for Mining and Development of Chile, 2014, p. 5). The huge buying power of mining offers the possibility of boosting a local industry of world-class mining suppliers. This, however, requires multiple actions from the public and private sectors and, above all, bolstering cooperation between them both (Commission for Mining and Development of Chile, 2014, p. 15).

Exports of mining intermediates and specialist services are not confined only to the more developed mining countries. There is evidence of exports from less developed mining countries, for example, in Ghana: "several informants (companies, Chamber of Mines, etc.) said that Ghanaian technical personnel (notably on the engineering side) were in demand across the region on a contract basis. On the equipment issue, I got the sense that there's a regional division of labor with interaction between mining suppliers and service companies based in Accra and their offices/depots elsewhere in West Africa. There may also be bulk exports (lime, chemicals, plastics) from Ghana, but this needs to be investigated further" (Correspondence with Dr. Robin Bloch, September 4, 2015).

These exports are on a relatively small scale and are largely for contiguous regional markets. However, there is significant potential for growth particularly if, as is very likely, there is major expansion in mining in the region. The Economic Community of West African States (ECOWAS) treaty advocates procurement policies that favor local and regional firms. Finally, given the critical importance of engineering in further development (see below), it is significant that exports include particularly engineering services and personnel.

There will be a range of constraints that curtail local production and prevent efficient supply. One key factor will be infrastructure. Transport is a key problem in Tanzania for local producers who are located far from the mining areas. In Nigeria, local suppliers are heavily restricted by electricity supply problems (Adewuyi and Oyejide, 2012, p. 456). Another key limitation for firms, particularly SMEs, seeking to upgrade is finance for the required investment. In each case, the nature of the constraints will differ and so will the optimal policies designed to ameliorate these constraints.

A key challenge for local firms will be to improve their capabilities – closing the capabilities gap with competitors located abroad. One constant element in government support will accordingly be policies to enhance the skills and technological capabilities of local suppliers or

potential suppliers. This will entail investments in skills and training. Skills shortages are pervasive in Africa and significantly curtail the operations of local firms (Morris, Kaplinsky and Kaplan, 2012, pp. 151–161). Similarly, the key institutions that compose the National System of Innovation are poorly developed (Morris, Kaplinsky and Kaplan, 2012, pp. 151–161, 167). Policies to enhance skills development that are generally complemented by incentives to encourage and support firm-level training will be required. Also required will be significant support for and investments in the institutions that compose the National System of Innovation: tertiary educational institutions that supply the high-level skills and the research that allows initially for technologies derived from abroad to be adapted to local conditions and that later are important in local innovation and government laboratories and testing stations that are required to ensure that firm outputs meet requisite standards.

At the outset, it is critical that government, in consultation with the mines, identifies the "low-hanging fruit," namely the products and services in respect of which local suppliers already have some local capacities that could be developed to the requisite standard with relatively limited resources and in a short time period. These firms would be the first "targets" of government's industrial policy. Critically, information and training will be required to get local firms to be effective suppliers. These might be supplied by the mines themselves or by government. Government, the mines and potential local suppliers would work collectively to enhance supply and capacities at the local level.

Government would also ideally identify products and services in which local firms might only have embryonic capacities and where more considerable resources and longer time frames would be required to allow local firms to become effective suppliers. For these "more distant" products and services, government would play the key role in providing the supports and the environment whereby local firms might enhance their embryonic capacities and skills.

It is important that policies be designed to enhance linkages commence as early as possible. The construction phase is especially promising in the opportunities it offers, more particularly in locations in which development is limited. The Mozal aluminium smelter is indicative.

Mozal was the first major investment project in Mozambique for decades. Evolving out of an earlier program to train local Small Medium and Micro Enterprises (SMMEs) in mining, Mozlink began a program for local economic development in 1999. By 2007, Mozlink had built capacity in 45 local SMEs, and monthly spending on 250 local firms supporting Mozal had increased to $17 million (ADB, 2014, p. 117).

There were numerous other spin-offs, including the formation of the Mozambican Business Network to encourage interaction with small and medium mining enterprises, and a three-year program (with backing from the IFC and large foreign investors) to get local SMEs more involved in procurement programs for mining, natural gas and other industrial areas (Jaspers and Mehta, 2008).

But, even before construction is underway, the design phase of a mine exerts a critical impact on the subsequent construction and operations phases. It is early in the design stage that standards are set and laid down which have a determinate effect on subsequent procurement. In the absence of any policy intervention, standards may well be established such as to accord with the client's mining operations elsewhere in the world, but with little or no reference to any existent, or the development of any future, local capacities, thus effectively shutting out local procurement for the entire life of the mine:

> Standardisation has a direct impact on procurement generally requiring specific global suppliers. Decisions in respect to specification are often made by the design team or the main construction contractor based upon precedent rather than on an understanding of available local expertise or manufacturing capacities of local and regional businesses. This not only reduces the role played by local suppliers of capital goods, but also effectively excludes local suppliers from subsequent maintenance and spares requirements that will develop over the life of the mine. (Hanlin and Hanlin, 2012, p. 470)

These authors cite an example of a gold mine in Tanzania in which every component used in construction had to conform to Australian standards, thus effectively precluding local suppliers even where products could be supplied to an equivalent standard – electrical plugs to the UK standard, for example.

There has recently been a spate of major discoveries of oil and gas, as well as other minerals such as coal and iron ore in a number of African countries. It is important that considerations as to the promotion of backward linkages are taken into account at the outset of the projects, namely in the design and the construction phases.

A number of caveats are in order:

First, insofar as support for local firms that are not yet effective suppliers entails higher prices for mine inputs, at least in the short term, this raises the cost structure for the mines. In turn, this may limit output

and/or profits. The trade-offs are important. As with infant industry protection from imports – and indeed this is a form of infant industry protection – such assistance for local firms will need to be time bound and reviewed regularly. In the event that the support does not indeed lead to effective suppliers within some limited time period, such support would need to be reconsidered.

Second, and following from the above, where mines enjoy considerable rents, the scope for policies to promote backward linkages via a price premium is enhanced. In reverse, the recent severe declines in commodity prices have reduced the scope of backward linkage policies as mines have become less profitable.

Third, there will be a wide range of possibilities in regard to backward linkages. Energy commodities – oil and gas, in particular – require far more high-technology inputs and the possibilities of effecting local linkage will be correspondingly less. But, even here, there are local production linkages, and some local products have a significant technological content. One example is in well construction and control systems, and information and communications technology for the Nigerian oil and gas industry (Adewuyi and Oyejide, 2012).

Finally, policy to enhance backward local linkages is only one route to development and structural change. A range of other policies to advance modern manufacturing and services not immediately linked to mining or other primary production activities will be required. Policy to enhance local linkages should be developed as complementary to the development of other local manufacturing and service activities not immediately linked to commodity production.

4.3.2 Forward linkages

For the country producing the raw material, the further manufacture of primary products, particularly minerals, appears to have a clear logic. Is not the manufacture of pots and pans a logical and natural next step for any country producing iron ore? This viewpoint has captured the public imagination. It also appears to speak to issues of "fairness and redress," namely that raw material countries, particularly in Africa, were historically prohibited from developing their own manufacturing capacities that utilized their access to raw materials.

However, if products are perceived not as material things but rather as a cluster of skills and competencies, one will arrive at a different conclusion. The cluster of skills and competencies required for mining iron ore will be different from those that are required to manufacture pots and

pans. Possessing skills and competencies in the mining of ore does not mean the possession of skills and competencies in the manufacture of pots and pans.

Furthermore, most commodities are available on the global market at a very similar price to the price prevailing in the producing country. As transport costs decline and as global markets for primary products become more integrated, the advantage conferred by proximity to the production of the primary products diminishes.

Gold is available globally at effectively the same dollar price. Thus, the manufacturing of gold jewelry in South Africa receives no substantive advantage from access to locally mined gold. Only a very small part of locally mined gold find is absorbed in local production – 2.8% (Anglo Gold Ashanti, 2008, p. 69). South Africa lacks the capacities in design, and this is reflected in the character of jewelry exports. "The export market is dominated by mass-produced, lighter ranges of jewelry where price is the decisive factor for the retailer. The output is very similar, if not identical, to those ranges produced by competing international fabricators. In these instances, international jewelry trends dictate design. In this category, the research did not reveal a uniquely South African product range" (Anglo Gold Ashanti, 2008, p. 84).

A recent study examined the case for beneficiation in South Africa's utilizing a large international data sample drawn from many countries over an extended period – the past 25 years. The conclusions were clear: "countries do not move downstream in their export development. This is as true for rich countries as for poor countries, and even truer for downstream movements from raw materials than for other manufactured goods" (Hausmann, Klinger and Lawrence, 2008, p. 1).

If, however, two conditions are met: namely, that the raw material is a significant component of the cost in the manufactured article, and being in close proximity confers a considerable advantage on local consumers of the raw material, then there will be a cost advantage. This cost advantage can provide the "space" for local production and the development of the skills and competencies of local producers.

Thus, support for local manufacturing downstream of primary production – beneficiation – is not precluded as a desirable strategy, but it is by no means automatic. It will need to satisfy quite stringent conditions.

To the extent that a country has a monopoly or a near monopoly over a valuable resource that cannot be obtained elsewhere, it will have considerable bargaining power as to the further usage of that resource. Diamonds in Botswana is a case in point. "Botswana's opportunity to ratchet up the pressure for forward linkages came in 2005 when De Beers

25 year mining license was due for renewal. The Botswana government had a great deal of bargaining power due to De Beers' reliance on production from its 50–50 joint venture with Debswana which supplied around 60 per cent of De Beers' global supply of rough diamonds. Moreover, Botswana produces high quality larger diamonds, which have higher profit margins. The government insisted that this concession would only be renewed (for another 25 years) if De Beers agreed to facilitate and promote forward linkages, beginning with cutting and polishing" (Morris, Kaplinsky and Kaplan, 2012, p. 67). In this case, the mining company, De Beers, also manages and undertakes further processes downstream of diamond mining, particularly sorting and purchasing. De Beers was thus in a position to transfer the skill and capacities entailed in downstream activities to local producers. This is unusual – generally mines engage, if at all, in only the most immediate downstream activity, namely refining. Platinum in Zimbabwe is an example. Sources of platinum are limited, and Zimbabwe was successful in threatening to halt exports of platinum to force platinum miners to build a local refinery. However, the pressure it can exert on consumers of platinum further downstream is very limited.

Even where governments are in a position to exert pressure for downstream manufacture of minerals, the "success" of such policies and the economic desirability are by no means certain. The ultimate test will be, as with all economic activities, whether this pressure will allow for the development of competitive local skills and capacities. There is far more potential for a positive outcome where, as in the case of diamonds, this pressure can be exerted on foreign firms that can transfer the requisite skills and capabilities required for downstream activities.

4.3.3 Lateral linkages

Skills and technological capabilities employed in mining and mining-related activities may diffuse laterally to other activities. Lateral linkages will be far stronger where local firms have the capacities and skills to absorb technological advances generated in mining. In South Africa, for example, there are numerous examples of the absorption of technological capabilities generated in mining and mining-related activities into other economic activities (Lorentzen, 2008). To take just one example, a number of South African companies in construction have developed internationally competitive capacities in the construction of large mining operations and extended these skills and capacities into other areas of construction.

Some analysts have argued that in South Africa, policy should accordingly focus on lateral migration rather than beneficiation. Of particular

note is the development of engineering capacities. "Concentrating on beneficiation may also lead policymakers to overlook more attractive 'lateral' development opportunities. Capabilities developed in mining may lead more naturally to other types of engineering for example, than to downstream minerals processing" (Hausmann, Klinger and Lawrence, 2008, p. 1).[11]

The development and diffusion of local capabilities in engineering specifically are of particular importance. Engineering overlaps with design, which can be defined as an activity or process that creates the "specifications" of products, processes and production systems. Engineering entails the realization of these specifications into concrete operations. As such it encompasses activities such as project management and procurement; implementation and systems integration; testing and supervision (Bell, 2012).

The ability of countries to assimilate technology; to adapt technology to local conditions; and to implement technology blueprints and design is critically dependent on engineering capacities. Engineering capacities have multiple applications – in the terms employed by Haussman and Klinger, they are located in the dense part of the product space (Haussman and Klinger, 2006). Engineering capacities are the most likely to migrate laterally from mining-related activities and to find application in a wide variety of other areas.

Mining and mining-related activities are engineering intensive. This is most apparent at the stages of specification, design and construction of a new mine. However, demand for a wide variety of engineering-related services remains consistently high throughout the life of a mine – repair, maintenance, project management and software design, for example.

Each mining-related project has its own peculiarities and cannot be resolved by application of a template developed elsewhere. Engineering-related services have to be applied and supplied directly to the operational activities. Moreover, delays in providing engineering services such as repair and maintenance, but also project execution, are likely to have a significant negative impact on operational efficiencies and be extremely costly.

Individually and collectively, these factors will place a high premium on the development of local engineering activities – and this applies to all countries with significant mining activities. In turn, the development of local engineering activities, while initially developed in relation to mining, can potentially enhance efficiencies in other areas of economic activity, including the assimilation and adaptation of foreign technologies to local conditions.

In countries in which the level of development is comparatively high and the mining industry well developed and long standing, mining-related engineering and other services may well be an area of comparative advantage based on well-developed technological competencies. This is the situation, for example, in South Africa. Mining equipment and mining-related services simultaneously exhibit a significant positive balance on the trade account and a significant cluster of highly valued patents. There exists considerable potential to expand and enhance both the overall volume as well as the sophistication of exports of mining-related engineering and other specialist services (Kaplan, 2012).

Where the level of development is lower and the mining industry less well established, capacity to export will accordingly be far more limited. In other African countries in which mining is a significant locus of activity, the rationale for particularly "targeting" the enhancement of mining-related engineering and other services rests in the key role that such activities play in enhancing technology diffusion very broadly – the effectiveness of technology absorption and adaptation.

How is the enhancement of mining-related engineering and related services to be effected? This is the subject for another study. But, in broad terms, the same principles of collaborative industrial policy as advanced in respect of backward linkages should be applied. Mining companies have a clear interest in the development of locally effective activities. Government, mines and local producers collaborate in a joint effort in order to "produce" effective suppliers.

4.4 Conclusion

Linkages between mining and high value-added activities will develop over time as a function of demand and the evolution of markets. However, if left solely to the market, development will be long delayed. Short-term cost considerations will consistently favor existent low-cost suppliers. At least, in the early stages, the low-cost suppliers are invariably located outside of the country. Akin to the traditional infant industry argument advanced to develop local manufacturing, preferences to local activities related to mining are required in order to allow localized learning and the enhancement of skills and technological capacities. The initial "customer," namely the mining industry, has a long-term interest in the development of locally based input suppliers, but it has neither the capacity nor the immediate incentives to make that happen. The role of government is that of a coordinator – to provide the incentives (and pressures) to mining firms to purchase local products as well as the supports

that allow local firms to develop the requisite skills and technological capacities and to engage in the two parties in a collaborative process.

Whether government will indeed take up this challenge and how it will do so is an issue outside of the purview of this chapter. But, for governments in mineral- and energy-rich countries that are committed to enhancing higher value-added local activities and the structural change that underpins development, energy and mineral products have considerable potential. The objective of this chapter is to elaborate on this potential and to suggest, at least in broad outline, the policies that might enable the realization of this potential.

Notes

1. The largest part of the 11% spent outside of South Africa was for imported plant, equipment and specialist services. Data supplied by Economics Advisory Unit, Chamber of Mines.
2. Only in 2006 and 2007, as a result of the commodities boom and consequent high levels of growth, did manufacturing employment rise (Statistics South Africa, 2014).
3. The largest part of the 11% spent outside of South Africa was for imported plant, equipment and specialist services. Data supplied by Economics Advisory Unit, Chamber of Mines.
4. According to the European Centre for Development Policy Management (ECDPM), the multiplier is 2.5 for South Africa and 3.2 for Ghana (2013 p. 9).
5. "Fast rising oil exports during the 2000s, driven by prices that rose from USD 35 a barrel on average in 2000 to USD 100 on average in 2009, make it the dominant feature of Africa's trade over that period. Nevertheless, this feature tends to obscure the fact that African manufactured exports – including machinery, transport equipment and processed commodities but excluding processed foodstuffs (SITC 6–9) – approximately doubled in nominal value between 2000 and 2009" (African Development Bank, 2014, p. 1).
6. The gold mining industry in Peru, for example, has invested in and acquitted significant capacities in bioremediation technologies. This technology has widespread application outside of the mining industry to any site in which pollution is generated (Kuramoto and Sagasti, 2006).
7. For middle-income developing countries (Andersen, 2012; Marin and Smith, 2011) and developing countries in sub-Saharan Africa (Ovadia, 2014; Morris, Kaplinsky and Kaplan, 2012; UNIDO, 2012).
8. For examples of lead mining firms initiating supplier development program, see African Development Bank, 2013: 75–76.
9. For example, Newmont has partnered with the International Finance Corporation (IFC) to implement the Ahafo linkages program in Ghana.
10. The Ahafo linkages program resulted in an increase in the number of local small to medium-size enterprises (SMEs) that did business with Newmont increasing from 25 in 2006 to 125 in 2008. The local procurement of the

Ahafo mine increased from US$1.7million in 2006 to US$ 4.7million in 2008 (World Business Council for Sustainable Development, p. 6).

11. In South Africa, the National Planning Commission has called for more policy attention to be paid to backward linkages. "Substantially more attention will be devoted to stimulating backward linkages of supplier industries (such as capital equipment, chemicals and engineering services). Demand is certain; there is an opportunity for specialized product development, and the product complement is diverse. They are also more labour absorbing than typical downstream projects. Such products have the potential for servicing mining projects globally, which is an advantage should the commodity boom persist" (National Planning Commission, 2012, p. 147).

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5

External Opportunities, Innovation and Industrial Growth: The Case of GVCs in Africa

Padmashree Gehl Sampath and Donatus Ayitey

5.1 Introduction

The unprecedented rise in global value chains (GVCs) for trade in both intermediate and final goods has challenged traditional consensus, raising questions of who benefits from GVCs and how their developmental implications can be better channeled (Keane, 2008; Suder et al., 2015; Johnson and Noguera 2012). GVCs segment product cycles in sectors from conceptualization and research and development (R&D), all the way to production, distribution and often also disposal of product waste (Kaplinsky, 2000), leading to a new fragmentation of production worldwide.

A GVC is structured around the creation of *value* along the various stages of the process. It has been argued that participating in GVCs carries multiple benefits, including international information exchanges, new markets for products produced in developing countries, and enhanced learning and innovation. Case studies and other investigations show that GVCs have received mixed responses, particularly insofar as their ability to foster technological upgrading is concerned. A review of the good and the not-so-good cases of ongoing GVCs shows that the ability of firms to participate in and benefit from value chains is accounted for by certain factors, starting with global demand: GVCs are mostly structured around products/services for which there is continuous, foreseeable demand. Participation and benefits are also determined by capabilities for learning and innovation, which dictate how much any supplier can value-add at any node in a GVC. Other factors include competitive production capacity, as defined by variables such as reasonable costs of production and ease of compliance with technical standards, among others (Kaplinsky, 2010; Beugelsvijk, Pedersen and Petersen,

2009; Morris and Fessehaie, 2013). These factors account for why some participants emerge as winners more than others: those that have the ability to value-add, tend to benefit more (Kaplinsky, 2010; Córcoles et al., 2014).

In Africa alone, trade value-added through GVCs has risen from 6 billion to 24 billion between 1990 and 2011 for African least-developed countries (LDCs) (UNCTAD EORA Data 2014 by Lenzen et al., 2013). The data show that most sub-Saharan African countries are integrated into GVCs as suppliers of low-value-added or resource-based products. Good examples of such products are coffee or cut flowers, where producers/farmers have suddenly found themselves in a position in which an external opportunity can be capitalized upon. Despite some good examples, on a broader basis, GVCs offer employment opportunities for a large number of farmers/local suppliers, especially in the agricultural sector, which still remains one of the largest sources of income and employment for a majority of the population in African countries. For example, in the case of Ethiopia, nine of the ten top export-earning products are natural resource based, led by coffee, and the agricultural sector accounts for 85% of total employment in the country (UNCTADstat). However, many of the essential benefits, particularly those related to technological learning and innovation capacity, do not occur, given the current low levels of capacity in many African countries.

In an effort to address these concerns, and to increase the ability of national actors to produce value-added outputs that can also help benefit more from GVCs, national governments in a large number of African countries embarked on an exercise to reform or enact new policies for innovation in the 1990s (UNCTAD, 2015). The new policy frameworks aim to shift the overall emphasis from just science policy or technology policy to innovation capacity, and target learning and technological upgrading within a landscape in which GVCs play a large role in domestic industry. The newer policy frameworks also aim to replicate the incentives that supported the successes of East Asian economies, which also began their journey toward greater technological change and industrial catch-up through low-value-added products, such as garments, footwear and office goods (Kim, 2003; Feenstra and Hamilton, 2005).

Despite the relevance of these debates, few studies have analyzed the technology implications of GVCs in general, and, specifically, the impact of the new policy frameworks on innovation on benefiting from GVCs, mainly because the GVC literature and innovation and technology research tend to review these questions in isolation (see, for example, Pietrobelli and Rabellotti, 2011).

These are the two concerns that motivate our chapter. First, we analyze the impact of innovation policy frameworks on the promotion of technological upgrading through GVCs in Africa. To examine whether appropriate policies can help countries in sub-Saharan Africa reap dividends from the ongoing surge in GVCs in various product categories, we focus on the renewed emphasis in a large number of African countries on innovation policies. We seek to understand whether such policy emphasis can be measured in terms of its effects on (a) greater participation in GVCs and (b) greater value-added in and through GVCs.

The second question that is dealt with in the chapter relates to *system effects*, that is, whether it is justified to assume that GVCs in low-technology segments will have little or no system effects in terms of promoting learning and upgrading, or whether there can be intersectoral spillovers. In analyzing this issue, we build upon the work by Feenstra and Hamilton (2005), who use a trade-archeology methodology to show that several East Asian countries began their journey toward greater technological change and industrial catch-up through low-value-added products, such as garments, footwear and office products. Moving away from the standard explanation of market-led, export successes of the East Asian countries, these authors show that success in upgrading was first achieved in specific product categories only, most of which were low-technology oriented. Lee (2013) similarly focuses on product categories to show that the eventual success of East Asian economies was dependent on their specialization on certain low-and medium-technology product cycles. Based on these works that shed light on the product categories that supported the East Asian Miracle,[1] this chapter seeks to explore the critical question, how can low-technology exports in specific product categories leverage sector-wide learning effects as it did in the case of East Asia, and what is the role of policy in this process? In order to analyze this issue, our chapter seeks to assess how local innovation systems react to external knowledge sources as in the case of GVCs, to promote capabilities.

The issues considered in this chapter, despite their mounting relevance, have not received much attention due to a variety of reasons (see Kaplinsky, 2010). An impediment to analyzing these aspects has been that traditionally the literature on innovation studies has focused on how local interactions and institutional parameters shape the capabilities of actors, while the GVCs literature has focused mostly on governance structures, production implications and the advantages of participation.

A second difficulty has been that exploring the impact of innovation policy on improving the position of countries in GVCs is a complex task and methodologically demanding (Sturgeon, 2015). It is not only difficult to identify appropriate measures for testing hypotheses but also challenging to create proxies that may reflect what the additional impact of policy is on learning and industrial value-added. In order to measure learning over time, this chapter chooses a proxy each for learning effects in GVCs and the impact of policy frameworks in fostering this. We measure the role of GVCs in technological upgrading and technological capabilities building by proxying for industrial value-added. Existing studies have stressed industrial upgrading and industrial value-added, that is, "the process by which economic actors (nations, firms and workers) move from low value to relatively high-value added activities in global production networks" (Gereffi, 2005, p. 171; Sturgeon and Gereffi, 2009). In this chapter, while analyzing the impact of policy on learning and value-added, we seek to emphasize technological upgrading, which remains a fundamental component of the process of industrial upgrading and industrial value-added. Other studies have used similar methodologies, focusing on industrial upgrading, to derive the extent of technological upgrading (Mahutga and Smith, 2011; Dicken 2003, among others).[2] The logic is that, without the capacity to technologically learn and constantly upgrade production techniques, firms are unable to move from low-value-added to higher-value-added activities as part of the industrial upgrading process.

To measure the policy impact of innovation policies on increased participation and value-added in GVCs, we choose industry R&D as a proxy. We do so because most innovation policy frameworks in African countries have set increased R&D spending (as a percentage of gross domestic product [GDP]) as their targets, and a large number of the countries have scaled up R&D investments and public R&D infrastructure in this regard (see Section 5.3). Finally, we use the term "Africa" to mainly denote sub-Saharan African countries (including South Africa) in this chapter.

5.2 GVCs and data limitations

Much of the GVCs literature and many of the approaches to measuring value distribution have been dominated by the trade literature. Viewing GVCs from a trade theory perspective has many advantages. It helps one to understand a two-way relationship: how the global production networks are evolving, and how global trade is channeling the demand

for certain products/services over others to create production networks around them, and thereby influencing industrial structures in developing countries. Methodologies for measuring value-added by trade economists show how the burgeoning global trade is becoming increasingly driven through network trade (i.e., trade in intermediate as well as finished products and services), and how this impacts the trade gains of countries.

Despite the growing body of work, however, there is still some disagreement on how to measure value along the various points of the GVC. Because the GVC literature grew from the perspective of comprehending the impact of various governance forms on performance and value additions, it was not focused on measuring the benefits of participating in any particular GVC as opposed to another for an individual firm. Over time, due to the enormous significance of understanding value addition in GVCs, not only to assess their benefits more accurately but also to codify the gains from trade to developing countries, various approaches have emerged to measure value in real terms or through proxies.

Furthermore, trade data has several shortcomings in measuring value-added through GVCs.[3] Given that GVCs are proliferated by trade in intermediate goods, which is rising more sharply than trade in finished products that embody these goods, using trade data to measure GVCs risks double counting (in terms of intermediate and then final products that embody the same value-added). Measuring the net trade value-added through input-output analyses has therefore been suggested as a reasonable means to measure GVCs, particularly to avoid double counting (see, for example, Suder et al., 2015; Johnson and Noguera, 2012). Other approaches include using local sales versus cross-border sales, shares of retail value-added, and final retail price as proxies for the division of value-added (Beugelsvijk et al., 2009). All these approaches have their strengths and weaknesses. Input-output approaches run the risk of assuming that firms produce in a vacuum, since they does not have any means to factor variables other than the input and the value-added output into the equation. The role of the firm's institutional environment, overall production costs, skills, linkages, and networks, both internal and external, in creating the value-added are overlooked. Similarly, assessing value-added through retail value-added tends to underestimate the retail margins in different contexts (high margins versus lower ones) and also does not factor in production costs (Keane, 2008). Sturgeon and Gereffi (2009, p. 13) note the limitations of using trade data to capture accurately that "trade statistics alone contain very partial information about the location of the value-added, and no

information about the ownership of these productive assets and output, when profits are reaped, or how these increasingly complex systems are coordinated." In addition, trade statistics alone cannot help pin down the relative technological learning of local versus external partners, and the knowledge flows and spillovers.

The OECD/World Trade Organization Trade in Value-Added (TiVA) database and UNCTAD-Eora database are currently two important sources of GVC data. While the TiVA database provides data on 57 countries, most of which are members of the Organization for Economic Cooperation and Development (OECD), the UNCTAD-Eora database provides information on value-added trade and covers 187 countries, including over 90% of countries in sub-Saharan Africa (Lenzen et al. 2012 & 2013). Presently, GVC analysis is an emerging area of research, and existing data on value-added trade have their own limitations, which are routinely being highlighted (see Sturgeon, 2015). Despite these limitations, UNCTAD-Eora data currently provide the most comprehensive existing data on value-added trade and GVCs for developing countries when compared with TiVA, which largely focuses on developed countries and only one country in Africa (i.e., South Africa). This chapter therefore relies on the UNCTAD-Eora value-added trade dataset.

We acknowledge that the UNCTAD-Eora data only provide a steppingstone and insights into the trade value-added and GVC situation in developing countries due to certain limitations. The first limitation is that many developing countries generally lack accurate intrafirm trade data upon which UNCTAD-Eora data are based. This creates loopholes in capturing sources of production inputs and the destination of outputs in such countries. The second limitation is that UNCTAD-Eora data have been criticized for reflecting largely activities within the manufacturing sector and not necessarily those in commodity trade, which generally constitute the bulk of trade in LDCs (see Keane, 2014). We therefore proceed with caution, using as many other variables as possible to augment the trade-in value-added data to draw conclusions.

5.3 GVCs, innovation capacity and policy effects

5.3.1 Technological capabilities, upgrading and innovation systems

There is a mutual, virtuous relationship between GVCs and innovation systems in all developing countries, but particularly in least-developed countries (which account for a large part of sub-Saharan Africa), which

some scholars have termed "endogenous and non-linear" (Pietrobelli and Rabellotti, 2011, p. 1261). Although the innovation systems literature and the GVCs literature both agree that there is a need to address this, the innovation systems literature has been slow to take account of foreign linkages and sources of knowledge. While the governance forms are critical for dictating what opportunities may ensue for suppliers at different nodes of the value chain, institutional frameworks that determine flows of knowledge, interactive learning and coordination in national innovation systems are equally important. On the one hand, participation in GVCs can help firms in African developing and least-developed countries acquire learning opportunities that may contribute to improving the innovation system on the whole, while on the other hand, the capacity of the local innovation system and its role in promoting firm-level learning is critical for reaping benefits from GVCs.

Specifically, given the important role of GVCs in trade, and by extension, the industrial composition of countries today, there is a large role for the study of innovation effects of GVCs from at least three distinct perspectives:

(a) the impact of the innovation policy and incentives therein (that is, the institutional framework) on building technological capabilities and thereby, greater industry value-added in GVCs
(b) the impact of GVCs on fostering the local innovation systems, in terms of promoting local innovation capabilities through technological spillovers, gradual technological upgrades and access to knowledge
(c) the relationship between greater industrial R&D capacity in countries, particularly less developed countries, and the ability to benefit and harness spillovers from GVCs beyond specific products to improve their innovation systems *per se*

Especially from the perspective of an LDC based in Africa, the most relevant benefits of participating in one particular GVC when compared to another is different at the firm level. From the standpoint of a local firm, the main benefits are export opportunities and the level of technological upgrading that it can eventually expect from being a part of the GVC (field interviews). Processes of upgrading at the firm level can take different forms. While in general, one assumes technological upgrading to include forms of technological learning and skills building,[4] other forms of upgrading activities can also occur as a result of integration in GVCs, all of which contribute to building technological capabilities.

This includes intersectoral and functional upgrading[5] activities both of which are critical to promoting innovation capacity in participating firms (Humphrey and Schmitz, 2000).

We acknowledge that technological upgrading that occurs through any of these channels is difficult to measure, but it remains an essential component of industrial upgrading and value-added, which is more easily measured. In order to find proxies for technological upgrading, we base our analysis on a number of useful taxonomies of technological capabilities that have been elaborated by several scholars, including Lall (1992), Ernst, Ganiatsos and Mytelka (1998), and Bell and Pavitt (1993), among others. We define technological upgrading as a process that results from skills that firms need in order for them to acquire, assimilate, use, adapt, change and create technology. These can range from basic production and manufacturing capabilities (which employ knowledge and skills used in plant operation) to redesign and product modification capabilities (employing firms' abilities to adapt and improve its products), or capabilities for new products and process design (which is required to create innovative technological breakthroughs) (see Oyelaran-Oyeyinka and Gehl Sampath, 2010). Therefore, we consider variables such as tertiary education, exports of high-technology products, and scientific and technological publications, in addition to trade variables in our model.

5.3.2 Policy effects

If policies for innovation are relevant, then one must be able to capture the effects of policy shifts on industry value-added in countries, and by extension, on technological learning over time. If this is not the case, then one would be forced to conclude that innovation policies at the national level do not exert an influence on the participation in, and benefits derived from GVCs, and that these are largely dictated by exogenous factors.

Reviewing the changes in the policy landscape, one finds a dramatic shift in African countries from policies on science or science and technology, to innovation policies that explicity seek to build and strengthen national innovation systems. Table 5.1 highlights the move in countries in the region toward science, technology and innovation policy frameworks with dedicated ministries and agencies for this purpose since the latter half of the 1990s. The critical change in the focus of these policies was the shift in perspective from focusing on the supply side of provision of scientists and engineers, to simultaneously promoting innovation capacity and technological capabilities. Policy reviews of

Table 5.1 Transition from science and technology (S&T) policies to science, technology and innovation (STI) policies in selected African countries

Country	National initiatives toward development of STI policies and strategies
Angola	Presidential Decree No. 201/11: July 20 Approves the 2011 National Policy for Science, Technology and Innovation
Ethiopia	First policy on S&T drafted in 1993. Revised and approved as STI policy in 2012
Ghana	Draft National Science, Technology and Innovation Policy in 2009. Adopted in 2010
Kenya	Kenya Science, Technology and Innovation Act, 2013. STI policy approved January 2013
Mauritius	In 1999, the National Productivity and competitiveness Council was set up The process to harness innovation for national competitiveness began in 2002 In 2006, a framework for innovation policy and strategy was crafted
Mozambique	Science and Technology Policy (2003) Mozambique Science, Technology and Innovation Strategy (2006)
Nigeria	Nigeria science, technology and innovation policy, 2004
Tanzania	S&T Master Plan, 2003–2018. Process toward STI policy began in 2006
Tunisia	In 1991, the Secretariat of State for Scientific Research and Technology (SERST) was created In 1992, Higher Council for Scientific Research and Technology was created In 2003, the National Program of Research and Innovation (NPRI) was created
Uganda	Cabinet approved first national STI policy in 2009
Rwanda	Cabinet approved national STI policy in July 2005
South Africa	In 1996, white paper on science and technology entitled "Preparing for the 21st Century" was drafted The white paper was approved by government in the same year
Zambia	In 2008, there was a review of the 1996 Science and Technology (S&T) Policy. Process toward national science and innovation policy began in the same year
Zimbabwe	In 2005, Zimbabwe created its Ministry of Science and Technology, and process toward STI policy began. The president launched the National Science, Technology and Innovation Policy in 2012

Source: Compiled by authors.

the policies show that the new policies have been structured around promoting linkages in national innovation systems, coordinating and strengthening infrastructure to promote industrial R&D, and reviving defunct public sector institutions.

By 2010, it was estimated that there were up to 40 ministries overseeing innovation-related activities across various countries in Africa (UNESCO, 2010). This transition came about to facilitate the coordination between economic and noneconomic actors that is required to promote innovation capacity within countries. Another important facet of these policies is the investment of greater percentiles of GDP into R&D, particularly since the eighth African Union Summit of 2007, which called for reinforcing African R&D spending to 1% of total GDP by 2010. Figures show that some countries managed to accomplish this, much ahead of the 2010 targets set out by the Summit (see African Innovation Outlook (NEPAD, 2010) and Appendix 5.1) and many others are well on their way to increasing their R&D expenditure on an annual basis. Hence, the important issues that stand out are the following: are these policy changes impacting the creation of an innovation environment in these countries differently from before? Even if we assume the time period to be relatively short between their enactments and the current time frame, are there already changes in the institutional infrastructure, particularly for industry support and R&D, that are noteworthy?

5.4 Data and analysis of GVC effects in sub-Saharan Africa

5.4.1 Data and methodology

For the analysis in this section, the UNCTAD-Eora dataset is estimated from national supply and use tables (where available) and input-output tables (where supply and use tables are not available). While supply tables capture products produced by each domestic industry; use tables show product use by each industry. The UNCTAD-Eora dataset is therefore constructed and presented as multiregion input-output tables.[6] This dataset has been supplemented by UNCTADStats and the World Bank's World Development indicators to identify variables that could help us understand the relationship between GVCs and technological capabilities.

In order to comprehend whether appropriate policy emphasis has made a difference in sub-Saharan Africa, we introduce an innovation policy variable in the model. This variable is measured as a dummy

that captures whether there was greater policy emphasis on innovation capabilities or not. The policy emphasis in innovation policy important because as noted earlier, the emphasis on greater innovation and R&D funding for further capacity building in the region is due to the shift to innovation policy. In addition, it also promotes greater investment into building human resources that feed further into technology and innovation capabilities. Similarly, we introduce industrial R&D to ascertain its impact on value addition and participation in the GVCs. R&D policy is also measured as a dummy variable capturing whether there was a greater investment in R&D or not. The two policy variables are important to help gauge the kind of investment and emphasis on innovation and R&D being projected in sub-Saharan Africa.

5.4.2 Variables of interest

Since the extent to which sub-Saharan African countries can benefit from the GVC depends on the degree of real industry value-added to which they can contribute, our variables are a combination of trade and innovation variables to construct this scenario. From the perspective of trade, the variables of interest include real industry value-added, real manufacturing value-added, real GDP and value-added trade (US$). From the perspective of technological capabilities building, variables chosen are tertiary school enrollment (% gross), trade (percentage of GDP), high-technology exports (current US$) and scientific and technical journal articles. We construct all the variables of interest as yearly averages across countries. These are augmented by policy-related variables.

Table 5.2 presents descriptive statistics of the variables employed in this analysis. It shows that for sub-Saharan Africa, mean real industry value-added was a little over US$ 4.0 billion over the 1990–2013 period, but there are wide disparities at the country level, ranging from maximum real industry value-added of US$ 7.03 billion in some countries, to the minimum realized by some others at US$ 3.24 billion. Statistics also show that the mean real manufacturing value-added accounted for US$ 1.75 billion, that is, 41% of the real industry value-added.[7] The mean real GDP in the sub-region in the period 1990–2013 reached US$ 12.82 billion, with maximum and minimum at US$ 8.86 billion and US$ 19.80 billion respectively. The mean of trade as a percentage of GDP was at 75.39 and that of value-added trade is US$ 10.7 billion.[8]

In the case of variables to measure technological capabilities, a mean tertiary school enrollment of 4.23% was recorded, with some internal variations. There are countries that record a minimum tertiary school

Table 5.2 Descriptive statistics

	Median	Mean	Std.dev	Min	Max
Real industry value-added (in billion US$)	3.82	4.23	1.01	3.24	7.03
Real GDP (in billion US$)	11.42	12.82	3.62	8.86	19.80
Real manufacturing value-added (in billion US$)	1.59	1.75	0.46	1.31	3.13
School enrollment, tertiary (% gross)	3.38	4.23	1.99	2.06	9.18
Trade (percentage of GDP)	77.11	75.39	6.62	61.56	83.66
High-technology exports (in million US$)	46.21	56.32	33.13	2.57	139.13
Scientific and technical journal articles	90.15	93.04	10.34	82.13	115.37
Value-added trade (in billion US$)	7.21	10.69	5.74	5.98	24.24

enrollment of 2.06%, while some also record a maximum enrollment of 9.18%. The mean of high-technology exports amounts to US$ 56.32 million for the region, whereas the mean number of scientific and technical journal articles for sub-Saharan Africa stands at 93.

Table 5.2 shows a wide variation in data across data points, largely because the 48 sub-Saharan African countries captured here vary in size and industrial capacity as well as exports capabilities. For example, high-technology exports across the sub-region vary from US$ 2.57 million to US$ 139.13 million. Real GDP (in billion US$) varies from a minimum of 3.24 to a maximum of 7.03. To minimize this wide variation across data points, variables are log transformed where necessary in our model specifications (see Table 5.3 for variable definition). We use industry value-added as the proxy to deduce industrial and technological upgrading. In isolation, this may not be sufficient, but we juxtapose it with technological variables such as scientific and technological articles and high-technology exports, which help pinpoint whether learning is taking place in the exporting firms (see Lall, 2000).

5.4.3 Specification of the model

To ascertain the effects of policy emphasis on innovation capacity for industrial and technological upgrading in sub-Saharan Africa as a result of the shift from S&T policies to those that focus on innovation, we identify two time periods. We construct these two time periods because, although

Table 5.3 Definition of variables

Global value chains
Value-added trade
Trade (% of GDP)
RGDP = Real GDP
Innovation capabilities
Real industry value-added
High-technology exports
Knowledge capabilities
Scientific and technical journal articles
School enrollment, tertiary
Policy intervention
S&T = Science and technology policy intervention
STI = Science, technology and innovation policy (Low emphasis on innovation = 0, coinciding with the period 1990–2004 in this study; greater emphasis on innovation = 1, coinciding with the period 2005–2013 in this study)
R&D = Industry research and development policy (Low emphasis on R&D = 0, coinciding with the period 1990–2005 in this study; greater emphasis on R&D = 1, coinciding with the period 2006–2013 in this study)

countries began shifting toward innovation policies, there is usually a time lag between policy focus and results in terms of implemented outputs. Therefore, our first period is from 1990 to 2004, which is the period of less policy emphasis on innovation capacity of the kind required to build technological capabilities, and by extension, less emphasis on industrial and technological upgrading. In this period, countries in the region were focused on S&T policies, or in the process of reviewing them to assess means to emphasize upon innovation. The second period spans 2005 to 2013, and is the period of clear policy emphasis on innovation capacity and technological capabilities, and for industrial and technological upgrading. By this time, most countries in the region had enacted policies in this regard and also allotted budgetary and institutional support structures for various aspects relevant to innovation capacity.

Similarly, 1990–2005 is the period of less policy emphasis on industrial R&D, and 2006–2013 is the period of greater policy emphasis on industrial R&D (which is part and parcel of innovation policies, and hence the same logic follows). Our innovation and R&D policy variables assume treatment "0" and "1" for the period from 1990 to 2004 with less policy

emphasis on innovation capacity, and for the period from 2005 to 2013 with greater policy emphasis on innovation capacity respectively.

Formally,

$$T_i = \begin{cases} 1 \Leftrightarrow 2005\text{–}2013, \textit{ period of greater policy focus on innovation capacity} \\ 0 \Leftrightarrow 1990\text{–}2004, \textit{ period of less policy focus on innovation capacity} \end{cases} \quad (1)$$

This follows recent developments in the field of economic policy impact evaluation (see Card and Krueger, 1993 and Blundell, Duncan and Meghir, 1998). Let Y_i be our set of dependent variables, X_i be our set of independent variables and D_i be our set of policy dummies. Following Heckman, Lalonde and Smith (1999), we specify our model as

$$Y_i = \alpha + \beta X_i + \rho D_i + \varepsilon_i \text{ where } E(\varepsilon_i / x_i) = 0, i \leq j \quad (2)$$

This implies, we have

$$D_i = \begin{cases} 1 \Leftrightarrow \textit{we observer outcome } Y_1 \textit{ (greater policy emphasis on innovation capacity)} \\ 0 \Leftrightarrow \textit{we observer outcome } Y_0 \textit{ (less policy emphasis on innovation capacity)} \end{cases} \quad (3)$$

Therefore, plugging $D = 0$ into Equation (2), we have[9]

$$Y_i = \alpha + \beta X_i + 0.\rho + \varepsilon_i = \alpha + \beta X_i + \varepsilon_i \quad (4)$$

And plugging $D = 1$ into Equation (2), we have

$$Y_i = \alpha + \beta X_i + 1.\rho + \varepsilon_i = (\alpha + \rho) + \beta X_i + \varepsilon_i \quad (5)$$

The assumption in this model is that there is no heterogeneity in policy effects, implying that

$$Y_1 - Y_0 = \rho \quad (6)$$

Policy emphasis on building innovation capacity leads to either an increase (when ρ is positive) or a decrease (when ρ is negative) in value-added and GVV participation across the sub-region. Technically, this

results in a parallel shift either upward or downward of the XY curve from Y_0 to Y_1.

5.4.4 Hypotheses

STI and R&D policy effects on the relationship between industry value-added[10] and participation in GVCs are zero.

In other words,

– greater emphasis on STI policies does not drive participation in GVCs and more value-added, and
– greater R&D capacity also does not drive participation in GVCs and more value-added.

Formally, the null hypothesis of the partial effect of policy is

$$H_0: \rho(x) = 0, \forall\ x$$

Against the alternative hypothesis that:

> STI and industrial R&D policy effects on the relationship between industry value-added and participation in GVCs are not equal to zero.

Formally,

$$H_1: \rho(x) \neq 0, \textit{ for some } x$$

In other words,

> – greater emphasis on STI policies drives participation in GVCs and more value-added, and
>
> – greater R&D capacity also drives participation in GVCs and more value-added.

5.5 Empirical findings: partial effects

5.5.1 Relationship between industry value-added and participation and value-added in GVCs

Table 5.4 contains the results of four different models. Model (1) presents the relationship between industry value-added and participation in the GVCs (using value-added trade as a proxy for GVC) for sub-Saharan Africa. Results in model (1) show that the effect of real industry

value-added on participation in the GVCs is positive and statistically significant at 1%. Specifically, a 1% increase in real industry value-added leads to a 2.63% increase in participation in the GVCs.

5.5.2 Policy effects of greater emphasis on STI capabilities building on participation and value-added in GVCs

Table 5.4, model (2), shows that greater policy emphasis on innovation capabilities building is statistically significant at 1%, and that greater policy focus on innovation positively impacts participation in GVCs when compared to the period of less policy emphasis on innovation-related capacity building for the region. More specifically, greater emphasis on innovation policy makes a difference of 34% in value-added trade through GVCs (Table 5.4). We therefore reject the null hypothesis that greater emphasis on STI policies does not drive participation and value addition in GVCs in favor of the alternative that greater emphasis on innovation policies drives participation and value-added in the GVCs for sub-Saharan Africa. Furthermore, this model also helps substantiate the results of model 1, by showing that a 1% increase in real industry value-added leads to a 1.82% increase in participation in the GVCs.

5.5.3 Policy effects of greater emphasis on industrial R&D building on participation and value addition in GVCs

Table 5.4, model (3) shows that greater R&D capacity positively impacts participation in GVCs, and this result is statistically significant at 5%.

Table 5.4 Policy effects on industry value-added and participation in the GVCs

Dependent variable: – Participation in the global value chains [log (value-added trade) as proxy]:				
	(1)	**(2)**	**(3)**	**(4)**
Intercept	–41.98***	–24.23***	–29.79***	–22.95***
	(3.093)	(4.443)	(5.971)	(5.138)
Log (real industry value-added)	2.63***	1.82***	2.07***	1.76***
	(0.139)	(0.202)	(0.271)	(0.234)
STI policy (2005–2013)		0.34***		0.31***
		(0.074)		(0.089)
Industry R&D policy (2006–2013)			0.23**	0.051
			(0.104)	(0.098)
Multiple R-squared	0.946	0.975	*0.958*	*0.975*
Adjusted R-squared	0.944	0.972	0.954	*0.971*

Notes: ***Significant at 1%; **Significant at 5%; *Significant at 10%; Number of observations is 24; Standard errors are in parentheses.

Specifically, greater emphasis on industrial R&D makes a difference of 23% in value-added trade. In other words, greater emphasis on industrial R&D within local innovation systems contributes to a 23% rise in value-added trade through GVCs. We therefore once again reject the null hypothesis that greater R&D capacity for industrial R&D does not drive participation in GVCs in favor of the alternative that greater policy emphasis on industrial R&D drives participation in GVCs for sub-Saharan Africa. We also see in model (3) that a 1% increase in real industry value-added leads to a 2.07% increase in participation in GVCs.

In model (4), the effects of greater emphasis on innovation policies and industrial R&D capacity are simultaneously estimated. The results corroborate the results in models (2) and (3), except that greater emphasis on industrial R&D capacity is not statistically significant in model (4). This might be because industrial R&D is subsumed under the variable for innovation-related capabilities building. The predictive power of models (2) and (3) is the same, with multiple R-squared coefficients of 0.975 and 0.975 respectively, implying that the 98% of the variation in the participation in GVCs is explained by variables in these models.

5.6 Technological capabilities, upgrading and innovation systems: the results

Previously in the chapter, we proposed that there is a large role for the study of innovation effects of GVCs on sub-Saharan Africa from at least three distinct perspectives:

(a) the impact of the innovation policy and incentives therein (that is, the institutional framework) on building technological capabilities and greater value-added in value chains
(b) the impact of GVCs on fostering the local innovation systems, in terms of promoting local innovation capabilities through technological spillovers, gradual technological upgrades and access to knowledge
(c) the relationship between greater industrial R&D capacity in LDCs and the ability to harness spillovers from GVCs beyond specific products to entire innovation systems

We explore these points in detail using empirical data here.

5.6.1 Impact of the policy emphasis on innovation capabilities on greater industry value-added and greater GVC participation

Figure 5.1 presents the results of the tests[11] for the relationship between industry value-added and participation in GVCs over the two policy periods (less and greater emphasis on STI capacity). The lower-left quadrant shows this relationship in the period 1990–2004, when there was less policy emphasis on STI capabilities building and, by extension, less emphasis on industrial R&D. The upper-right quadrant shows the relationship in the period 2005–2013, when there was greater policy emphasis on innovation.

In line with the results presented in Table 5.4, Figure 5.1 depicts a positive relationship between industry value-added and participation in GVCs over the two policy regimes. We assess the impact of greater

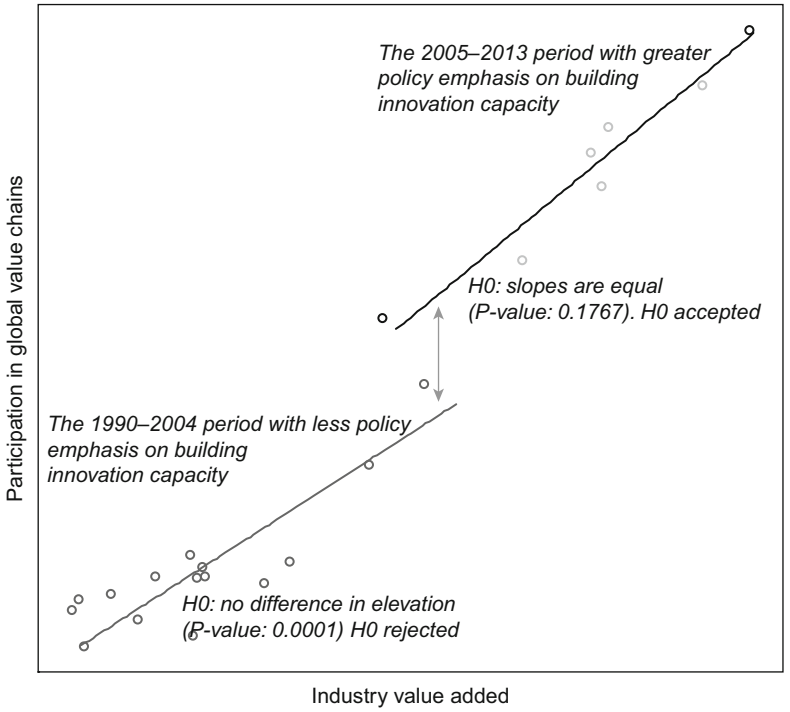

Figure 5.1 Results of policy effects on industry value-added and participation in GVCs over the two policy periods

innovation capabilities, as reflected in the capacity to produce industry value-added, on greater participation of countries in GVCs.

The results show that, in both policy regimes, *regression slopes are equal* (H_0 is accepted). Although the slopes of the two models remain the same (broadly indicating that change is slow in the two time periods), there is an increase in participation in GVCs and industrial value-added over time, as demonstrated by the parallel upward shift in the GVC curve. This implies that policy changes seem to have an emphasis on greater industry value-added. A second important inference from the shift of the GVC curve upward is as follows: the increase in industry value-added is leading to greater participation in GVCs, not necessarily in the same product category, but maybe across other product catgeories. This is an important finding, which helps address the second question raised by this chapter. It shows that opportunities presented by GVCs themselves are not a sufficient precondition for promoting capabilities building in African countries by themselves. But rather, it is innovation policy and the inherent emphasis on innovation-related activities that are extremely relevant to harnessing the system effects of participating in GVCs in sub-Saharan Africa as of 2004, much like in the case of East Asian economies. Therefore, from this point on, innovation policy has led to a greater emphasis on industry value-added and greater participation in GVCs in the same and new product categories.

5.6.2 Impact of the policy emphasis on industrial R&D on greater industry value-added and greater GVC participation

Figure 5.2 presents the results of the tests[12] for the relationship between industry value-added and participation in GVCs over the two policy regimes (less and greater policy emphasis on industrial R&D). Again, the lower-left quadrant shows this relationship in the period from 1990 to 2004, when there was less policy emphasis on industry R&D. The upper-right quadrant shows the relationship in the period from 2005 to 2013, when there was greater policy emphasis on industry R&D. Also, in line with the results presented in Table 5.4, Figure 5.2 shows a positive relationship between industry value-added and participation in GVCs over the two time frames.

However, there is no shift with respect to increase in the intercept, and the results show no statistically significant differences either in the slopes (see upper-right quadrant in Figure 5.2) or in the elevation (see lower-left quadrant in Figure 5.2). The hypotheses that the regression slopes are equal and that there is no difference in elevation are accepted

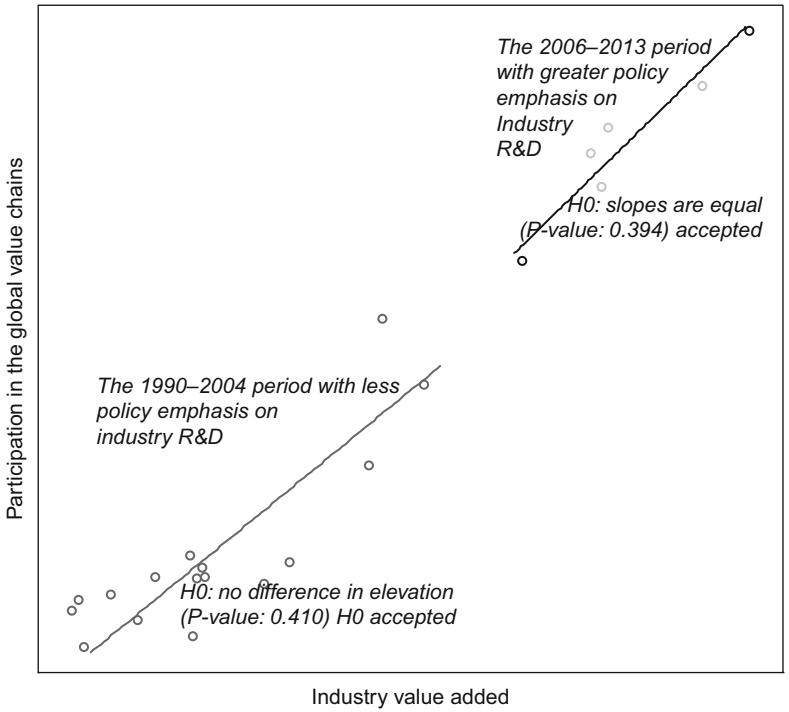

Figure 5.2 Results of R&D policy effects on industry value-added and participation in GVCs over the two policy regimes

(H_0s are accepted) in the test for equal slopes and the test for differences in elevation respectively.

This implies that a greater emphasis on industrial R&D in policies does not necessarily help us pinpoint a greater industrial value-added by way of a shift of the GVC curve upward, as we observe in the case of the emphasis on innovation policy. This implies that over the period 2006–2013, industrial R&D policies have not had much impact on industrial value-added. There are two reasons that could account for this. First, although sub-Saharan Africa countries have set targets for R&D as a percentage of GDP, these have not yet been accomplished in most countries. Gross R&D expenditure (GERD) in selected sub-Saharan African countries varies from 0.11% to 0.98% in 2011 (see Appendix 5.1). The mean R&D expenditure in 2011 was 0.50% for these selected sub-Saharan African countries. Kenya's R&D expenditure

was the highest, amounting to 0.98% in 2011. This was followed by South Africa, with R&D expenditure of 0.76% in 2011. Countries like Madagascar and Ethiopia invested 0.11% and 0.25% in R&D respectively in 2011. Second, industrial R&D investments take much more time to materialize and show results than what could be captured by the time periods that are specified in the model in this chapter (specifically 2006–2013). Therefore, although we see stronger effects of STI policy on industrial value-added, we do not have similar results for industrial R&D policies.

5.6.3 Drivers of greater industry value-added

In this last section of the chapter, we return to our original assumption that technological upgrading is a critical prerequisite to achieving industrial upgrading through GVCs and that trade data needs to be supplemented with variables on technological learning, to better understand value addition. In Table 5.5, we estimate the effects of variables on industry value-added in sub-Saharan Africa over the 1990–2013 period. These are real GDP, real manufacturing value-added, tertiary school enrollment (% gross), trade (% of GDP), scientific and technical journal articles and high-technology exports (current US$).

In model (1), we capture GDP as a proxy of participation in GVCs (OECD, WTO and UNCTAD, 2013). Therefore, the greater the GDP, the greater the participation in GVCs. The results show that the effects of real GDP and real manufacturing value-added are statistically significant at 1%, and these two variables account for 97% of the variations in industry value-added over the period (see multiple R-squared equal 0.974). More specifically, in model (1), results show that a 1% increase in real GDP leads to a 0.02% increase in real industry value-added. But a 1% increase in real manufacturing value-added has led to a 0.01% decrease in real industry value-added. This can be explained by the fact that currently a large number of GVCs are structured around mining and natural resource-oriented sectors, and do not necessarily contribute to manufacturing value-added in the region.

In model (2), we introduce tertiary school enrollment to establish the extent to which the generation of knowledge at the tertiary level drives real industry value-added. Results show that the effect of tertiary school enrollment on real industry value-added over the period is not statistically significant, even though there appears to be a positive relationship between them.

In model (3), we find that trade has a statistically significant effect on real industry value-added and that the effect of high-tech exports on

Table 5.5 Estimated multiple linear models (main effects)

Dependent variable: log (real industry value-added):				
	(1)	**(2)**	**(3)**	**(4)**
Intercept	7.32***	7.356***	7.39***	7.395***
	(0.011)	(0.0407)	(0.038)	(0.032)
Log (real GDP)	0.02***	0.019***	0.01***	0.013***
	(0.001)	(0.001)	(0.002)	(0.0017)
Log (real manufacturing value-added)	–0.01***	–0.009**	–0.007***	–0.004
	(0.001)	(0.002)	(0.002)	(0.002)
Tertiary school enrollment (% gross)		0.0001	0.0002	0.001**
		(0.0001)	(0.0001)	(0.0002)
Log (trade)			0.006***	0.0019
			(0.002)	(0.002)
Log (high-technology exports)			0.0001	0.0001
			(0.0001)	(0.0001)
Log (scientific and technical journal articles)				–0.008***
				(0.002)
Multiple R-squared	*0.974*	*0.980*	*0.989*	*0.993*
Adjusted R-squared	*0.972*	*0.977*	*0.986*	*0.990*

Note: ***Significant at 1%; **Significant at 5%; *Significant at 10%.

Number of observations is 24.

Standard errors are in parentheses.

real industry value-added is not statistically significant. Results show that a 1% increase in trade leads to a 0.006% increase in real industry value-added.

In model (4), the results show that our set of independent variables, namely, real GDP, real manufacturing value-added, tertiary school enrollment, trade, high-technology exports and scientific and technical journal articles account for 99% of the variations in industry value-added over the period (see multiple R-squared equal 0.993). This implies that many of these variables are key drivers of industry value-added. A closer look at the effect of scientific and technical journal articles on real industry value-added shows that the effect is statistically significant but negative. A 1% increase in scientific and technical journal articles leads to a 0.008% decrease in real industry value-added. The explanation for this negative relationship lies in the fact that the real industry value-added that is currently occurring in the sectors is not technologically

intensive (i.e., mining, natural resources, etc.). These articles need to be exploited for greater value-added, without which the resources invested in their production or acquisition may not be of much value to real industry value-added, and hence the negative relation in the present context.

5.7 Concluding remarks

This chapter has analyzed the linkages between GVCs, technological capabilities building and the relevance of innovation policies (and to some extent, industrial R&D). Our results confirm that greater policy emphasis on innovation capacity and industry R&D within policy frameworks matters for greater value addition and greater participation in GVCs.

The two questions dealt with in detail are as follows. First and foremost, can appropriate policies help African LDCs reap dividends from the ongoing surge in GVCs in various product categories? To assess this, we studied the policy effects of shifting toward policies with a greater emphasis on innovation capabilities on increased participation in GVCs and greater value-added. In this regard, the results show that policy emphasis on innovation capabilities from 2005–2013 in sub-Saharan African countries had a positive impact on increased industry value-added and greater participation in GVCs. Results further confirm that innovation policies are critical to ensuring that system-wide effects on technological learning and industry value-added are harnessed beyond the product categories in which GVCs trade is currently ongoing. These results should not be overlooked in debate on GVCs and development.

The second question relates to system effects, as based on the work done by Feenstra and Hamilton (2005). In this regard, we analyzed the role of local innovation systems in promoting the creation of local capabilities for innovation in and through GVCs, to enhance domestic value-added. The analysis helps conclude that, although opportunities presented by GVCs are important, they are by themselves not a sufficient precondition to promote capabilities building in African countries. It is innovation policy and local innovation system effects that are strengthened through such policies that are both extremely relevant to harnessing the system effects of participating in GVCs in sub-Saharan Africa as of 2004.

We also find that over the time period considered in this chapter (namely 2000–2013), GVCs may not have had a positive impact on

manufacturing value-added in the region. However, our results show that the lack of a clear impact is related to the weak interface of GVCs participation with variables for technological capabilities building, due to weak or nonexistent policy, and institutional support for innovation capacity in countries in the region prior to the time period studied in the chapter. Our findings in this regard are as follows:

(a) Greater policy emphasis on local innovation capacities contributes to a 34% rise in value-added trade through GVCs in the period 2006–2013. This could perhaps be larger when measured over a longer period of time in the future, with successive emphases on innovation policy in the same direction as we witness now. We therefore conclude that the low impact on manufacturing value-added, which has been expressed as a criticism against GVCs for sub-Saharan Africa in many studies, can perhaps eventually be reversed through greater policy emphasis on innovation capacity building in the region.
(b) Greater policy emphasis on industrial R&D began to show positive effects (23%) in the period 2006–2013, but its impact is not clearly demonstrable, as in the case of the impact of innovation policies. We conclude that this may be due to the fact that most countries in the region have yet to implement the R&D investment targets that they have set out for themselves, and because the results of industrial R&D can only be measured over longer intervals of time.

A last set of results of this chapter relates to the relationship between GVCs, industrial upgrading and technological upgrading. In the model presented in Table 5.5, we find that many of these variables on technological capabilities and upgrading are key drivers of industry value-added. The results show that real GDP, real manufacturing value-added, tertiary school enrollment and trade have been important drivers of industry value-added in sub-Saharan Africa in the past two decades.

Although the time period considered in this chapter is rather short, it is illustrative of the extreme importance of innovation policies on facilitating learning through GVCs. Based on these empirical findings, we conclude that sub-Saharan Africa needs even greater commitment and investment in the development of local innovation systems, with focus on promoting industry R&D to help boost value addition while promoting greater participation in GVCs and to tap into global knowledge bases and innovation systems.

Appendix 5.1

Table A 5.1 GERD as a percentage of GDP in selected sub-Saharan African countries (2010–2012)

	2010	2011	2012
Cape Verde	...	...	0.07
Ethiopia	...	0.25	...
Gambia	0.02	...	0.13
Kenya	...	0.98	...
Lesotho	0.03	...	0.01
Madagascar	0.15	0.11	0.11
Mali	...	0.66	...
Mozambique	...	0.46	...
Senegal	...	0.54	...
South Africa	0.87	0.76	...
Togo	...	0.25	...
United Republic of Tanzania	...	0.52	...
Mean	*0.27*	*0.50*	*0.08*
Minimum	*0.02*	*0.11*	*0.01*
Maximum	*0.87*	*0.98*	*0.13*
Standard deviation	*0.41*	*0.27*	*0.05*

Source: UIS data.

Notes

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1. See Lee (2013) for a further, strong exposition of these arguments in the East Asian context.
2. Mahutga and Smith (2011), for instance, point out that industrial upgrading to a large degree depends on outsourcing decisions and technological upgrading of firms
3. See Sturgeon and Gereffi (2009) for a detailed account.
4. Note that in theory, as Morrison, C. Pietrobelli and R. Rabellotti (2006) observe, it is often not clear whether upgrading is used as a synonym for innovation or as something that is the result of innovative activities.
5. The movement from assembling to design activities.

6. See http://unctad.org/en/PublicationsLibrary/diae2013d1_en.pdf.
7. In most countries in the region, industry value-added is a sum of manufacturing, mining and utilities.
8. This figure captures all value-added trade in intermediate goods and final products: the larger the amount of intermediate goods, the greater the figure in the case of many developing countries.
9. See Fox John (1997).
10. As the proxy for measuring industrial upgrading, as explained earlier in this paper. Technological upgrading as a component of industrial upgrading is deduced through other variables in our model.
11. See application of SMART 3, an R package for estimation and inference about allometric lines by Warton, Duursma, Falster and Taskinen (2012).
12. See application of SMART 3, an R package for estimation and inference about allometric lines by Warton et al. (2012).

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6

Growth and Structural Change in Africa: Development Strategies for the Learning Economy

Bengt-Åke Lundvall and Rasmus Lema

6.1 Introduction

Recent press reports suggest that Africa may now be at a turning point in terms of economic growth and development. These reports point out that, although starting from a low base, Africa is now the world's fastest-growing continent (August, 2013). However, naive optimism on this ground should be avoided (Karuri-Sebina et al., 2012). The recent growth has been concentrated in particular countries and sectors, and the transformation of growth into sustainable social and economic progress will not happen automatically.

There is thus a discrepancy between the reporting of record growth rates for African economies in the media and the reality of how people's living conditions have evolved over the last decade in the African high-growth economies. The widely shared understanding among development scholars that registered economic growth and development must be seen as two distinct, even if related, processes has become more evident than ever. In this chapter, we argue that in order to transform the economic upswing as measured by gross domestic product (GDP), fast-growing African countries need structural and institutional change across the economic, social and political spheres that bring them closer to what we refer to as "learning economies."

The widening of the gap between reality on the ground and perceptions based on growth rates reflects partly that the increasing global demand for natural resources – especially for commodities such as oil and minerals – has led to advantageous change in terms of trade and to increased export volumes, and raised the rates of gross national product (GNP) growth,

while the impact upon domestic employment has often been limited and sometimes negative. The expansion of the commodity sector does not automatically create large-scale employment directly, and so far it has rarely resulted in a substantial increase in job creation in upstream and downstream manufacturing and in knowledge-based services.

It has even been argued that the structural change that occurred in low-income economies with high rates of growth had a negative impact upon the potential for future aggregate economic growth (McMillan, Rodrik and Verduzco-Gallo, 2014). The share of low-productive workplaces, many of them in informal sector activities or in subsistence agriculture, has grown in the midst of the period of rapid growth. This has gone hand in hand with deindustrialization – the share of the labor force in manufacturing has fallen from an already low level.

We will take this as starting point for an analysis of opportunities and policy options for African countries seeking innovation and learning-based development strategies. What kind of policies and institutions are necessary in order to transform the current increase in rents from commodities exports into industrial investment and the upgrading of agriculture and agroindustrial development?

We raise this question amid discussions within the global policy community about Sustainable Development Goals (SDGs) to replace the Millennium Development Goals (MDGs) (United Nations, 2014). The SDGs, unlike the MDGs, address the need for productive capacity in developing countries and see the eradication of poverty as an effort proceeding from within, with less reliance on donors. Our chapter aligns with these ambitions.

To inform the discussion, we draw on an analysis of competing theories about economic development. We contrast the recommendations of neoclassical economists with those that can be derived from the classical development economics, which includes scholars such as Dobb, Hirschman and Sen. The theoretical perspective that we propose on this basis takes into account that we have entered a phase – the learning economy – in which it is useful to take as starting point that "learning" is at the core of any process of development. Development is a process in which individuals and organizations learn to do new things, and learn to do them in new ways in conjunction with structural transformation. At the core of the process of development is competence building. In this chapter, we analyze development and learning at the micro-, macro- and meso-levels.

On the basis of empirical patterns and theoretical considerations, we discuss policy options in relation to the African reality. This is not

easy. First, there are major differences between African countries – there is not one strategy that fits all. Second, in many African countries the most fundamental barriers for development are sociopolitical rather than technoeconomic. Here political transformations must go hand in hand with socioeconomic and technological transformations. Finally, as outsiders to the African scene, we can refer to lessons from other parts of the world and sketch dilemmas and alternative options, but the relevance of these lessons needs to be assessed on a case-by-case basis, and the specific strategies need to be built on the basis of local experience.

6.2 Recent developments in Africa's economies

6.2.2 Growth and structural change

In a recent contribution, Valensisi and Davis (2011) analyze the latest patterns of growth and structural change in the least-developed countries, including most of the sub-Saharan countries. They refer to the rapid growth between 2000 and 2009 – on average GNP has expanded at 7% per annum. They show that even average GDP per capita increased as much as 5.5% (growth was unevenly distributed, so median growth for this group of countries was 2.2%). The authors make an effort to go behind this observed pattern of growth in order to understand the underlying structural change process.

They find that the impressive record of economic expansion was based upon rapid growth in the exports of hard commodities and on a capital inflow (foreign direct investment, overseas development assistance and remittances) that allowed for development of consumer demand for services as well as demand for imported consumer goods. Agriculture grew only slowly, and in most of the least-developed economies there was deindustrialization (in two-thirds of the least-developed economies, the share of manufacturing was reduced from its already modest level).

The growth process and the increased demand for natural resource-based commodities did not lead to any increase in the investment ratio – on average the rate of investment remained close to 20%. Most of the extra income was absorbed by middle-class consumption, and in many of the countries imports grew more than exports (in 38 out of 49 countries). One problem with this pattern of growth is that it does not create a sufficient number of decent jobs for the many young people in Africa. Another issue is that it establishes a vulnerable economic structure in which the whole economy is dependent on single hard-commodity export products.

6.2.2 Insufficient job creation and poverty reduction

The UN 2013 economic report on Africa recognizes the problems with the current lopsided growth pattern – seen in the heading "Making the Most of Africa's Commodities: Industrializing for Growth, Jobs and Economic Transformation" (United Nations, 2013b). This UN report points out that the employment problem remains unsolved in most African countries:

> Strong growth across the continent has not been translated into the broad-based economic and social development needed to lift millions of Africans out of poverty and reduce the wide inequalities seen in most countries. This is because Africa's recent growth, driven by primary commodities, has low employment intensity – that is, the ability to generate jobs…
>
> Thus the continent continues to suffer from high unemployment, particularly for youth and female populations, with too few opportunities to absorb new labor market entrants.
>
> More than 70 per cent of Africans earn their living from vulnerable employment as economies continue to depend heavily on production and export of primary commodities. Investments remain concentrated in capital-intensive extractive industries, with few forward and backward linkages with the rest of the economy. (United Nations, 2013b, p. 30)

The report also indicates that the impact of growth on poverty reduction has been modest:

> Recent data show some slight improvement in poverty reduction, even though the region will not be able to achieve the related MDGs. The proportion of people living in extreme poverty (below $1.25 a day) in Africa (excluding North Africa) has been projected to reach 35.8 per cent in 2015 against the previous forecasts of 38 per cent (United Nations, 2011). This slight, albeit slow, improvement is partly attributable to high and sustained economic growth since 2000. (p. 35)

The general picture is that the growth in global demand for natural resource-based commodities, especially hard commodities such as minerals, has driven growth in the high-growth economies in Africa. Combined with an inflow of financial resources, this has stimulated

private consumption of domestic services and imported manufactured goods. The employment impact and the impact in terms of poverty reduction have been limited. A third problem is that the kind of structural change that has taken place with deindustrialization, growth in urban informal employment and stagnating productivity in agriculture may undermine the prospects of future economic development.

6.2.3 Growth-reducing structural change

McMillan and Rodrik (2011) pursue a simple exercise in which they break down the observed aggregate growth in labor productivity into two components for the period 1990–2005. One component reflects productivity growth within sectors, and the other component is the effect that comes from moving labor from sectors with low levels of productivity to sectors with high levels of productivity. According to the authors, most African countries have been characterized by a trendwise move of labor from high- to low-productivity sectors (including urban informal sectors). This is what the authors refer to as growth-reducing structural change.

This observation goes against what should be expected since productivity gaps between sectors are extremely big in the least-developed countries. Therefore, we should assume that economic development takes the form of workers moving from low- to high-productivity sectors. But actually the opposite takes place in most of the observed countries. Exceptions are Ghana and Ethiopia, where structural change gave a positive contribution to economic growth. According to McMillan and Rodrik, to change the dominant negative direction, there is a need to directly invest in manufacturing and especially to expand manufacturing activities with more value-added to the products. According to the authors, flexible labor markets should help. Below, we propose more ambitious policies related to building learning economies as a response.

6.2.4 National technological capabilities in Africa

Mayor, Blazquez de la Hera and de Diego Ruiz (2012) have attempted to map the distribution of technological capabilities in Africa. Their analysis covers 30 African countries for the years 2010–2011, and the data they use emanate from the World Economic Forum and come either from statistical sources or from an executive survey. Technological capabilities are presented in three dimensions: (a) the available base (Internet use, educated labor and research and development [R&D]); (b) government and business technological effort (technological infrastructure,

enterprise performance and policies related to innovation); (c) results (patents and intellectual property-regime).

The analysis leads the authors to define four clusters of countries in which South Africa stands alone as the lead country, followed by Morocco, Tunisia and Egypt. The countries with the weakest technological capacities are Algeria, Libya, Mauretania and Zimbabwe. It should be taken into account that most of the data come from surveys with business leaders and that there might be a bias in favor of regimes that do not intervene by regulating business activities.

Nonetheless, the analysis illustrates that Africa is heterogeneous and that different countries face different challenges when it comes to developing and making use of technological capabilities. It is also worth noting that almost all of the lead countries have experienced political turmoil recently. We are going to turn back to this issue later since it indicates that investments in upgrading the skills of the young generation that are not followed by economic opportunities may lead to discontent and unrest.

6.3 What is development?

6.3.1 A neoclassical theory of development

If we start from neoclassical economics and deduce how less-developed countries may catch up, the focus of policy intervention would be on institutional design aiming at well-defined private property rights, including intellectual property rights. It would certainly recommend ubiquitous introduction of the market mechanism, and it would propagate private ownership and recommend keeping the public sector as small as possible. It would advise against protectionism and hampering international trade and capital flows. The role of government should be limited to securing a stable macroeconomic context and to guaranteeing private property, including intellectual property.

In cases of *obvious* market failure, however, government may be allowed to intervene. For instance, scientific information may be seen as a public good and therefore require state production or subsidy. But generally, governments should stay out of the economic process and leave it to the market to give signals to actors. Specifically, there would be a strong emphasis upon the advantages of free trade. Through the free working of comparative advantages, resources would be used in the most efficient way. Since all countries have equal access to information, including technology, we would expect a general tendency

toward convergence in productivity and living standards. This "neoclassical theory of development" lies behind what has been called the Washington Consensus.

Recent history demonstrates that most of the countries that have built their strategy on the assumptions of neoclassical theory have failed to develop and that most of those that have prospered, especially those in Asia, have deviated from these ideas. Going further back in history, it is obvious that the rich countries did not become rich by following the neoclassical prescriptions. They protected their industries, and they showed little respect for intellectual property rights. Actually, it was almost a rule that countries emulated technologies developed in other countries, often with such success that they became technology leaders. But the theory and the prescriptions remain very much alive since they are strongly supported by powerful global interest groups and institutions rooted in the developed countries.[1]

A book by Stiglitz et al. (2013) on industrial policy in Africa offers a modified version of the neoclassical development theory that uses the frequency of market failure and not least the importance of knowledge and learning as arguments for a more selective and interventionist industrial policy. Actually the authors argue that neoclassical economics has accepted that industrial policy is now not only acceptable but also commendable. It may be noted that the authors say nothing about infant industries and trade and that there is a tendency to recommend moderate interventions with full respect for "comparative advantage."

6.3.2 Development economics

In the late 1940s, there was a growing interest in trying to explain and remedy economic underdevelopment. One of the first important contributions that triggered the debate was offered by Rosenstein-Rodan (1943). The basic question was, how could the poor countries catch up with the rich countries? The debate was quite polarized. Some of the literature came from Marxists, who saw global inequality as rooted in an imperialist system and assumed that the only way for poor countries to grow rich was through a transformation toward a socialist and centrally planned economy. Others, belonging to the liberal camp, took the opposite view and saw underdevelopment as reflecting that markets were not free and that capitalist institutions were not sufficiently well established.

A group of scholars with a mixed ideological background – Lewis, Rosenstein-Rodan, Singer, Dobb, Sen, Hirschman and others – came up

with more complex prescriptions for how poor countries could grow rich. They proposed that five elements were absolutely essential for development:

1. A high rate of savings and investments;
2. A first stage of import substitution increasingly to be combined with expansion of export;
3. The capacity to absorb technological knowledge from abroad;
4. A focus upon expanding the manufacturing sector;
5. An active role for the state in guiding the direction of development.

It is interesting to note that in the countries that were the most successful and competitive entrants in the world economy, Japan, Korea and China, all five elements were present. But it is also true that in other parts of the world, the attempts to combine import substitution with learning from abroad were much less successful in developing self-propelling industrial growth – at least in the long term. The less-successful examples were often countries in Latin America and Africa with higher degrees of inequality and with political systems that invested less in building the domestic knowledge base necessary to learn from abroad.

So one cannot say that the theory was ever proven to be wrong. Rather, the experience indicated that while the five conditions listed might be necessary, they were not sufficient. In the meantime, international organizations such as the World Bank, the International Monetary Fund (IMF) and the Organization for Economic Co-operation and Development (OECD), dominated by the United States, set conditions for loans and assistance that made realizing the conditions very difficult for those developing countries that became (made themselves) dependent on loans and grants.

6.3.3 Aggregate growth and structural change

Macroeconomists sometimes assume that economic growth takes place, as in a corn economy, with only one sector. They do so in order to keep things simple and make advanced mathematical modelling possible. Yet this perspective misses out on the fundamental fact that growth and structural change are two sides of the same coin (Pasinetti, 1980). Aggregate growth will reflect the uneven growth rates in different sectors in the economy – and in national accounts, the growth of the whole is actually a weighted sum of the growth of its parts.

In this context, Kuznets (1966) makes an elementary but often neglected point. He shows that high rates of aggregate growth typically

require that the big sectors expand rapidly. Even if a new sector develops quickly, its contribution to aggregate growth will, to begin with, be modest. Therefore, accelerating growth in the currently dominant sectors – such as agriculture or the urban informal service sector in Africa is an obvious way to raise income per capita in the short to medium term. A typical pattern of growth for the rich countries has been to raise productivity in agriculture, while workers have moved from agriculture to manufacturing. In Africa, increasing the productivity in the informal sector and creating demand for labor outside the informal sector is a major challenge.

This is important since the informal sector remains a significant and even expanding economic force in sub-Saharan Africa. The sector is estimated to account for more than 65% of nonfarm employment in sub-Saharan Africa (Adams et al., 2013). It is obvious that a successful industrialization strategy would reduce the relative weight of the informal sector in the long term. Given its current weight in the sub-Saharan economies, measures to upgrade workers' skills and the technologies used in the informal sector would provide substantial contributions to growth and welfare. The same is, of course, true for agriculture, which is the other major sector in terms of employment in most of the least-developed economies.

But it is equally the case that in the long term, the emergence and growth of new sectors is crucial for the wealth of the nation. The ideal new sectors would be characterized by rapid technological learning, increasing returns to scale and increasing world demand. And these sectors must to some degree build upon already existing domestic competence in the labor force and in enterprises. It may be a problem to foster such new sectors when traditional big sectors have strong representation in the political system (cf. soy producers in Argentina and the oil industry in northern Africa). Finding ways to align the interests of dominating sectors with the formation of new sectors may be necessary to overcome such barriers.[2]

One of the most fundamental questions now debated among innovation scholars is what role that natural resource-based sectors, and especially those producing hard commodities such as minerals, oil and gas, can play in a process of industrial transformation. Is it correct that such sectors offer less potential for technological learning and for building upstream and downstream couplings, as well as a lateral transfer of knowledge to other sectors? Or does this version of the "resource curse" view just represent leftovers from the classical development economists? Do new perspectives on how local firms can link up to global value

chains make these views obsolete? Another relevant question is whether it is possible to create a sufficient number of new jobs for the young generation without industrialization. We return to these questions in the last sections of the chapter.

6.3.4 Learning, innovation and development

Stiglitz (2011) proposes that there is a need to engage in "rethinking development economics." It is remarkable that he builds his argument around the concept of "the learning society" – a notion that has been central among innovation scholars for many years. Braendgaard et al. (1992) presented ideas for innovation policy in the learning society in the context of the analysis of national systems of innovation (Lundvall, 1992). Two years later, Lundvall and Johnson (1996) further developed this concept under the heading "the learning economy." As pointed out in Lundvall et al. (2009), several scholars, such as Viotti (2002), have proposed to refer to national learning systems in developing countries rather than to present them as national innovation systems. In this section, we offer a perspective on development that is rooted in our interpretation of the concept of the learning economy.

An ambitious definition of development must refer not only to registered economic growth and structural change. We should also take into account the welfare of individuals and how resources and capacities are distributed among individuals, regions and classes. Long-term generational perspectives also need to be taken into account. Such a definition would include both material conditions and mental and spiritual conditions, including positive and negative experiences of traditional and new communities. It would need to reflect experiences from different roles in life, such as those of consumer, family member, citizen and worker. Short-term gains should be weighed against long-term costs and foregone opportunities, such as environmental degradation and the depletion of nonreproducible natural resources.

Here we are going to be more modest and bring in two dimensions that tend to be neglected in the traditional view on development and economic growth. The first refers to *the quality of working life*, while the second refers to the crucial role of the uneven capacity to learn and the *uneven access to learning*. The most primitive versions of welfare economics assume that increasing the bundle of consumption goods is basically what constitutes increased welfare. This is why national income per capita is the most frequently used indicator. The perspective is implicit in the argument in favor of free trade combined with "flexible" work arrangements.

For instance, while the positive impact of globalization on consumption opportunities is taken into account, possible negative consequences upon job security and working conditions are neglected. This traditional perspective is especially problematic when it comes to assessing economic development in Africa, where increasing consumption opportunities for the middle class seem to have gone hand in hand with more vulnerable employment and less quality in working life for the majority of workers.

In order to understand the importance of learning, it is useful to start from Sen's definition of welfare as the "freedoms" and capabilities to realize what one regards as valuable. This is, in general, a valuable approach because it takes into account that the aspirations of people may be different in different countries and regions. We would nonetheless, in this context, like to emphasize "access to learning" as perhaps the most fundamental freedom, especially in a society characterized by rapid change in people's private and professional lives. The two concepts of learning and development are crucially interconnected both at the individual level and at other levels of the economy – learning organizations, learning regions and the learning economy at the aggregate level. There are two reasons why we should focus upon learning.

First, a crucial prerequisite for any kind of economic transformation is a speed-up of learning as competence building both among individuals and within organizations. Structural change is a process in which people are confronted with new tasks. Second, we would argue that learning is not only of instrumental value in enhancing the productivity of the individual worker; it is also of substantive value for individuals. This is obvious for the child's development into adulthood. To block the child's process of learning to communicate and act in society would be cruel. For most adults, a life without any learning would constitute monotony.

This perspective does not rule out that the speed of learning imposed by circumstances may become disturbingly high and create stress and suffering, especially when individuals have no capabilities to understand and manage the processes involved. Neither does it mean that all forms of learning represent progress. And learning new things implies that old knowledge becomes obsolete. Learning as well as development will *always* involve creative *destruction*. As new patterns take form, old ones tend to be destroyed. Often the old patterns are seen as positive by some of those living in the society. In worst cases, destruction takes place without much creation. While some form of creative destruction is necessary to lift African people out of poverty, the involvement of

ordinary citizens in the management of change would make the processes of change and learning less painful.

Stiglitz (2011) asserts that there is another kind of link from a learning economy perspective to inclusive development. His argument is the correct observation that the learning society will be most successful when learning is broad based and knowledge is widely spread in the economy. In a series of papers on the learning economy, we have presented a somewhat different perspective in which we have shown that, if left to itself, the learning economy tends to become increasingly polarized. Only with strong and systematic government intervention aimed at strengthening the capacity of weak learners and offering them better access to learning is it possible to build strong learning societies.

6.4 Transformation pressure, learning capacity and redistribution

In a context of global competition, national economies as well as firms are exposed to a more or less intense "transformation pressure." For instance, the strong competition from China has put intense transformation pressure on manufacturing firms in Africa. At the level of the manufacturing firm, such competitive challenges can be mitigated in different ways. For instance, workers may accept lower wages, the currency may be devalued or government may introduce trade barriers to protect the domestic firms in order to promote import substitution. An alternative is that the firms are left to themselves to cope with the intensification of the transformation pressure. They may do so by downscaling or declaring bankruptcy. Alternatively, they may respond by engaging in organizational and technological learning, resulting in stronger competitiveness based upon higher productivity and incremental product and process innovations.

When the transformation pressure is growing, it speeds up structural change in the national innovation system. Low-productivity activities will be closed down. With a sufficient population of firms that have a capacity to innovate and adapt, the resources that are freed up from the firms failing will be absorbed by these new or growing high-productivity activities. But with a weak learning capacity at the level of firms, the result will be a further increase in underemployment in informal activities and unemployment. How the cost and benefits of the transformation are distributed affect how willing people will be to contribute actively to the process of change within the firms. The response at the

national level will reflect the strength of the national innovation and competence-building system.

6.4.1 Why we need to broaden the innovation system concept

One major difference between neoclassical economics and evolutionary economics is that in the evolutionary perspective, history and institutions matter (Nelson, 1993). The national system of innovation (NSI) concept signals that the economic structure and the current institutional setup, both with historical roots, need to be analyzed and understood in order to set policy priorities. However, it is obvious that different authors mean different things when referring to a national system of innovation. Some major differences have to do with the focus of the analysis and with how broad the definition is in relation to institutions and markets.

American scholars, with a background in science and technology policy, tend to focus the analysis on "the innovation system in the narrow sense." They are inclined to regard the NSI concept as a follow-up and broadening of earlier analyses of national science systems and national technology policies (see, for instance, the definition given in Mowery and Oxley, 1995, p. 80). The focus is upon the systemic relationships between R&D efforts in firms; science and technology (S&T) organizations, including universities; and public policy.

Freeman (1987) developed a broader concept that took into account national specificities in how firms organize innovative activities. He emphasized, for example, how Japanese firms increasingly used "the factory as laboratory." Researchers in Aalborg also developed a concept of innovation systems in which there are other major sources of innovation than science. Innovation is seen as reflecting interactive learning that occurs in connection with ongoing activities in production and sales. Therefore, the analysis takes its starting point in the process of production and the process of product development, assuming, for instance, that the interaction with users is fundamental for product innovation.[3]

None of these approaches, however, gave sufficient attention to the broader set of institutions shaping competence building in the economy, such as labor markets, the education and training system, and their relation to systems of corporate governance. Nor did they consider the wider connections between these institutional sub-systems and national political cultures and welfare regimes. In order to capture this broader set of interactions in a dynamic perspective, we introduce an evolutionary framework for analyzing how economies learn under the pressure of globalization.

6.4.2 Mediating transformation pressure

The starting premise is that a range of factors has resulted in an acceleration of economic change, which includes economic globalization; policies and demands of international institutions, such as deregulation of finance; population growth; technological change and so forth. In many African countries, the boom in commodities exports adds to these factors. When the *transformation pressure* becomes more intense, firms will have to engage in change in terms of organization, technology and capability if they want to survive and grow. At the level of the labor market, this process will be reflected in dynamics in which workers will gain, lose or change jobs while learning new (and forgetting old) skills and competences.

A crucial characteristic of a national system is how it responds to an increase in transformative pressure. The *capability to innovate and to adapt* will reflect systemic features having to do with how easy it is to establish interactive learning within and across organizational borders (social capital) and with the preparedness to take risks (entrepreneurship). Organizational capabilities and the competence structure of the workforce play an important role. Social cohesion may be an important factor behind social capital, while it might get in the way of entrepreneurship.

The mechanism for *redistribution of costs and benefits emanating from change* differs between national systems.[4] Figure 6.1 is adapted from the framework developed in Archibugi and Lundvall (2001) to link transformation pressure to the capacity to innovate and to the distribution of cost and benefits of change.

The view developed in Archibugi and Lundvall (2001) is that capabilities for innovating and adapting reflect systematic differences in national institutional arrangements at the levels of the science and technology system, labor markets, education and training, and finance. These institutional sub-systems will have an impact on how knowledge is developed and used within organizations, and these organizational differences in turn will have a bearing on innovation pace (fast or slow) and innovation style (incremental or radical).

But national differences in innovation systems need to be seen in an even broader perspective and take into account feedback from the distribution of costs and benefits to the capacity to innovate and to adapt. An uneven distribution may create a negative attitude toward change among those who mainly register the costs, and if there are high degrees of insecurity among individuals, they will tend to oppose change.

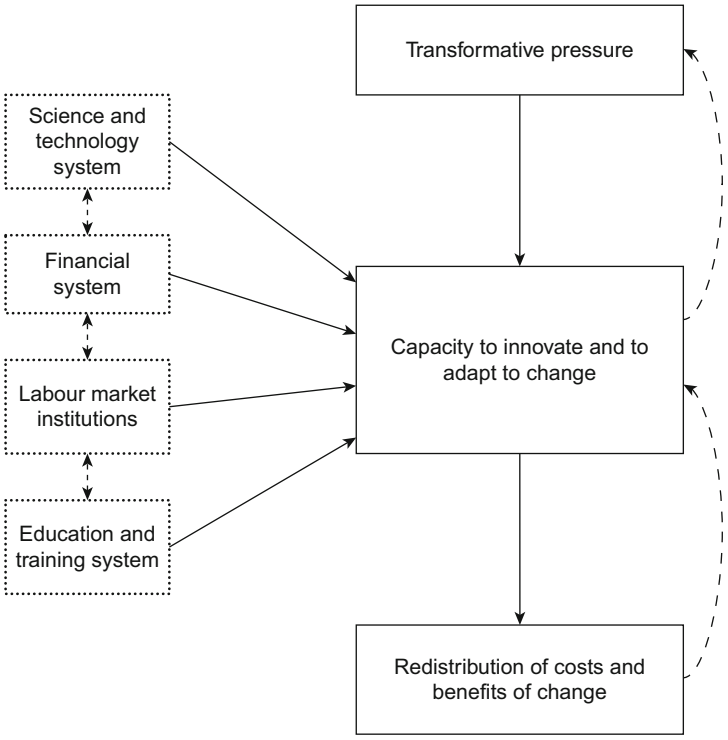

Figure 6.1 A model linking transformation pressure to the capacity to change and to the distribution of the costs and benefits of change

A second kind of feedback mechanism goes from the ability to innovate to transformation pressure. Increasing the ability to innovate involves stimulation of entrepreneurship and the building of more flexible organizations. This implies a selection of people and institutions that are more change oriented, and this further increases transformation pressure.

Our analysis of transformation refers to how, under capitalism, the interplay between Schumpeterian competition and capacity building is reflected in differentiated economic performance in a process of creative destruction in low- and middle-income countries. Transformative pressures arise, for example, from increasing competition from China and other emerging economies. There are other external transformative pressures that have underpinnings of a more political nature, such as certain "conditionalities" associated with engagements with multilateral

lending institutions and providers of overseas development assistance. Such pressures may be contrasted with more internal political agendas arising from popular pressures for economic and social transformation. The latter was captured in the first draft of the SDGs, in which the launch report distinguished "five transformative shifts" that should characterize the SDGs (United Nations, 2013a).[5] We would argue that the external pressures to which we refer need to be taken into account when designing realistic policies aiming at the five transformative shifts and vice versa, and that it might be necessary to intervene in the competition process and give direction to capacity building in order to realize them.

6.4.3 Development strategies responding to transformation pressures

The simple model presented above can be used to distinguish between different developmental strategies. The Washington Consensus, based upon neoclassical assumptions, recommends that governments leave it to the market to determine the transformation pressure and to install a capacity to adapt through flexible labor markets. Redistribution of costs and benefits of change should be kept at a minimum in order not to get prices and incentives wrong.

Development economists (Singer, Dobb and Sen) saw a need for less-developed economies to regulate the transformation pressure shielding new industries from the full impact of international competition. It is interesting to note that they, as well as the fathers of the concept of "infant industry argument" (Alexander Hamilton and Friedrich List), saw strengthening of the knowledge base of the economy as another necessary prerequisite for economic development.

List thus insisted that "mental capital" was more important for development than physical or financial capital. The emphasis upon intangible capital, knowledge and technology has become even clearer in recent theories of economic development that point to "capabilities" and innovation systems as crucial for economic development. In the next section we go more deeply into how knowledge and learning link to economic development.

As we remarked above, the Asian countries were more successful using the protective strategy than countries in Latin America and Africa, in which the result was stagnation rather than economic growth. One explanation is that (a) there was too little emphasis upon building innovation capacity, (b) the protection from competition from abroad was not compensated by other mechanisms such as stimulation of domestic

competition and promotion of export orientation, stimulating competitiveness, and (c) income and access to land were distributed more unequally in Africa and Latin America.

6.4.4 Macro conditions for development

The general macroeconomic situation will affect the capacity of firms to engage in investment and innovation. This is one of the points on which there is agreement among those belonging to the Washington Consensus camp and those in favor of selective industrial policies promoting innovation. But there are differences in terms of focus. The Washington Consensus recommendations only propose financial discipline and stable prices. This perspective neglects that innovation is to some degree demand driven and that engaging in entrepreneurial activities is much less risky in a situation in which aggregate demand is growing. Also, neoliberals propose to leave it to the market to regulate finance, something that results both in more instability and in very limited access to loans, especially for small and medium-size enterprises.

6.4.5 Investment and finance

One of the most fundamental weaknesses of national innovation systems is the financial system. In most of the least-developed countries, access to capital for supporting ordinary trade, for investments in production capacity and especially for new innovative ventures is limited. Banks do not have the routines and skills to deal with more risky projects and neither have government authorities.

Therefore the creation of new public-private institutions that fill the function of development banks is crucial. This would require building new competence, and here South-South learning could play an important role. Among the sources of finance to be channeled into the new institutions could be export levies on nonrenewable hard commodities.

6.4.6 Educated labor

The role of education and lifelong learning opportunities is addressed in the SDGs. It is proposed that all learners acquire the knowledge and skills needed to promote sustainable development (United Nations, 2014). The SDGs move toward an expansion of the focus on the quality of education. This is different from the MDGs, which tended to focus only on quantity, for example, high enrollment rates. But it is a major challenge to increase enrollment rates while maintaining quality. The SDGs

are an opportunity for the world community to focus on the quality of education – of learning – and the role of education in development.

It is obvious that education is an important prerequisite for economic development. This can be seen from the historical record of developed economies and from the recent growth of Asian countries. Basic education offering literacy and basic mathematical skills may be seen as a fundamental human right since such skills are necessary for full participation in society. Secondary and tertiary levels of education are, of course, important for economic and social development.

A major problem is that the demand for candidates with higher education is limited in the least-developed countries. This leads to an exodus of highly educated people to the rich countries, and in this way the scarce resources invested in universities end up being used in the developed countries. The 2012 UNCTAD report on the least-developed countries has a theme on the issues of brain drain and brain gain, and also on how remittances from emigrants may be mobilized for development.

The report shows that the outflow of highly trained people from the least-developed countries increased from 1990 to 2000 and that it has continued to grow in the new millennium. For many African countries, the brain drain rate (the brain drain rate is the emigrants' share of the corresponding age and educational group in the home country) is over 40%. This is, for instance, true for Uganda, Rwanda, Somalia, Eritrea, Liberia, Sierra Leone and Gambia.

While the report discusses the possible advantages of having a diaspora of trained people abroad, there is little doubt that the outflow of skilled people from the poorest to the richest countries (the United States remains the main destination) is unfair and undermines development efforts in the home countries.

The main reason for the exodus of skilled people is the lack of job opportunities and the big difference in earning between home country and the host country. In an article on higher education, innovation and economic development (Lundvall, 2008), we showed that the lack of demand reflects the absence of innovation and that therefore investments in higher education need to be coordinated with support to framework conditions and policies that stimulate innovation. The higher the rate of innovation, the higher the rate of return on investments in higher education.

It is also a serious problem that the education system replicates elements from the former colonial powers. Universities train people with a strong emphasis on social science and humanities, while there is a tendency to neglect the training of vocational skills and engineering.

Emphasis is upon narrowly defined scientific disciplines, and higher education institutions often operate as academies, with limited elements of practical training. Introducing problem-based learning and aspects of practice into theoretical studies may reduce the problem of creating jobs for the candidates.

6.5 Public policy and institutional design

As pointed out in the introduction, there are strict limits to what external experts can offer when it comes to designing and implementing public policy schemes and to conceiving new institutions that support economic development. In what follows, we refer to what seems to work in other contexts and what we see as general principles for promoting development.

6.5.1 Nondiscrimination as development strategy

The learning economy perspective on economic development makes it clear that the inclusive formation of people's skills and their interaction is crucial. In many of the least-developed economies, including those in Africa, there is discrimination against ethnic minorities and women in terms of access to resources and citizen rights. A focus on reducing discrimination when it comes to learning – not only in terms of access to formal education but also processes of learning in production and policy processes – expands access to human resources and creativity. In many societies, the inclusion of women and ethnic minorities can offer new potential and more commitment to economic processes.

A specific problem in Africa is the age structure, with a strong share of young people. Developing new institutions that give young people a "voice" in development issues may be a special challenge in countries in which there is a tradition of listening mostly to the old and experienced.

Such changes may be crucial also for attracting the diaspora intellectuals who often find patriarchy and authoritarianism repelling.

6.5.2 Industrial and trade policy

A recent document from UNCTAD refers to some general principles for economic development (UNCTAD, 2012, p. 21):

> In recent years, UNCTAD has repeatedly argued that progressive transformation in economic structure is a prerequisite for LDCs to achieve accelerated and sustained economic growth and poverty reduction. The policies and strategies needed to attain structural transformation

> will involve, inter alia, (a) the development of a new industrial policy based on a strategic approach that reflects the specific needs and conditions of LDCs; (b) a catalytic developmental State to compensate for the incipient and weak private sector in LDCs; (c) measures to encourage private investment in productive activities and public investment in basic infrastructure, including the development of skills and support institutions; (d) the promotion of domestic technological learning and innovation and improvements in productivity in both agricultural and manufacturing sectors.

Our analysis above supports these principles, but they are somewhat too general to be implemented as such, and they need to take into account the specificities of African countries' recent development. The UN economic report for Africa 2013 moves in that direction by demonstrating the limits of the current development patterns in which natural resource rents are not transformed into investment in manufacturing and agriculture.

The UN report points to the formation of "industrial clusters" around commodity production on the basis of private-public partnerships as the central strategy. The advantage with such an incremental strategy is that it builds upon what is already there and aims at raising productivity in existing activities.

But there might be a need for bolder industrial policy strategies that take the wider perspective of the national innovation system and aim at fostering new manufacturing industries with high learning potential. Here the productivity of the whole economy could be increased by moving resources from low- to high-productivity sectors.

6.5.3 Industrial policies as learning processes

It is useful to see public policy as a learning process. There is no reason to assume that policymakers get things right from the very beginning. For instance, we found that the original intentions of the Chinese reforms aimed at creating "markets for knowledge" did not succeed (Lundvall and Gu, 2010). The enterprises were not ready to procure knowledge from universities and other knowledge institutions. Instead, knowledge suppliers had to move ahead and establish their own enterprises in order to bring knowledge into use. This unintended process turned out to be an important step for China in its catch-up process, and it was accepted as such by policymakers.

When policymakers in African countries take new initiatives in industrial policy, they should be aware that it is a learning process. This

involves systematically evaluating outcomes and not least registering unexpected outcomes – both positive and negative – and making sure that the next wave of initiatives takes these experiences into account.

Stiglitz et al. (2013) discuss the argument that industrial policy should be avoided in Africa because there is too little administrative capacity to pursue industrial policy there. Yet they reject the argument. But there is little doubt that there is much for African policymakers to learn from successful catching-up economies. Programs with expert exchange between African countries and some Asian countries could be one way of speeding up policy learning.

6.5.4 Environmental policy as industrial policy

As the global climate change regime moves ahead toward 2020, there will be increasing investments related to climate change mitigation and adaptation in poor countries. Substantial opportunities for funding of low-carbon innovations will arise particularly in Africa. Ensuring that the most adequate technologies are selected and that they are diffused and used in such a way that the outcome is better living conditions for the population is a major challenge (Lema et al., 2014).

At the same time, environmental policy is an important form of industrial policy with potential for job creation. Making it more costly to use carbon-based technologies and giving support to low-carbon solutions will change not only the structure of power production but also the wider industry structure. Introducing low-carbon solutions into agriculture and into the informal sector, for instance, through new systems for recycling and repair activities can offer both investment and job opportunities.

6.5.5 The BRICS connection and below-the-radar innovation

The most recent developments in Africa, with the growing dependence on production of commodities and a tendency toward deindustrialization, reflects the growing role of China and other major economies. It is a major task for governments in Africa to exploit the potential for a positive interaction with the BRICS (Brazil, Russia, India, China, South Africa). This potential reflects that emerging economies are in a particularly strong position to advance relevant and affordable technologies because conditions in the BRICS are more similar to those in poor countries.

But even the most "adequate" technologies developed abroad will need to go through a process of transformation in order to become both efficient and inclusive in the specific context of African countries. The fact that solutions may be adequate has little to do with the source of

the technology, but rather depends on the contextualization and adaptation of the technology into the local context (Arocena and Sutz, 2000). Building absorptive capacity in the informal sector and in agriculture requires new types of policy initiatives.

6.5.6 The global regime for knowledge protection and sharing

Above, we could see how scarce resources used for higher education went into investments in people who then moved to rich countries that could benefit from the investments. The lack of protection of these resources can be argued in terms of the need for individual freedom to move from one country to another. The argument is weakened, however, when it turns out that the rich countries' respect for this freedom is highly selective. Ordinary poor people with less education are effectively blocked at the frontiers of the rich countries.

The lack of protection of human capital stands in strong contrast to the global rules regarding intellectual property rights. The World Trade Organization (WTO) agreements on TRIPS set very strict limits for the use of knowledge developed abroad, and they have been even further restricted by bilateral agreements between the United States and least-developed countries (Gehl Sampath and Roffe, 2012). The WTO agreements also include references to the duty of developed countries to engage in "technology transfer to the least-developed economies" but those references are vague without monitoring and sanctions (Gehl Sampath and Roffe, 2012).

There is little doubt that the global regime for knowledge sharing and protection is biased in favor of the rich countries. To renegotiate this regime would require a coordinated effort of African countries, perhaps with a role for the African Union.

6.5.7 The natural resource curse and the need to promote manufacturing in Africa – some reflections on the implications for public policy

The data and conclusions presented under the heading "the resource curse" in Sachs and Warner (1999) have triggered a substantial amount of analytical work as well as heated debate among economists and political scientists. Recently, the topic has attracted the attention of scholars linking innovation and innovation policy to development (Morris, Kaplinsky and Kaplan, 2012).

Some early contributions to the resource curse debate by economic historians such as Gavin Wright and Paul David demonstrated that knowledge creation and learning in direct connection with the

exploitation of mineral resources have been crucial for US economic growth. Others such as Ferranti et al. (2002) have argued that the most important explanation of the different paths of development, in which Nordic countries succeeded in developing strong and diversified economies starting from a situation of natural resource specialization, while Latin American countries failed to do so, had to do with a weak knowledge base and with an institutional setup that did not support processes of learning.

On this basis, innovation scholars have argued against a specific version of the natural resource curse based upon assumptions that the learning potential and the knowledge content is limited in natural resource-based sectors. Natural resource-based sectors tend to develop as enclaves, with limited capacity to drive the creation of upstream and downstream manufacturing.

It is in line with the argument in this chapter that the key difference between successful and less successful growth policies lies in the nature of the learning process that promotes the economic potential of access to natural resources (Wright and Czelusta, 2007). A crucial issue is how natural resource-related activities make use of and master new technologies and knowledge to improve production processes (de Ferranti et al., 2002). A key question is how Africa can exploit the "window of opportunity" opened up by increased global demand for natural resources and transform into a knowledge base that would allow for sustained and inclusive growth.

We share the skepticism toward the generalized resource curse hypothesis and see the building of clusters around natural resources as one useful step toward economic development in Africa. But we see a need to develop further the policy implications which arise from the critique. We are not convinced that the natural resource base should be *the only* starting point for industrialization in Africa. The fact that most African countries import big proportions of their consumption goods from abroad indicates a potential for import substitution. Second, we see the broad-based growth of manufacturing as crucial for making Africa's economies less vulnerable and for creating jobs for the young generation. This is the case even if there is a great potential for learning and upgrading in natural resource-based sectors.

In relation to building clusters around natural resources – both mining and agriculture – we see a crucial need for building relevant capacity in *engineering and design*. Without local competence in these areas, there is no possibility of linking up with global value chains that have unique and high-value-added products. But the same is true for any attempt to

build industrial capacity. One important reason why the attempts to realize import substitution in Latin America and Africa did not succeed is that technical training and engineering have been given too little attention as compared to general education in science, social sciences and humanities.

Notes

1. An important factor is that, daily, thousands of young economics students are exposed to programs teaching this message. Many of those working in ministries of finance in African countries have been trained to believe in it.
2. The fact that the landed aristocracy in England became involved in trade and industry was a major factor that made the Industrial Revolution possible.
3. To a certain degree, these differences in focus reflect the national origin of the analysts. In small countries such as Denmark, as in developing countries – a major concern of Freeman – it is obvious that the competence base most critical for innovation in the economy as a whole is not scientific knowledge. Incremental innovation, "absorptive capacity" and economic performance will typically reflect the skills and motivation of employees as well as inter- and intraorganizational relationships and characteristics. Science-based sectors may be rapidly growing, but their shares of total employment and exports remain relatively small.
4. In the Anglo-Saxon countries, the basic idea is that individuals should carry as much as possible of both benefits and costs. In the Nordic countries, universal tax-financed welfare systems redistribute in favor of individuals who lose their job or become handicapped. The more conservative systems in place in Continental European countries tend to redistribute through employment-tied public insurance systems. In Southern Europe, where systems of social protection are relatively weak, the family can still play an important role as a redistributing mechanism. In Japan, the big corporations redistribute resources to older workers who would otherwise be victims of change by offering them lifelong employment.
5. The five transformative shifts were described in the New Global Partnership report produced by a High-Level Panel on the 2030 Agenda for Sustainable Development under the United Nations (United Nations, 2013a). The five transformation shifts were described under the following headings: (1) leave no one behind, (2) put sustainable development at the core, (3) transform economies for jobs and inclusive growth, (4) build peace and effective, open and accountable institutions for all and (5) forge a new global partnership.

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7

Using Industrialization to Raise Urban Living Standards

Oyebanke Oyeyinka

7.1 Introduction

The Millennium Development Goals (MDGs) focused almost exclusively on the evident widespread poverty and the income divide manifested in the economic structures of the richest and the poorest countries of the world and proceeded to set clear goals to halve poverty over a 15-year period. What they did not pay direct attention to were the ways and means to deal with poverty and related vulnerabilities. This chapter addresses this issue, which has now been taken up under the Sustainable Development Goals (SDGs). We suggest that Africa's relative economic backwardness is in large part a result of its industrial and technological backwardness. In this chapter, we propose pathways to reduce persistent poverty and raise living standards. In doing so, we provide broad theoretical and empirical evidence from case studies that can be broadly applicable to other African settings.

Africa is a not a homogeneous group, and continent-wide generalizations might obscure important economic differences about both the historical and contemporary growth diversity that characterize the region. Clearly, African countries have experienced a resurgent economic growth; however, their industrial manufacturing sector remains uncompetitive and contributes little to global industrial outputs. While industrial growth has not been as robust, quite a few countries have managed to grow at respectable rates for a decade or more. This chapter calls attention to industry-led growth to propel economic performance across the region.

In articulating the notion of industrial pathways, the chapter takes its cue from the work of the High Level Panel on SDGs, which has now broadened the global framework to incorporate sustainable "production

and consumption." Drawing from this framework, we propose that African countries should articulate dynamic industrialization policies at the national level, employing a clear notion of sustainable development, in relation to the SDGs agenda (fully discussed in other chapters of this book). Additionally, it highlights the need for countries to better coordinate industrial policy with social policy objectives, prioritizing industrial policy mechanisms that have a greater and faster impact on reducing employment and poverty. It proposes that national economic agendas should provide the necessary institutional support to ensure that social benefits are harnessed in tandem with industrial productivity. It specifically uses industrial clusters as exemplars of how industrial dynamism in sub-Saharan Africa (SSA) can translate to improved human development indicators.

To be sure, industrialization has equally been recognized by African leaders and countries, and there have been several attempts to adopt industrial policies in various forms over the last 50 years as a pathway to development, ever since Britain's Industrial Revolution (Amakom, 2008). Historically, most of the SSA countries adopted a package of policies aimed at either stimulation of economic growth or stabilization and adjustment in return for multilateral and bilateral loans. During the two decades of Structural Adjustment Programmes (SAPs) in Africa, several studies raised questions related to the appropriateness and efficacy of such measures as trade liberalization and their lasting impact on African industrial development. The verdict on the outcomes has been less than favorable, but this is not the focus of this chapter.

In sharp contrast to the poor industrial performance in African countries, we do know that economic growth, driven by various industrial development strategies, has been considerable in several developing countries over the past decades. The "Asian Tigers," namely Taiwan, Hong Kong, South Korea and Singapore, as well as China, have set such considerable standards of dynamic growth, showing that catching up with the traditionally viewed industrial leaders is possible (Amsden, 1989; Bei, 2011; Stiglitz, 1996; Vogel, 1991; Wade, 2004; World Bank, 1993). Other newly industrializing economies like Indonesia, Malaysia, Thailand and the Philippines (to a lesser degree) have also emerged as "a second generation of Asian Tigers" (Organization for Economic Co-operation and Development [OECD], 2013, p. 21).

Theoretically and empirically, the case for industrial mechanisms for growth and as an engine of catch-up through the promotion of manufacturing in various forms is therefore unarguably clear. The faster the growth rate of manufacturing output, the faster the growth rate of gross

domestic product (GDP), which correlates highly with rising income; manufacturing labor productivity, due to increasing returns; high skills and specialization; and direct and indirect employment, job creation and lower prospects of structural unemployment (Kaldor, 1966, 1967). Moreover, linkage and spillover effects are stronger in manufacturing than other sectors. The evidence from an analysis of studies experiencing rapid catch-up after 1973 shows the significance of manufacturing as an important engine of growth and catch-up, and, hence, as a generator of employment in developing countries (Fagerberg and Verspagen, 2002; Kathuria and Raj, 2010; Szirmai, 2009 inter alia).

Specifically, manufacturing contributes to growth in various ways. First, manufacturing productivity commands higher wages and remunerations than that associated with the agricultural sector, thus contributing more to improved living standards. Second, the contribution of manufacturing to improved livelihoods is indirect via forward and backward linkages. In most economies, industrial manufacturing accounts for about 16% to 20% of the total employed labor force (Lavapo and Szirmai, 2012). Third, industrial activity contributes to employment through induced Keynesian-style multiplier effects in both demand and supply sides (Tyler, 1976; McMillan and Rodrik, 2011). According to some estimates, for every job created in manufacturing, there is a multiplier effect of between five to twenty indirect jobs (UNIDO, 2012). The corresponding rise in income as a result of increased levels of employment stimulates spending, thereby creating further demand and investments. Clearly, a structural shift from agriculture to industry is therefore a well-known pathway out of poverty because it creates diverse avenues for wage employment.

There are several ways to promote industrial growth of the kind in policy and practice. Cluster-based industrialization is acknowledged for its contributions to triggering industrial transformation. Industrial clusters, defined as the "sectoral *and* spatial concentrations of firms" (Schmitz and Nadvi, 1999, p. 1503, *emphasis by authors*), are increasingly seen as a viable solution for economic growth and competitiveness in developed as well as developing countries in which poverty, unemployment and inequality still remain significant (Bianchi, Miller and Bertini, 1997; Schmitz and Nadvi, 1999). In the past decade, for example, China's industrialization pattern has been increasingly characterized by the clustering of firms (Zeng, 2011; Long and Zhang, 2012). China, through dynamic industrial growth and development policies has succeeded in achieving an unprecedented expansion of its manufacturing contribution to GDP (from 22% in 1987 to 45% in 2008), accompanied with

an equally dramatic reduction in poverty (*Economist*, 2012), albeit with increasing intercountry inequality (Sicular, 2013). Notably, growth in Asia was most poverty reducing than in any other part of the world (UNIDO, 2012).

This chapter uses the specific case of the Otigba information and communications technology (ICT) cluster in Lagos, Nigeria, to highlight how productive industrial clusters in developing countries impact the welfare of the workers employed within them. The challenge of low workers' living standard is particularly acute in Nigeria, as in many SSA countries, because labor is largely employed in the informal sector, and in this setting, social protection instruments of the state are poorly constituted and/or implemented. Why then might firms in industrial clusters choose to pass on benefits that would impact on the welfare of their workers, when formal institutions might not require them to do so, or in situations in which existing social protection policies are not enforced? How can industrial policies be steered to encourage nascent and growing clusters while working in tandem with social policies to improve living standards?

This chapter is organized as follows. The next section looks at industrialization and industrial clusters in the African context. Subsequently, the chapter methodology for exploring how industrial clusters lead to poverty alleviation is set out, while providing the background on our case study. Following this is a discussion of the results based on the empirical data on the Otigba case. The final section summarizes the chapter and provides implications for policy and areas for future research.

7.2 Industrialization in Africa

In development history, industrial policy has traditionally taken two forms: a strong export orientation with deep government involvement, working with the private sector in correcting market failures; and import substitution with more ad-hoc policy designs and interventions. Since independence, African countries have adopted and built several industrialization pathways into their development strategies as vehicles of structural transformation (Lall and Wangwe, 1998); however, industrial performance on the continent has remained poor.

The root of the African economic crisis, which became pronounced in the early 1980s, can be traced to a number of factors, but in our view it came down to a lack of capability first to industrialize and then policy failures to use industrialization to raise living standards and provide

employment. There were, as expected, major debates as to the causes of the problems confronting the continent. The new orthodoxy then was identified as a major cause of the problem. The various mechanisms under the "rules of the game" set by the Bretton Woods institutions, the World Trade Organization (WTO) and major donors resulted in a restrictive global environment for development. The Bretton Woods institutions then championed neoliberal policies, which highlighted government failures, encouraged privatization and called for a reduction in the state's involvement. One notable and arguably, notorious set of policies were the SAPs that compelled almost all of the SSA countries to adopt a package aimed at stabilization and adjustment in return for multilateral and bilateral loans.

As evidence of poor industrial progress, manufacturing value-added (MVA), measured as percent of GDP in SSA, was 11% in 2013. This was a significant drop from 15% in both 2000 and 2001. These figures are, however, still below the rule of thumb that specifies a 25% level for meeting the condition of industrialization (UNIDO, 1975).[1] For the East Asia and Pacific region, the MVA for 2000 and 2011 was 24% and 20% respectively. Considering only the developing countries in the region, the figures are even higher, at 31% for 2000 and 29% for 2010 (World Bank, World Development Indicators, 2013). Though many African economies have collectively been experiencing good growth – for example, the average growth rate rose to 4.6% in 2010, and was at 5% in 2012 (Economic Commission for Africa [ECA] and African Union [AU], 2013) – this growth is still largely driven and characterized by a heavy dependence on the production and export of commodities, few backward and forward linkages, local industries that add little value, and no economic diversification (ECA and AU, 2013).

The fact that economic development in Africa is not being driven by structural changes and deepening manufacturing has resulted in poor employment growth and a lack of overall improvement in human and social development. The impressive economic performance on the continent has not resulted in generating the much-needed jobs and income to curb high unemployment levels (including rising youth unemployment) and poverty (ECA and AU, 2012, p. 3; Martins, 2013). Furthermore, while there have been achievements in certain areas including education, child and maternity mortality rates, and gender equality, the pace of change is still too slow, making it unlikely for African countries to attain social development goals, such as some set by the MDGs before the 2015 end date.

7.3 Clusters as an instrument of industrial development

The agglomeration of firms is one channel through which manufacturing growth enhances industrial activity and employment creation. This is pertinent for developing countries, where small and medium-sized enterprises (SMEs) tend to be the main contributors to national productivity and manufacturing. The awareness of small-scale industrial districts in Europe, especially in Italy, producing competitively for international markets in the 1970s and 1980s spurred the attention of scholars to look into like clusters in developing countries, and under what conditions they produced, modified or prevented their growth (Schmitz and Nadvi, 1999). Findings revealed that there was a significant amount of industrial clustering in developing countries, characterized by a wide variation in their growth experiences and pronounced internal heterogeneity (Otsuka and Sonobe, 2011; Schmitz and Nadvi, 1999).

The term "cluster" has been conceptualized in a variety of ways. Porter (1998) put forward the notion of cluster as a group of firms operating in a national economy. Schmitz's (1992) definition of a cluster emphasizes geographical proximity. The present study adopts McCormick and Oyelaran-Oyeyinka's (2007) definition of a cluster, which characterizes it as a sectoral and geographical concentration of enterprises, and emphasizes interfirm and collective learning approaches. This definition, which emphasizes geographical proximity, is more appropriate for developing country contexts, typically characterized by "poor infrastructure, frail information systems and cultures that place high importance on face to face communication" (McCormick, 1998, p. 4). Similarly, different typologies[2] of clusters exist, giving evidence of their diversity in technical and production features, depth of skill and knowledge, historical origin, formation trigger factors, policies that sustain/hinder them and the institutions within which they are embedded.

This idea of industrial districts is not novel, and was put forward by Alfred Marshall (1890) using "the concept of external economies" (cited in Schmitz 1999, p. 468). Moving beyond Marshall's conceptualization of clustering, Schmitz and Nadvi (1999) assert that incidental external economies alone are not sufficient to explain cluster dynamism. They thus introduce the collective efficiency framework, a concept that brings together the incidental (external economies) and deliberate (joint action) efforts of the clusters:

> Incidental external economies are of importance in explaining the growth of contemporary industrial clusters, but there is also a

> deliberate force at work, namely consciously pursued joint action.... [Joint action] can be of two types: individual enterprises cooperating (for example, sharing equipment or developing a new product), and groups of firms joining forces in business associations, producer consortia and the like. Cutting across this distinction, one can distinguish between horizontal cooperation (between competitors) and vertical cooperation (between producer and user of inputs or between producer and seller of outputs). (Schmitz, 1999, p. 469)

Porter (1998) highlights the ubiquitous nature and critical role of the locality in maintaining comparative competitive advantage, in spite of an increasingly globalizing world. He articulates, "What happens *inside* companies is important, but clusters reveal that the immediate business environment *outside* companies plays a vital role as well" (p. 78). Within a cluster, firms are able to enjoy access to "a pool of specialized workers, easy access to suppliers of specialized inputs and services and the quick dissemination of new knowledge" (Schmitz and Nadvi, 1999, p. 1504). This is the external economy that Marshall conceptualized. In sum, firms' localization garners specific benefits to them: improved market access, which allows firms to increase production; improved potential for technological upgrading; joint action, which allows firms to deal with external shocks particularly from the global economy; easy flow of and access to information; and finally, it enables firms "to make good use of relatively small amounts of resources" (McCormick, 1999, p. 1545). Clustering also helps firms reduce transaction costs between actors in a business exchange including manufacturers, suppliers, traders and consumers (Otsuka and Sonobe, 2011).

Clustering therefore serves as a platform to spur economic growth, productivity and raise living standards, as it reduces the constraints that erstwhile stand-alone firms would face. These constraints can be understood as spatial and industrial isolation, which is the distance from the assets that are required for productive industrial processes. Levitsky (1996, p. 10) recapitulates, "Studies of recent years have led some researchers to the conclusion that it may not be the size as such that is the real cause of the weakness but the isolation of small firms." This isolation, coupled with a poor institutional framework for addressing these issues, makes industrialization in African countries seem unattainable (Institute of Development Studies [IDS], 1997; McCormick, 1999).

Many clusters exist in Africa, but many are self-starting and self-sustaining clusters, lacking adequate state support and an enabling environment, and have failed to maximize the industrial and social

benefits achievable through firm agglomeration. Using McCormick's (1999) categorization, most are groundwork clusters, which provide the foundation for industrialization. Others are industrializing clusters that have not attained the status of industrialized clusters, but have begun the "process of specialization, differentiation, and technological development" (p. 1531). However, fewer, complex clusters such as the South African Wine Cluster and the Lake Naivasha Cut-Flower Cluster exist, and these have the ability to, and have begun producing competitively for foreign markets. Groundwork clusters, however, represent the plethora of clusters in Africa.

The hitherto failed industrialization of Africa necessitates cluster-based industrial development, which by its nature is inclusive since clusters are open and easy to access by new entrants of whatever scale of production (Sonobe, 2014). Drawing on successful industrial development cases from emerging and Southeast Asia countries, Otsuka and Sonobe (2011, p. 6) propose an entrepreneur-led, government-assisted approach, consistent with "the theoretical proposition of Rodriguez-Clare (2007) that the best policy entails the direct promotion of clustering in the sector in which the country has a comparative advantage." Furthermore, industrial clusters have the potential of eradicating poverty by reducing the industrial isolation that SMEs in developing countries face and providing employment for workers (Mano et al., 2011; Weijland, 1999).

While the role of industrial clusters in fostering growth and productivity is evident in the regional agglomeration literature, less studied is the systematic and explicit link between industrial clusters and poverty alleviation (Nadvi and Barrientos, 2004; Fowler and Kleit, 2014). Notably, while productivity is necessary, it is not a sufficient condition for reducing poverty (Srinivas, 2009). The relationship between poverty alleviation and industrial clusters can therefore be established as being dependent on the cluster's features (cluster's location, the type of firms within it and type of employment generated), processes (agglomeration gains, joint action, cluster institutions and social capital) and dynamics (cluster growth, upgrading and differentiation). In other words, clusters are different, and their individual features, processes and dynamics determine their impact on poverty, who they would have the greatest impact on e.g. employees, residents of the surrounding areas, and how sustainable it would be. For example, incipient, survival, rural-based and informal urban clusters that employ low skills and technology might help generate employment and have low barriers to entry, but they might not survive in the face of intense external competition (Nadvi and Barrientos, 2004).

7.4 Data and methodology

In order to demonstrate if and under what conditions productivity and growth can help reduce poverty and improve living standards, we employ the case of the Otigba Information and Communications Technologies Cluster in Lagos, Nigeria, also called the Otigba or Computer Village. The study adopted several methodological techniques, including the use of survey questionnaires, archival research and formal and nonformal interviews. While a single core case study was employed, research drew on both primary and secondary data, and was complemented and enriched through secondary literature.

Otigba was chosen as an appropriate case for several reasons. First, preliminary investigations helped corroborate the choice of the selected case study. Initial site visits were made to the Kamakunji Metalworks Cluster in Nairobi, Kenya (which was originally under consideration for this study), and Otigba. In comparison to the former, Otigba had more dynamism and variability of firms and workers to define and organize this study. As opposed to many African clusters characterized by low skill, and employing low-technology manufacturing techniques, Otigba employed both low- and high-skilled labor, had high prospects of further upgrading, possessed the necessary technological dynamism and seemingly held the potential for wealth generation and poverty alleviation. A subsequent pilot study at Otigba provided persuasive evidence that it had a positive impact on living standards. In addition, the cluster had a mélange of Nigeria's ethnic nationalities, all with different approaches to business, learning and collaborative behavior.

Second, the structure of the industry in Otigba was highly heterogeneous, comprising small, medium and large firms,[3] and rendering different services with ownership structures that were highly diverse as well. This variability further argued for the choice of the cluster, as it would contribute to understanding how different size firms with varying types and levels of skills, capabilities and policies led to diverse living standard outcomes for their workers. In addition, while the literature places the state as a central actor in fostering cluster growth, the cluster itself had experienced poor state support, while formal institutions for social protection for informal workers tended to be weak. It therefore served as a good case for examining how firms passed on benefits to workers in the absence of institutional regulations that mandated and enforced the delivery of social protection to workers.

Surveys were used in the study to enhance a general understanding of the Otigba cluster and were administered to both employees and employers.

Two types of questionnaires were constructed and administered, one targeted to employees and the other to owners/CEOs and managers of the companies. This chapter highlights results from the employee surveys. The questionnaires enabled respondents and their firms to be anonymous by not requiring their names or the name of their firms. Due to the sensitivity of some of the questions, that is, on poverty, living conditions and firm particular data, anonymity was given to encourage truthfulness in responses. Initial interviews and a pilot survey were designed to feed the development of the final survey questionnaire. A total of 40 questionnaires were analyzed from the pilot survey. The initial site visit was followed by a separate visit in March 2012, during which the pilot survey[4] was carried out. The pilot survey was then improved upon and changed to reflect the more specific concentration of the study. Questions that were not properly answered or that did not contribute to the analysis in the pilot survey were removed or modified.

Subsequent field research was carried out in July/August 2012, and between January and the beginning of March 2013. During these latter visits, data was collected from primary and secondary sources using interviews, survey questionnaires and general observations of the cluster. Archival research to collect old and relevant newspaper articles on the cluster and poverty in Nigeria was also carried out. Informants for this study included ICT and non-ICT business owners and employees within the cluster; business owners who had ICT businesses, but were not within the geographical location of the cluster; government officials; bank employees; and others who had information and knowledge on the topic. The cluster was categorized in terms of the different types of firms based on products and services rendered. Interviews were then sought with firms that fit into these different types as well as some of the bigger players in the cluster and ICT industry.

In all, a total of about 60 formal interviews and informal conversations took place, generally face to face. The final surveys were distributed within Otigba and also to two big players in the industry that were located outside of the cluster. In addition, survey questionnaires were also disseminated via e-mail to members of the Computer Society of Nigeria and as well at the Lagos and Ijebu-Ode chapter meetings of the Society. The target number of questionnaires to be retrieved was between 150 and 200, but a total of 257 questionnaires (101 CEO/Management and 156 employees) were retrieved and examined using basic descriptive analysis and Discriminant Analysis. For the employee data, which is analyzed in this chapter, respondents included 109 employees (76.2%) within the Computer Village itself, 29 employees (20.3%) outside of the Computer Village and 5 employees (3.5%) working in non-ICT businesses.

Living standards were measured both subjectively and objectively. The former were used to gauge workers' perceptions of their living standards, while the latter were used to compare living standards in the cluster with standardized (and internationally recognized) indicators of multi-dimensional poverty and slums indicators. The perceptions of workers were drawn out with such questions as shown in Box 7.1.

Box 7.1 Sample questions of subjective living standard measurements

About how much do you make on average every week (in Naira)?
a) 0 to 1000 b) 1001 to 5000 c) 5001 to 10,000 d) 10,001 to 50,000 e) Above 50,000

Has your working in this company raised your standard of living?
a) Yes b) No

Between when you started working here and today, how much has your standard of living changed?
a) Drastically reduced b) Reduced c) Remained the same d) Increased
e) Drastically increased

Between when you started working here and today, about how much has your income changed over time?
a) Drastically reduced b) Reduced c) Remained the same d) Increased
e) Drastically increased

How would you describe your current standard of living compared to that of your peers?
a) Poor b) Surviving c) Comfortable d) Rich e) Very Rich

⇒ *Please tick either True or False to the following statements, based on your opinion of the Computer Village* (i.e., *Otigba*):

Statement
Workers doing the same work but in different companies in Computer Village get different financial rewards.
Workers in Computer Village are faring better financially than those doing the same work outside of Computer Village.
Job security within Computer Village is good (that is, there is no fear of losing one's job)
Most workers working in Computer Village are very satisfied
Given the opportunity, most workers will go to work outside Computer Village
For most workers, their standard of living improves when they begin working in Computer Village.

Source: Author's survey (2013).

For the standardized measurements, data gathered on the indicators from the standard of living component of the Multidimensional Poverty Index (MPI)[5] and the definition of a slum household as defined by the United Nations Human Settlements Program (UN-Habitat) were used. Drawing from these two concepts, the study gathered data on respondents' electricity, cooking fuel, drinking water, sanitation, cooking fuel, assets, flooring and housing. Table 7.1 highlights these different indicators. While this study was influenced by the MPI, it differed in certain ways from it. First, while the target population for MPI surveys are households, this study targets individuals (though some questions might pertain to their households). Second, we did not attempt to calculate a single MPI statistic for the cluster, as is done for MPI for various countries.

7.5 Nigeria's socioeconomic landscape

Nigeria is a country that typifies the prosperity-poverty conundrum. While its economic growth indicators have been good, human development indicators have been poor. In the past decade, the country experienced relatively rapid growth, with an average growth in GDP from 2005 to 2010 of 6.68%; however, the estimated real growth rate for 2011 was 7.36% (NBS, 2012). The recent rebasing of the GDP has made the country the 26th-largest economy in the world and the biggest in Africa, with a GDP of US$510 billion (Faul, 2014). However, in 2012, Nigeria had a human development index (HDI) position of 153 out of 187, with an index of 0.471, placing it in the low human development category. The inequality-adjusted index (IHDI) was even lower at 0.276. As of 2008, the country's MPI figure was 0.31 (United Nations Development Programme [UNDP], 2013).

Unemployment, poverty and inequality figures are also dismal, with the unemployment rate as of 2010 being close to 20% (Agu and Evoh, 2011, p. 16). From data compiled from the National Bureau of Statistics (NBS), national poverty levels were 54.4%, with a total of about 71.3 million people considered poor as of 2004 (p. 16). In terms of inequality, "[b]etween 1985 and 2004, inequality in Nigeria worsened from 0.43 to 0.49, placing the country among those with the highest inequality levels in the world" (UNDP, 2008/9, p. 11). This is in spite of increased growth that has been experienced in the past decade. "Thus, 2001–2010 was indeed a decade of jobless growth for the country given those years of economic growth was not translated to more wage employment opportunities and poverty reduction" (Agu and Evoh, 2011, p. 16).

Table 7.1 Overlap in MPI, UN-Habitat and study indicators

MPI standard of living indicators and deprivation criteria	**Study standard of living indicators**	**UN-Habitat slum indicators**
Electricity: If household does not have electricity	*Electricity*: Source of lighting; frequency of public power supply	
Cooking Fuel: If they cook with wood, charcoal or dung	*Cooking Fuel*: Type of cooking fuel	
Drinking water: If does not meet MDG definitions, or is more than 30 mins walks	*Drinking water*: Amount spent on drinking water; source of drinking water	*Access to improved water*: Water that is sufficient, affordable and can be obtained without extreme effort
Sanitation: If does not meet MDG definitions, or the toilet is shared	*Sanitation*: Access to toilet facilities at home	*Access to improved sanitation facilities*: A private toilet, or a public one shared with a reasonable number of people
Assets: If do *not* own *more than one* of: radio, tv, telephone, bike, motorbike	*Assets*: Ownership of assets; change in personal assets since working in firm	
Flooring: If the floor is dirt, sand or dung	*Material used to build house*: Natural, rudimentary, finished	
	Condition and location of home: In need of major repair, in a hazardous place, on or near toxic waste	*Durable housing*: A permanent structure providing protection from extreme climate conditions
	Sufficient living area: More than 3 people share a bedroom	*Sufficient living area*: No more than three people sharing a room

Source: Compiled from S. Alkire and M. E. Santos (2010, p. 7); United Nations Human Settlements Program (2008, p. 33).

7.6 The Otigba information and communications technology cluster

The Otigba ICT cluster "is an example of self-starting and self-sustaining small enterprises that are in some cases family owned" (Oyelaran-Oyeyinka, 2006, p. 20), providing employment for many people,

including graduates. It originated in the early 1990s on two streets that were designated as residential by the local government, but now occupies eight streets, with Otigba being the largest (p. 20).

The cluster interestingly lies on a scale ranging between formal and informal. On the one hand, it is viewed as informal by the state government because it is a residential zone turned into a business district by private individuals. On the other hand, it is recognized by the same state government, which relates with it through the umbrella association the Computer and Allied Products Dealers Association of Nigeria (CAPDAN), and collects its taxes from the firms. It is a spontaneous cluster, as opposed to a planned one, which are those "induced by public policies, or 'constructed' from scratch, and 'range from technopoles' and industrial parks to incubators and export processing zones (EPZs)" (Zeng, 2008, p. 2). The "stimulus for the growth of the cluster was the relatively high demand for computers and peripherals from businesses and academic institutions – Lagos is home to 60% of Nigeria's industrial production and the region also has the nation's highest percentage of educated people and educational institutions" (Abiola, 2008, p. 67).

The major activity of the cluster is the assembly and trade of computer hardware and software, and it "has been variously described as the information and communication technology (ICT) hub of West Africa, potentially the biggest ICT market in Africa, and the Silicon Valley of West Africa" (p. 66). From our survey, we find about 64% of businesses involved in the sale of new laptops, and 61.5% in retailing. Laptop accessories have the third-largest number of firms involved (57.1%), and installation follows closely (56.4%). More than 50% (53.2%) of firms are, however, still in the business of cloning computers. A sizable percentages (46.2%) of firms are also wholesalers, and some sell in bulk to others within the cluster or for resale in other parts of the country and beyond. Table 7.2 shows the percentage of firms involved in the market of various products and services.

The ICT industry also has firms such as Omatek, Zinox, Speedstar and Brian technology making locally branded products. These companies are original equipment manufacturers, but still face competition from foreign brands like Dell and Toshiba, which many consumers prefer. Omatek is itself not located within the cluster, while Speedstar and Brian technology are located in close proximity to it. Zinox has an office (though not the headquarters) within the cluster itself. Other non-ICT-related products like clothes, shoes, cooked food and fruit are also sold in the cluster. Businesses that support and are present in and around the cluster include financial institutions (for example, Zenith Bank, Skye

Table 7.2 Percentage of firms involved in the market for various products and services

Product/service	%	Product/service	%
Laptop – new	64.1	Phones (GSM) – new	41.7
Retailing	61.5	Repairs and servicing of desktop	41
Laptop accessories	57.1	Repairs and servicing of laptop	40.4
Installation	56.4	Downloading	39.1
Cloning of computers	53.2	Marketing	39.1
Desktop-new	52.6	ICT solutions/Applications	37.2
Desktop accessories	47.4	Phones (GSM) – used	34.6
Desktop – used	46.2	Cyber café services	32.5
Wholesale	46.2	Non-ICT products – Shoes	25
Laptop – used	45.5	Non-ICT products – Clothes	23.1
Other ICT products (Ipad, tablets)	45.5	Non-ICT products – Food	17.9
Phone accessories	42.3	Other	8.3

Source: Author's field survey (2013).

Bank) and cargo companies (for example, DHL, FedEx Corporation, TNT, AS, Global express, IMS and Tranex). Indian (Zed Mobile) and Chinese (Techno) firms are also penetrating the market. Credit facilities from banks as well as other SMEs are also available in the cluster.[6]

The Computer Village has a large population of youth, with 68.7% of employees reportedly between 21 to 30 years of age. Employees younger than 20 constitute 7.8%, while under a quarter (23.5%) are above 31. Survey results show a comparable mix of female (48.1%) and male (51.9%) employees. The cluster also has a large population of graduates, with close to 50% being university graduates and almost 30% with technical degrees, as seen in Table 7.3. Concerning education level, 19.1% reported having high school degrees, while 3% had attained only elementary school education. These results are corroborated by previous studies that found a significant number of skilled workers in the cluster who were trained in computer engineering, computer science, electronics, business administration and other related disciplines (Small and Medium Enterprises Development Agency of Nigeria [SMEDAN], 2005; Oyelaran-Oyeyinka, 2007). In particular, SMEDAN (2005, p. 85) found "55 percent of respondents are university graduates, 15 percent are graduates of the polytechnic, 20 percent are technicians, while the rest 10 percent are the unskilled ordinary traders."

According to SMEDAN (2005), CAPDAN had about 3,500 registered enterprises, with about 8,000 to 10,000 employees excluding their employers. There are also about 1,500 street operators. The cluster has

thus served to employ a lot of people, including graduates. Informants agreed that the Computer Village helped to provide a source of employment and income for people, including graduates. One interviewee was categorical that in the unlikely event of closing down the market, it would lead to unemployment, poverty, and insecurity. The secretary of CAPDAN stated in response to a newspaper interview question: "what significant role would you say the Computer Village is playing in the national economy" that

> The contribution from this cluster has been enormous…. Computer Village, I stand to be corrected, has done more than any other sector has done for this country…. When you talk about employment and wealth creation here, it is amazing what impact this village has made on the economy. (*National Mirror*, 2012)

The cluster has shown a consistent pattern of profitability over time. Between 1999 and 2004, it saw an increase in profitability and output exported. In particular, profitability was recorded at approximately 40%, 35%, 37%, 39%, 42% and 44% between 1999 and 2004 (Oyelaran-Oyeyinka, 2007). In surveying the present worth of the firms, 11.6% of respondents each fell into the N0 to N50,000 and N50,000 to N100,000 categories.[7] The largest number of respondents (27.4%) indicated that their businesses were worth between N1,000,001 and N5,000,000, while 10.5% had businesses worth over N100,000,000.

The trade reach of the cluster extends beyond Lagos State, and even Nigeria. This is because the cluster has a large variety of customers, including individual end users, companies and other retailers, nationals and foreigners, for example, Congo and South Africa, although most customers come from West Africa – Abidjan, Ghana, Sierra Leone, Togo. Furthermore, firms in the cluster obtain their inputs largely from within the cluster and ICT distribution centers, while others have established contacts with firms in countries of origin such as China, Malaysia, Dubai, the United Kingdom, the United States of America, Hungary and Mexico to purchase parts and intermediate products. One implication of this is that the prices of the goods are significantly influenced by the exchange rate regime, showing the importance of macroeconomic policies on firms.

7.7 Presentation and discussion of findings

The nature and quality of employment impacts, albeit differently, the income and nonincome benefits received from a firm. Certainly, other

Table 7.3 Profile of employees in Otigba

Characteristics of employees	**Respondents**	
Age group	**No.**	**Percentage**
<20	12	7.8
21–25	57	37.3
26–30	48	31.4
31+	36	23.5
Total	153	100.0
Sex		
Female	75	48.1
Male	81	51.9
Total	156	100.0
Educational attainment		
University Degree	64	48.9
Technical	39	29.8
High school	25	19.1
Elementary	3	2.3
Total	131	100.0
Weekly income in Naira		
0–N1,000	27	17.3
1,001–5,000	29	18.6
5,001–10,000	33	21.2
10,001–50,000	44	28.2
Above 50,000	6	3.8
No response	17	10.9
Total	156	100.0

Source: Author's field survey (2013).

factors besides income affect one's quality of life, standard of living and wealth/poverty level; however, employment remains an important determinant (World Bank, 2013). The worker's income determines to a large extent the living standard, including expenditures on both luxury items and basic necessities such as housing, sanitation, water, transportation and household assets. In this section, therefore, statistical analysis based on data from the survey questionnaires is reported.

In order to situate analysis on the cluster within the broader national context, the present multidimensional poverty indicators at the national level are presented here, showing results for both the urban (within which the cluster is located) and the rural areas, and comparing them to select indicators from survey of the cluster. As Appendix figure A.7.1 (see Appendix 7.1) shows, there are clearly significant differences between

intensities of rural and urban poverty, with a greater percentage of households located in rural areas being far more severely deprived than those located in urban areas on almost all the indicators. Overcrowding is the only exception for which more households (43.7%) were deprived in occupancy rate (persons living per room) in households located in urban areas than rural areas (42.4%). The results reflect the reality that poverty in rural areas is more prevalent than in urban areas. While urban poverty is exacerbated by high-intensity slum formation, the rural areas are less populated and have low population densities, but lack the most basic amenities such as water, electricity and a health-care system.

In both urban and rural areas, "[y]ears of schooling of women members" shows the highest level of deprivation at 97.5% (urban) and 98.5% (rural). Deprivation in water and sanitation facilities is, however, very high, greater than 80% and 90% in urban and rural areas respectively. The least deprivation is found in female nutrition (urban – 8%, rural – 9.9%). In comparing the national urban figures to available indicators for the cluster, we see that employees in the Computer Village are less deprived in sanitation, drinking water and assets. This could be because access to adequate sanitation and water, though deficient in Lagos, might be better than in other urban areas. Furthermore, employees in the cluster might be able to access certain assets like radio and television at a rate cheaper than urban households for which the supply of these goods or the taste for them is not as high. However, compared to urban areas in Nigeria, Otigba employees tend to live in more crowded rooms, use more kerosene or firewood as cooking fuel and use other means of lighting except electricity.

7.8 Standard of living of employees in the cluster

In reporting the cluster findings, descriptive as well as bivariate analysis of both the subjective and standardized measures is reported. Survey results showed that 70% of employees indicated that working in their firms had increased their standard of living. Furthermore, and of great significance for this study, firms located in the cluster tended to have employees who reflected a higher standard of living than those not located within the cluster. About 55.1% of employees who responded agreed that workers in the Computer Village are faring better financially than those doing the same work outside of the Computer Village. Although less than half (46.8%) admitted that workers in the Computer Village are very satisfied, only 35.9% of respondents to the question indicated that most workers would go work outside of the Computer Village, given the opportunity. Thus subjective measures of living

standards show that most employees perceive that they are doing better since working in the cluster.

Next, descriptive analysis show standardized measures of living standards among Otigba employees, using the standard of living indicators of the multidimensional indicators, and as well UN-Habitat's slum household indicators. In addition, these standardized or objective measurements are further broken down and measured against the self-reported standard of living indicators. The self-reported standard of living indicator used is based on the response of employees' in comparison to their colleagues. In particular, the question "how would you describe your current standard of living compared to your peers?" was asked. Five possible answers were given: poor, surviving, comfortable, rich and very rich. For ease of analysis, the five categories were contracted to three: poor = poor and surviving; comfortable; rich = rich and very rich. We analyze the different indicators in this order: energy use; drinking water; sanitation (access to toilet facilities); housing; and personal assets.

7.8.1 Energy use: cooking fuel and electricity

For this study, employees' responses concerning the cooking facility they use are grouped into three: modern fuel, which includes electricity, LPG, natural gas and biogas; improved fuel, which includes kerosene, coal, lignite and charcoal; and traditional fuel, which consists of firewood, straw and dung. In the survey for this study, respondents tended to use first modern (46.8%), followed by improved (37.8%) and then traditional (9%) fuel sources to cook.[8] However, while a larger proportion of the comfortable and the rich used modern fuels, the largest percentage (48.21%) of those who self-identified as poor tended to use improved fuel sources. Surprisingly, among those who used traditional cooking facilities, the rich were the largest percentage. The results support the evidence that wealth affects the choice of or access to basic amenities like cooking facilities that individuals and households use, and consequently, their standard of living.

In the same manner, in considering lighting used in the homes, lighting from main electricity, that is, from the public grid (36.5%), generators (19.9%) and kerosene (14.7%) were the three largest categories used by employees in the cluster. Taking a close look at the self-reported living standard categories, we find that the poor and comfortable indicate that main electricity is their main source of lighting. However, it is possible that the electricity that is received is not frequent. Indeed, a survey (Lagos Bureau of Statistics, 2011) shows that in Lagos, 97% of respondents got their power supply from the federal agency in

Table 7.4 Association of standards of living and main source of lighting

Living standards → Source of lighting	Poor		Comfortable		Rich		Total
	No.	%	No.	%	No.	%	No.
Kerosene	12	54.55	4	18.18	6	27.27	22
Gas	5	38.46	8	61.54			13
Main electricity	16	32.00	31	62.00	3	6.00	50
Electricity from generator	4	12.90	11	35.48	16	51.61	31
Candles	8	44.44	7	38.89	3	16.67	18
Firewood	1	50.00	1	50.00			2
Other					1	100.00	1
Total	46	33.58	62	45.26	29	21.17	137

Note: Chi-square = 42.465, Sig. = 0.000.

Source: Author's field survey (2013).

charge of electricity, the Power Holding Company of Nigeria, while 3% got power from other sources. However, in considering the frequency of unexpected interruptions, up to 90% of the households experienced daily interruptions. Similarly, in terms of the frequency of electrical provision per day, only 4% and 1% of respondents had between 11 to 15 hours and 21 to 24 hours of electricity each day.[9] For cluster employees, less than 20% (18.6%) receive power supply all the time, while 34% receive it a few hours a week, 24.4% a few times a week, 9% once a week and 9% once a month.

Not surprisingly, among the rich in the survey, the largest percentage of respondents receives their main source of lighting from an electrical generator (see Table 7.4). Clearly this means is expensive, and causes a lot of air and sound pollution; however, for both companies and individuals, given the failure of public services, individuals resort to private provision of these amenities. In light of the expenses associated with maintaining and fueling an electrical generator, and the inadequacies of publicly generated electricity, some respondents resort to the use of kerosene, gas and candles.

7.8.2 Drinking water

In this study, drinking water can be gotten from improved or nonimproved sources. Improved drinking water sources include piped water into dwelling, plot or yard; public tap/standpipe; tubewell/borehole; protected dug well; and protected spring and rainwater collection. Unimproved drinking water sources include unprotected dug well;

unprotected spring; cart with small tank/drum; bottled water;[10] tanker truck and surface water (river, dam, lake, pond, stream, canal, irrigation channels) (World Health Organisation and the United Nations Children's Fund, 2006).

Survey results show that a significant percentage of Otigba employees have access to improved drinking water sources. In particular, 53.8% use water that was piped into the dwelling, piped into the compound/plot, bottled water, and the public tap, 32.1% used an open well in the yard/plot, open public well, protected well in the dwelling, protected well in the yard/plot, protected public well, and 8.3% got their drinking water from a river, stream, pond, lake, rainwater, satchel and tanker truck. This result could be reflective of most of the respondents living in Lagos, which itself has a lower percentage of people using unimproved drinking sources, with the exception of sachet water (15.9%). Unfortunately, there are those who seek to benefit from deplorable and scarce water situations, and when "municipal authorities do attempt to extend water supply to poorer neighborhoods they are often met with violence and intimidation from water tanker lobbies, 'area boys' and other groups who benefit from the unequal distribution of water and the 'micro-circuits' of exploitation which characterize slum life" (Gandy, 2006, pp. 12–13).

Looking more closely at Lagos, in the 2011 Lagos state household survey, among the sampled households, it was found that more than half of respondents (57%) got their water from the borehole. Other sources of water were as follows: 8% – piped water into dwelling, 3% – piped water to yard/plot, 4% – public tap/stand pipe, 10% – protected dug well, 3% – unprotected dug well, 13% – small-scale vendor and 2% – tanker truck (LBS, 2011, p. 144). However, only 34% of households attested to treating their water to make it safer before drinking it (p. 153).[11]

In comparing the perception of respondents' living standard and their source of drinking water, the largest percentage of those classified in the poor (36.71%) and comfortable (55.70%) living standard categories were in the first category, that is, piped into dwelling, piped into compound/plot, bottled water and public tap, while the largest percentage of the rich (40.91%) were in the second, which is a largely equally good category, that is, an open well in the yard/plot, open public well, protected well in the dwelling, protected well in the yard/plot, and protected public well. Overall, there is conclusive evidence that those who work in the cluster and the ICT sector have good access to improved drinking water.

7.8.3 Sanitation

Sanitation is here measured by access to toilet facilities. This indicator has been grouped into three categories, namely: flush, improved and no facilities. Improved facilities consists of traditional pit, ventilated improved pit and latrine, while people using a bush, field, bucket, and pan for toilets are grouped as having no facilities. Survey results show that 56.4% of employees use flush toilets at home, followed by improved (21.2%) facilities; however, 16.7% do not have toilet facilities at home. It is found, too, that the relationship between standard of living and access to toilet facilities is highly significant (Sig. = 0.000; Chi-square = 22.987). The highest percentage of respondents across all categories is using flush toilets. In particular the largest percentage of poor (33.75%) and comfortable (57.50%) respondents are found in this category, while the biggest percentage of the rich (40.63%) use other improved sources. About 17.64% of all respondents, however, have no facilities, with the poor (41.67%) making up the largest percentage of this category, followed, surprisingly, by the rich (37.50%). The percentage of those with no facilities on the national level is 28.2%, while that for urban areas is 18.1% (National Bureau of Statistics, 2012).

In Lagos (LBS, 2011), many of the respondents indicated using flush toilets, albeit flushed to different places: to tank (54%), pour to pit (27%); pour to street, yard, ditch (13%) and covered pit latrine (6%). Results also showed that 51% have their toilet facilities inside the house, while 49% and 1% respectively have them outside the house on the plot, and outside the plot/public toilet.

7.8.4 Assets

Survey results also show a significant relationship between change in personal assets and the living standards of workers. Cluster employees own a wide variety of assets, from radios to cars; nevertheless, most seem to possess the least expensive ones and fewer own the more expensive ones. Particularly, the largest number of respondents had radios (74.4%), then a television (70.5%), a computer (64.7%), a refrigerator (62.2%), a generator (55.8%) and a car (34%).

However, working in a firm in the cluster seems to have generally improved the possession of these personal assets. The poor and comfortable in particular have a greater percentage who attest to this improvement as opposed to the rich, who might have had these assets before working within the cluster.

7.8.5 Housing/sufficient living area

Information on employees' home conditions was collected. In the cluster, more than a quarter (26.3%) of the employees who responded lived in houses in which more than three people share a bedroom; an indicator of insufficient living condition by the UN-Habitat. More generally, as seen in Table 7.5, more than half live in houses that are in need of major repairs, while more than a quarter have houses located in a hazardous place, on or near a toxic waste site, in a flood plain or on a steep plane.

Table 7.5 Summary – standardized measures of living standards among Otigba employees

Multidimensional/slum household indicators	**Cluster employees' living standard**
Compared to urban areas in Nigeria	Otigba employees fare better in sanitation, drinking water and assets than national urban averages, but tend to live in more crowded rooms, use more kerosene or firewood as cooking fuel, and other means of lighting except electricity
Cooking fuel	Largest percentage (46.8%) uses modern fuel sources, that is, electricity, LPG, natural gas, and biogas
Electricity	Largest percentage (36.5%) uses electricity from the public grid; however, power supply can be irregular
Drinking water	Largest percentage (53.8%) uses improved drinking water sources
Sanitation – access to toilet facilities	Largest percentage (56.4%) uses "flush" toilets at home
Assets	More than half of the respondents have all personal assets, apart from cars (34%): radio (74.4%), television (70.5%), computer (64.7%), refrigerator (62.2%), generator (55.8%)
Housing	More than half live in houses that are in need of major repairs (53.2%), while more than a quarter have houses located in a hazardous place (31.4%), on or near a toxic waste dump (31.4%), in a flood plain (28.2%) or on a steep slope (30.8%)
	The largest percentage (47.17%) live in houses made of finished material (encompass parquet or polished wood, marble, linoleum, ceramic tiles, cement (polished), carpet and terrazzo)

Source: Author's field survey (2013).

Currently, in Nigeria there is a significant dearth of affordable, decent and safe dwellings (Ademiluyi, 2010). As of 2013, the figure had risen to a deficit of 16 million housing units, with Lagos having 5 million, or 30% of the country's shortage, according to the state's commissioner for housing (Uroko, 2013). Survey results from the Lagos Bureau of Statistics (2011) show that about 73% of households live in an average of 1 to 2 rooms, and 21% occupy 3 to 4 rooms, while 1% occupy an average of 5 to 6 rooms. Evidently the supply constraints in the housing sector equally impact the workers of Otigba, given that the cluster is located in Lagos, a state with a significantly high housing shortage.

Concerning the material used in their houses, respondents say that there are three main categories, namely natural, rudimentary and finished. Natural material consists of earth, sand, and mud, while coarse wood planks, palm/bamboo and unpolished cement are classified as rudimentary material. Finished material encompasses parquet or polished wood, marble, linoleum, ceramic tiles, cement (polished), carpet and terrazzo. Among respondents in this study, 19.01% used natural, 38.84% rudimentary and 42.15% finished materials for their homes. While the results of analysis associating type of housing material with respondents' standard of living is not significant (Sig. = 0.761), it is still worth mentioning that the largest percentage of the poor (45%) and the rich (42.86%) live in accommodations made of rudimentary materials. However, the comfortable have their largest percentage (47.17%) living in houses using finished materials.

Table 7.5 shows a summary of the standardized measures of living standard among Otigba employees and how they fare compared to the national urban averages. On most indicators – cooking fuel, drinking water, sanitation and assets (except cars) – a larger percentage of employees are using/have access to the more improved sources. Sometimes, this percentage is even greater than half, for example, for drinking water, sanitation and all assets (except cars). For housing as well, apart from the situation in which more than half live in houses that require major repairs, across the other indicators, approximately 68% do not fall under the other less desirable housing location conditions.

In summarizing the subjective versus standardized measures of living standards, results show that self-reported poor tend to fare less well than the rich on most indicators. However, the poor and the rich tend to have used similar housing materials to build their homes. The comfortable tend to have some overlay with the poor (choice of lighting, source of drinking water and access to toilet facilities), and the rich (cooking fuel). However, the rich are better able to make more "luxurious" choices in terms of type of cooking facilities, lighting and transportation used.

Of note as well is the finding that firms provided nonincome benefits – child care, pension, funding for further education, cars, housing, health insurance, company products, feeding allowance, transport allowance and training – to their workers that largely encompassed and surpassed benefits that might be expected by formal labor protection policies. Discriminant analysis showed at the 5% level that age of employee, firm size, length of service in the firm and location of firm were significant in characterizing the firms that employees identified as giving them these nonincome benefits. That is, older employees and those whose firms were located within the Computer Village tended to receive more nonincome benefits than others. In addition, larger-sized firms, measured by the number of employees, were more likely to give nonincome benefits to their workers, while the longer the individual had spent in the firm, the more likely the employee was to receive these benefits.

Similarly, it was also shown that within the cluster, informal institutions help facilitate improved welfare. In particular, it was found that employees and apprentices often depend on family and friends for accommodations and job referrals, with some of them working in firms owned by people they know and due to kinship relationships.

7.9 Prioritizing inclusive industrial policy mechanisms

The findings of this study provide strong evidence to support literature on the benefits of industrialization and firm agglomeration in particular in a developing country setting, not only in improving firm-level productivity but also for achieving poverty reduction objectives. It supports Otsuka and Sonobe (2011) in that, government – working toward the goal of employment creation, increased productivity and poverty reduction – should spearhead the development of clusters, provide support services for self-started clusters and acknowledge their contribution to national productivity by including cluster-related infrastructure in development plans.

At this juncture, one might seek to address a pertinent issue in industrial policy as to which form of industrial agglomeration is better and should be encouraged by the government, that is, spontaneous clusters like Otigba or those that are enacted by policy like the industrial parks, special economic zones (SEZs) and export-processing zones (EPZs). Fowler and Kleit (2014), who found that the presence of economic clusters in the United States tended to reduce poverty rates, did not distinguish between the spontaneous and policy-induced clusters, and acknowledged that it might be an area for further research, particularly with regard to poverty connections.

Policymakers can use spontaneous clusters as a signal to gauge comparative advantage, the skills of the workforce, and what kind and type of other industries they can encourage. Fowler and Kleit (2014, p. 129) noted that "regions with a higher share of employment in clusters, and with that employment dispersed across many industries within the same cluster, fare even better than those where employment is concentrated in a single industry." Industrial policy can therefore be creatively used to advance other industries that might already have been budding as they support the present one.

An enabling environment makes clusters more dynamic, and the lack of adequate infrastructure for firms is an obstacle in the industrialization process. In Otigba, more than half of the firms in the cluster view public provision of security of security, electricity and transport as not good or fair. Lack of investment in knowledge and physical infrastructure is causing firms to allocate significant proportions of their capital and operational expenses to alternative facilities such as generators and water boreholes. Public provision of such infrastructure could enable firms to allocate these funds to growing their businesses. Public provision could also prove cheaper in the long run as there would be economies of scale that would be attained through mass provision. There are other support systems that the government can also help enhance cluster productivity, and in some cases concurrently generate employment for other sectors and industries. These include the provision and development of good transportation facilities for products going to and from the cluster, and enacting import duties that are favorable to the industry.

7.10 Enhancing social benefits through institutional support

In addition to putting in place appropriate industrial policies, proper institutional support needs to be established to ensure that the social benefits of these policies are harnessed while enhancing industrial productivity. Indeed, social policy instruments that acknowledge the diversity and intensity of vulnerabilities within industrial activity groups can be instituted.

In bridging industrial and social policies, it is crucial for planners and policymakers to be aware that there are various categories of workers and vulnerabilities within each economy and area of industrial activity. Using the Otigba cluster as a case in point, conventional wisdom circulating among the populace states that a lot of money is being generated within the cluster. The reality, however, shows that a wide range of actors is exposed to various kinds of vulnerabilities. A mapping of industrial districts and sectoral activities would help distinguish between actors and the types of social protection that they need. Drawing from Lund

and Srinivas (2000, p. 13), this line of questioning enables us to analyze the following:

> how far down each sectoral strand or chain we can extend existing measures of protection, or introduce new ones ... How far and under what conditions can existing mechanisms be made to penetrate towards the less formal and less protected end ... At what point down the chain should the State be active? Or employers? Or the private insurance industry ... At what point down the chain do workers have to be unionized or organized in some other way in order to get access to protection measures?

Institutions that will promote equitable and inclusive development (World Bank, 2003), as well as the consistency of markets and social cohesion (Ocampo, 2007) are also imperative. One avenue to achieving this is by supporting effective communication between the government and private actors, for example, through representative associations. State-private dialogue becomes critical to resolving the evolving conflicts of economic growth and human development objectives, particularly in urban areas. For example, the Lagos state urban renewal plans involve new urban designs and the beautification of the city. This sometimes compels the state government to "sanitize" the cluster, clearing it of street hawkers and movable shops, which line the streets of the cluster and give an impression of a chaotic mess of human and vehicle traffic. From the point of view of the workers, this action destroys the livelihoods of traders who cannot afford to pay for a shop because rents are high and shops are scarce. For workers who survive on small margins to eat and make a living, which the cluster enables them to do, the only recourse might be illicit activities that conflict with state welfare goals. Communication thus needs to be effectively managed between governments and their electorate to ensure that while industrialization is achieved, socially optimal goals are also maximized.

In the same vein, this chapter further makes the point that there is a role for the state to work with stakeholders to strengthen existing largely informal institutions that are helping reduce vulnerabilities or fill in the gap in which formal social policies are absent. Informal institutions based on personal, kinship and familial ties often exclude some actors from accessing available financial, economic and poverty-enhancing benefits, for example, employment, provision of apprenticeships and housing. Indeed "formally guaranteed rights to welfare and employment security, embodied in legitimated states and regulated labor markets, will always be superior to a clientelist, or even reciprocal, system of informal rights

which deliver dependent rather than autonomous security" (Wood and Gough, 2006, p. 1698).

Finally, policies that aim to enhance both industrial dynamism and create jobs can foster stronger institutional linkages across the economy. Countries like the United States have long recognized the need for partnerships between industry and academia to promote industrial dynamism and innovation. Collaboration with universities can be fostered to encourage knowledge spillovers as well as research and development of new technologies. Trade associations that would help market national products can also be set up. The South African wine cluster, for example, has various institutions from which it receives support. It gained technical support "through the partially state-funded science council for the agricultural industry, the Agricultural Research Council (ARC)," while ARC Infruitec-Nietvoorbij also conducts wine-related research, for example, on "soil science, disease management, pest management, ... technology management and transfer," in addition to providing technical support (Wood and Kaplan, 2008, p. 111).

The Wine Industry Network for Expertise and Technology serves as a coordinator for the technicians and scientists from ARC Infruitec-Nietvoorbij and the universities, and ensures the "dissemination of research to end users" (p. 112). The South African Wine Industry Information and Systems assists "industry players in their marketing activities," while Wines of South Africa (WOSA) is responsible for the international promotion of South African wines (p. 113). WOSA also works closely with the "Western Cape Tourism Board to advance Cape wine tourism" (p. 112). South Africa's wine cluster is just one example of clusters across SSA that show that there are numerous possibilities for institutions to foster research, marketing and in essence improve the dynamism, productivity and reach of industrial clusters.

7.11 Conclusion

The marginalization of Africa in world trade, especially for manufactured exports, has now become one of the most enduring legacies and lasting manifestations of Africa's multifaceted development failures (Elbadawi, Ghura and Uwujaren, 1992). The "lessons" from East Asia in particular, and the recent development success of China points to the fact that domestic capabilities are the touchstone that either facilitate export orientation (e.g., Korea and Taiwan) or in fact drive export-led success in Southeast Asia particularly. In each of these instances, the state was instrumental in facilitating industrial growth. However, it is imperative to find the overlay between the notions that prioritize industrial policy mechanisms but still have a greater, and faster, impact

on reducing employment and poverty, within national economic agendas. This chapter has attempted to highlight how these can be achieved through promoting industrial clusters in SSAs where SMEs abound. It further stands in tandem with the SDGs' response to the long-standing academic and policy debates about how Africa should build a strong comparative advantage in exports, especially exports of labor-intensive manufactured goods, while highlighting the need to reduce poverty and institute social protection systems that buffer the poor and vulnerable.

Appendix

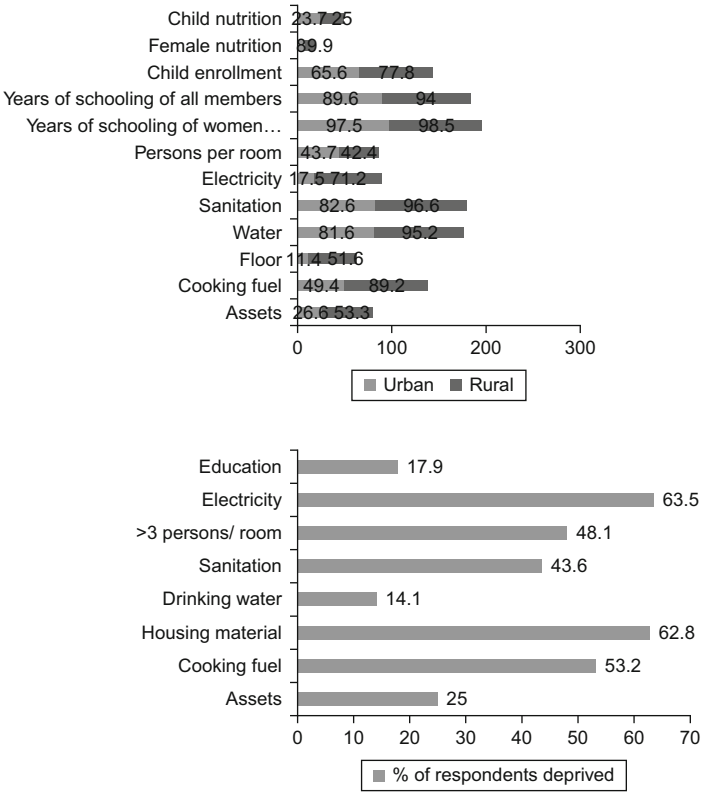

Figure A 7.1 Levels of deprivation in households in Nigeria and the Otigba cluster

Source: Calculated from Demographic and Health Survey (DHS) data (2008); Graph on the right is calculated from author's field survey (2013).

Notes

1. This point was reiterated that "[o]nly when a minimum of 25 percent of GDP emanates from the industrial sector, will Africa be able to achieve the desired economic growth rate, jobs creation and economic transformation that is needed to eliminate poverty" (News24Kenya, June 11, 2013).
2. Some other typologies include Pederson (1997) – the diversified industrial cluster, sub-contractor cluster, market town or distribution center and specialized petty commodity cluster (cited in McCormick, 1998); Markusen (1996) – the Marshallian New Industrial District (NID), with its recent Italianate variety, the hub-and-spoke district, the satellite industrial platform and the state-centered district; McCormick (1999) – groundwork cluster, industrializing cluster and complex industrial cluster.
3. The Small and Medium Enterprise Development Agency of Nigeria (SMEDAN, 2005) breaks down firm sizes in terms of numbers of employees, into micro (1–15), small (16–50) and medium (50–200).
4. A taskforce member of the umbrella association at the cluster, the Computer and Allied Products Association (CAPDAN), assisted in contracting others to disseminate and retrieve the survey questionnaire from selected informants.
5. The MPI is a relatively new dataset (Alkire and Foster, 2009) and comprises ten indicators that correspond to the three dimensions – education, health and living standards – of the Human Development Index (though wider in scope), and "captures a set of direct deprivations that batter a person at the same time" (Alkire and Santos, 2010).
6. A bank that gives a loan to established businesses (having shops), had an interest rate of between 27 percent to 30 percent, depending on the plan, up from 25 percent. And also a 2.5 percent one-off management fee.
7. Exchange rate €1 = N224.915, as of April 29, 2014. www.oanda.com; N0 to N50,000 = €0 to €222; N50,001 to N100,000 = €222 to €445; N1,000,001 to N5,000,000 = €4,446 to €22,231; N100,000,000 = €444,613
8. Where reported percentages do not add up to 100%, as in this case, the missing numbers represent missing values, i.e., from nonrespondents.
9. Sixteen percent of households in Lagos claimed to receive less than one hour of power supply each day, 55% received between 1 to 5 hours, 19% between 6 to 10 hours, and 5% between 16 to 20 hours.
10. Bottled water is considered improved only when the household uses water from an improved source for cooking and personal hygiene
11. Respondents added bleach/chlorine – 23 percent; boiled it – 25 percent; let it stand and settle – 27 percent or used ceramic, sand or composite water filters – 24 percent (LBS, 2011, p. 153).

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8

Sustainable Development and Inequality of Opportunity in Africa

Olumayokun Soremekun, Oyebanke Oyeyinka and Dominique Haughton

8.1 Introduction

Traditionally, the debate surrounding development has focused mainly on the prevalence and effects of poverty and minimal economic growth (Chen and Ravallion, 2008). Some studies have also attempted to give explanations for this present situation of poverty and low economic growth. In all, a plethora of studies exist covering such issues as aid versus investment (Moyo, 2009); globalization (Kaplinsky, 2005); migration and the effects of the brain drain (Rivera-Batiz, 2008); corruption and the need for good governance (Rivera-Batiz, 2002); the resource curse (Sala-i-Martin and Subramanian, 2003); the ubiquitous effects of colonialism (Maathai, 2009); and geography (Gallup, Sachs and Mellinger, 1999). This chapter, however, invites us to examine how inequality of circumstances leads to unequal outcomes, ceteris paribus.

According to United Nations estimates (UN-Habitat, 2008), sub-Saharan Africa ranks second after Latin America and the Caribbean for the highest levels of disparity between the urban rich and the urban poor within the developing world. However, although there is no dearth of acknowledgment that inequality can lead to undesirable social effects, international development efforts have nonetheless focused less on eliminating these disparities and more on poverty reduction (UN-Habitat, 2008). In many African countries, "economic inequalities remain largely understudied. While … the study of equality of opportunity is only at its beginning" (Cogneau and Mesplé-Somps, 2008, p. 4). African cities often serve as prime exemplars of the wide gap between the rich and the poor, as measured by the Gini coefficient.[1]

The relevant question that remains unasked in the context of these rising disparities is, why is it that within the same country, and

between countries with similar path dependencies, we find some individuals living in poverty and others who are extremely wealthy? To what extent can relevant outcomes be explained by unequal circumstances, as indicated by the lack of one or more of the following: access to improved water, access to improved sanitation facilities, sufficient-living area, durable housing and education?[2] Are unequal outcomes in access to opportunities reflective of choice or of circumstances beyond the individual's control? The distinction between circumstances and individual choices in this case is highly relevant. For instance, an individual has no control over his/her gender or his/her region of birth. Opportunities, however, are situations that can be influenced by the actions or inactions of individuals. Basic opportunities can be defined as services that are critical to a child's development. Examples include access to primary education, minimum nutritional levels, access to clean water, sanitation and electricity. Access to these services is not controlled by the child, but is dependent on external factors determined by the family or society as a whole. The universal provision of these basic services is considered to be a valid social goal as evidenced by such declarations as the Millennium Development Goals (MDGs). However, access to such opportunities is often determined by the circumstances of families or societies in developing countries. As a result, whether children receive access to certain basic facilities that define their opportunity as children is often not in their sphere of influence at all. A child cannot be expected to make the effort needed to access these basic services on his/her own. This begs the question, how is a child's access to basic services and opportunities influenced by his/her circumstances?

This chapter sets out to understand the levels of inequality of opportunity and its impact on inequality in society by systematically examining the issue of access to basic services and opportunities for all within an equal opportunities framework. The central question it addresses is not necessarily one of equality, that is, equal rewards for all, but one of equity, that is, equal chances for all (Barros, Ferreira, Vega and Chanduvi, 2008b). With this understanding, it is easier to show how the playing field can be leveled so that individuals can be given similar opportunities to succeed and not be constrained by circumstances beyond their control.

This chapter examines the determinants of inequality of opportunity in Africa. How do circumstances over which a child has no control affect his/her access to basic services and opportunities (education, water, sanitation etc.) that are necessary for his/her growth and development?

How does a child's circumstance influence access to basic services and opportunities that would influence his prospects for a high standard of living in the future? Specifically, we estimate and measure the level of inequality of opportunity for children in six African countries using logistic regression. This chapter thus considers at a more micro level how characteristics of children's access to basic opportunities such as water, sanitation, electricity, durable housing and health care relate to circumstances such as ethnicity, gender, parents' education, parents' income and area of residence (urban vs. rural) for six countries in Africa. Our research methodology involves cross-national calculations and comparison of inequality of opportunity for six African countries. Data used are from the Demographic and Health Survey (DHS-V survey) ranging from 2006 to 2008. The countries chosen for this study are regionally diverse within Africa, and include Kenya and Uganda in East Africa, Nigeria and Ghana in West Africa, Egypt in North Africa, and Zambia in the southern part of the continent. In order to calculate the inequality of opportunity for these countries, we adapt to the African context a Human Opportunity Index (HOI), which was previously introduced for studies of inequality of opportunity in Latin America (Barros et al., 2008b).

The rest of this chapter is organized as follows. The next section presents the analytical framework, followed by the literature review, highlighting inequality in Africa in particular. We then elaborate on the research methodology and report the findings, while the last section gives the conclusions and policy recommendations, as well as suggestions for further research.

8.2 Studying inequality of opportunity

Inequality of opportunity and the means to measure and analyze it are rather recent. The diagram in Figure 8.1 presents an analytical framework for this study, focusing on how inequality of circumstances leads to inequality of outcomes, concentrating particularly on those factors that are not dependent on individual choices, talents or motivations.[3] The boxes highlighted in gray[4] in the framework show the area of focus of our analysis.

Inequality of outcome consists of the observable disparities in livelihood among people, evident across different dimensions, for example, income, education, shelter, living standards and so on. As the model shows, it arises because of differences in the choices people make or due to inequality of opportunity.

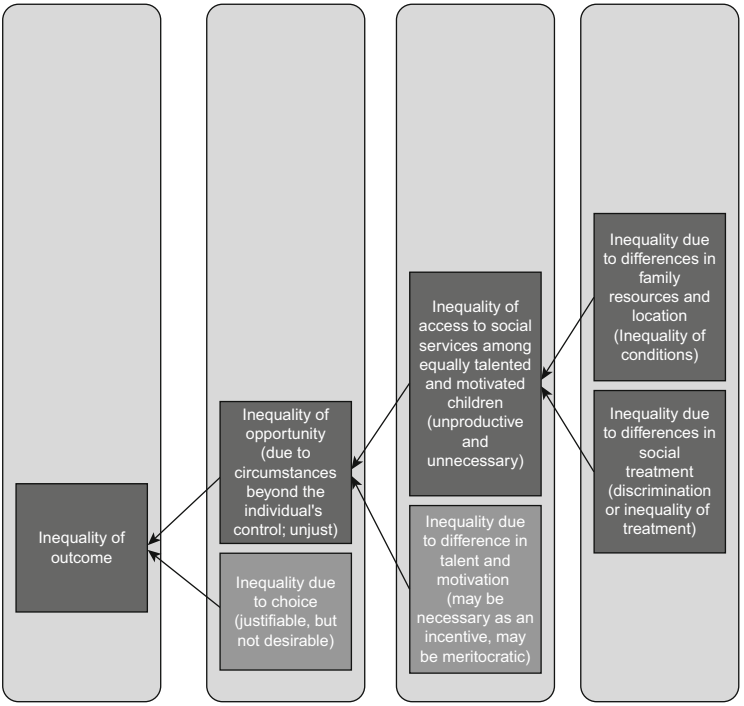

Figure 8.1 A framework for inequality of outcome and opportunity

Inequality due to choice consists of those disparities that arise from different choices that individuals make, for instance, at a basic level, the choice to be diligent or to be lazy. These choices eventually lead to different outcomes, only because individuals faced with similar options made different choices (Barros et al., 2008b). Inequality of opportunity, which is the main focus of this study, is the inequality that ensues due to differences in circumstances beyond a person's control, which then affects the outcomes the person has in life. These circumstances include such things as place of birth, education of parents, gender and race. Inequality of opportunity is itself broken into inequality due to talent and motivation, and that due to unequal access to social services.

Inequality due to talent and motivation takes into consideration the fact that individuals are born with diverse talents and are motivated by different things. Many of these factors are innate, and may thus be

seen as uncontrollable by the child. Inequality of access to social services, even among those who are equally talented and motivated, can be broken into inequality due to differences in family circumstances and differences in social treatment.

Inequality due to differences in family resources and location is that which occurs because individuals experience varying family circumstances, as indicated by factors such as the education of the parents, and the father and mother's income. These can affect the opportunities that are made available to the child. Inequality due to differences in social treatment, however, is that caused by discrimination toward certain groups of people, based on particular societal criteria, including race, ethnicity and gender. By better understanding the level of inequality of opportunities in African countries, we hope to present policies that will help mitigate these inequalities and level the playing field.

8.3 Inequality of opportunity: issues specific to Africa

Africa remains a highly unequal society, despite recent economic growth trends. Inequality in Africa is evident as divides in economic, spatial, social, urban and opportunities, and it is measurable in all these dimensions.

Economic inequality has been the classical way of measuring inequality, and traditionally, the Gini coefficient has proven to be a reliable indicator in this regard. Applying the Gini analysis, various explanations have been given for the high levels of socioeconomic inequalities on the continent. Van de Walle (2009, p. 30), for instance, provides a political explanation that "the surprisingly high levels of inequality in Africa can be understood as resulting from a process of class formation linked to dynamics of state building that have their origins in the economic institutions of the early colonial state." Gyimah-Brempong (2002, p. 183) found that "increased corruption is positively correlated with income inequality. The combined effects of decreased income growth and increased inequality suggest that corruption hurts the poor more than the rich in African countries."

In recent times, social science analysis has rightly argued that while economic inequality reflects differences in income and spending capacity, other forms of inequality are significant in explaining why these continue to persist in society. The spatial divide shows the physical evidence of inequalities. That is, within the same country or geographical area, there are pockets of both luxury as well as poverty. In fact,

people also suffer stigmatization based on the geographic area in which they live. For example, slums are a physical manifestation of poverty. In a task force report on slum dwellers (Garau, Sclar and Carolini, 2005, p. 1), it was reported that

> [a]ccording to the most recent international estimates, more than 900 million people can be classified as slum dwellers, most living under life- and health-threatening circumstances, often lacking several of the following conditions: access to adequate clean water, access to improved sanitation facilities, sufficient living space, dwellings of sufficient durability and structural quality, and security of tenure. Almost one out of three urban dwellers (one out of every six people worldwide) already lives in a slum.

UN-Habitat (2008) has argued that the spatial divide in cities of developing countries is reflective of not just "income inequalities among households; it is also a byproduct of inefficient land and housing markets, ineffective financial mechanisms and poor urban planning." Spatial and social disparities are critical disablers of inclusion in that they lead to severe job restrictions and higher rates of gender disparities, and contribute to deteriorated living conditions, social exclusion and marginalization, a lack of social interaction and a high incidence of crime (see also UN-Habitat, 2008).

Table 8.1 Proportion of urban population in slum areas

Major region or area	**1990**	**1995**	**2000**	**2005**	**2007**	**2010**	**2012**
Developing regions	46.2	42.9	39.4	35.6	34.3	32.6	32.7
Northern Africa	34.4	28.3	20.3	13.4	13.4	13.3	13.3
Sub-Saharan Africa	70.0	67.6	65.0	63.0	62.4	61.7	61.7
Latin America and the Caribbean	33.7	31.5	29.2	25.5	24.7	23.5	23.5
Eastern Asia	43.7	40.6	37.4	33.0	31.1	28.2	28.2
Southern Asia	57.2	51.6	45.8	40.0	38.0	35.0	35.0
South-eastern Asia	49.5	44.8	39.6	34.2	31.9	31.0	31.0
Western Asia	22.5	21.6	20.6	25.8	25.2	24.6	24.6
Oceania[a]	24.1	24.1	24.1	24.1	24.1	24.1	24.1

Note: [a]Trends data are not available for Oceania. A constant figure does not mean there is no change.

Source: United Nations Human Settlements Programme, 2013.

8.4 Inequality and the notion of equal opportunity

Any effort to rethink urban development in Africa has to begin by placing the concept of equality of opportunity within the discourse on inequality. The emphasis should be on equal opportunities, which implies "leveling the playing field" at the childhood level, as opposed to an emphasis on equal outcomes at a later stage in life, when it may be hard to influence. According to Roemer (1998, p. 12), "leveling the playing field means guaranteeing that those who apply equal degrees of effort end up with equal achievement, regardless of their circumstances." In many African countries, because of certain circumstances beyond their control, individuals might be prevented from having access to the same opportunities, and in turn to achieving the same goals as their counterparts.

The emphasis should therefore be on influencing people's options at the start of the process, relying on the fact that children's access to basic opportunities will invariably affect the outcomes in their lives, measured in terms of overall well-being (health, education and social services and inclusion), and access to opportunities that will enable them to live the life that they desire. Inequality of opportunity applies the concept of path dependency in that it embeds the idea that "happenings at an earlier point in time will likely affect possible outcomes at a subsequent point in time" (Isaac, 1997, p. 7). It is also based on the notion that people's ability to succeed should be determined by their own choices, efforts and talents, and not circumstances that they cannot control such as birthplace, ethnicity, family background and gender (Barros et al., 2008b).

There are many ways to level the playing field, in this sense. One of these would be through an equal opportunity policy (EOp), which is an intervention that would guarantee such equal achievements for the same degree of effort applied (Roemer, 1998).

Previously, studies on inequality of income opportunity in Africa have sought to investigate the relationship between current outcomes and historically predefined circumstances of people or communities.[5] However many of these methodologies have limited their explanatory variables to parents' means, parents' education or birth factors, without including living conditions that might contribute to a child's success in life (see, for example, Cogneau and Mesplé-Somps, 2008).

To appropriately assess inequality of opportunity, there is a need for a critical analytical shift: one needs to move beyond simply a focus on unequal outcomes, to some of the root causes of such unequal outcomes.

Inequality in outcome between and within countries is clearly evident. Data show inequality based on such measurements as income, health, education, infrastructure, empowerment and so on. Many countries are impoverished relative to others. The MDGs are just one indication of how the international community is seeking to decrease the impoverishment evident in communities, but there are many other ways in which this could be measured, many of which are harder to address. Opening up the question of inequality to opportunity would help address equality in a much more multidimensional way.

A second important question in this field of study is the availability of the means to quantify the inequality of opportunity. Several scholars have rightly noted that the notion of "equity," which is perhaps more reflective of equality of opportunity, is comparatively difficult to measure (Birdsall, 2006; Barros et al., 2008b, among others). The recently coined HOI enables such calculations and allows for the analysis of basic opportunities (Barros et al., 2008b). In their effort to create the index through a detailed study of inequality of opportunity in Latin America, the authors define basic opportunities "as a sub-set of goods and services for children, such as access to education, to safe water, or to vaccinations, that are critical in determining opportunity for economic advancement in life" (p. 3). Overall, their study concluded that, for equality of opportunity to prevail, exogenous circumstances should not have a role. They identified countries with high inequality rates in Latin America and found that birthplace matters in those countries. Specifically, the birthplace tended to determine a child's access to clean water, sanitation and electricity. Parental education was also found to be important since it explained access to early secondary schooling, and to water and sanitation, and was strongly related to economic and educational achievement.

Third, it is our belief that if policymakers can identify root causes for unequal outcomes, they may be better able to design policies to address them. As Charles de Montesquieu[6] notes, "In the state of nature … all men are born equal, but they cannot continue in this equality. Society makes them lose it, and they recover it only by the protection of the law."

8.5 Data analysis and methods

For the purpose of our analysis, we use DHS data to estimate the HOI for children in sub-Saharan Africa. The DHS surveys that we use are the DHS-V surveys, which were administered in these countries over a period of two years (2006 to 2008). These surveys represent nearly 302,000

children aged 0 to 17 from sub-Saharan Africa (Table 8.2). DHS surveys are nationally representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health and nutrition. DHS surveys collect information on household characteristics, including availability of electricity, water and sanitation facilities, as well as type of flooring material and cooking fuel. A major advantage of using DHS data is that DHS surveys are standardized across countries with the same categories and category definitions. This helps us overcome a major challenge in which datasets for different countries have different categories/indicators or different definitions for categories/indicators.

We consider five opportunities in this chapter: education, access to electricity, clean water, sanitation and durable flooring. We categorize these opportunities into two groups: Education and Housing. We include durable flooring as an additional opportunity. We also include durable flooring because it is one of the variables that connotes the "habitability" of places. A child's access to good and conducive housing conditions is an essential element of the opportunity to live a healthy life. These opportunities are considered as important for a child's growth and development. The circumstances considered in this study are gender (gender of the child and gender of the household head), economic factors (income) and household characteristics (area of residence, level of education for household head).

The DHS indicators we consider include the following

8.6 Opportunities

- Education: All respondents provide the highest level of education achieved and school enrollment. The DHS dataset includes a number of education indicators, which are used to measure the educational level or attainment of household members. We use the highest educational level indicator (consisting of four levels: 0 – "no education," 1 – "primary education," 2 – "secondary education," and 3 – "higher education").
- Water and sanitation: In terms of water, the survey asks if the source of water is piped into the dwelling, piped into the yard/plot, public tap/standpipe, tube well or borehole, protected well, unprotected well, protected spring, unprotected spring, river/dam/lake, rainwater, tanker truck, cart with small tank and bottled water. The survey also asks if the type of toilet facility is flush, traditional pit latrine, improved ventilated pit latrine or no facility. Many studies have

looked at the impact of improved water and sanitation on children's mortality rates (Abou-Ali, 2003; Galiani, Gertler and Schargrodsky, 2005; Rutstein, 2000). Ensuring access to water and sanitation for all comprises goal 7 of the MDGs.

- Electricity: Access to electricity is also a very important opportunity. Electricity improves the lives of all household members by providing lighting, energy sources for cooking and heating, and access to information through the radio, television or the Internet. Electricity also has an effect on a child's education and health. Gustavsson (2007) finds that children are able to spend more time studying when electricity is provided. Also the provision of electricity reduces eye irritation, coughing and nasal problems in children caused by some alternative energy sources, for example, firewood, candles and kerosene stoves, thus improving their health. The DHS survey asks a dichotomous question with regard to electricity: "Does your household have electricity?" A yes is coded as a 1, while a 2 is coded as a no.
- Durable floor: The DHS survey asks what the floor in the household's habitation is made of. The options include natural floor (earth/sand, dung), rudimentary floor (wood planks, palm/bamboo), and finished floor (parquet or polished word, vinyl or asphalt, ceramic tiles, cement, carpet). Durable floor represents a dwelling that provides physical security, shelter from weather, and protection from threats to health, like structural hazards and disease for its occupants. The type of flooring in a home is an indicator of the type of housing that it is. For example, a floor that is made of sand or earth will most likely be found in a mud hut with a thatched roof. Habitability is one of the many aspects of the human right to housing. Habitable housing provides occupants with adequate space, physical security, shelter from weather, and protection from threats to health like structural hazards and disease.

8.7 Circumstances

- Education of head of household: The number of years of education for the head of household.
- The wealth index: The wealth index is meant to allow for the identification of problems particular to the poor, such as unequal access to health care or education, as well as those particular to the wealthy. The wealth index is particularly valuable in countries that lack reliable data on income and expenditure, the traditional indicators used to measure household economic status. The wealth index is a composite

measure of the cumulative living standard of the household. It is calculated using data on a household's ownership of selected assets such as televisions, bicycles, materials for housing construction and types of water access and sanitation facilities. Each household asset for which information is collected is assigned a weight or factor score generated through principal components analysis. The resulting asset scores are standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. These standardized scores are then used to create the break points that define wealth quintiles as Lowest (Poorest), Second (Poorer), Middle, Fourth (Richer), and Highest (Richest). The wealth index is used in our study as a proxy for household income. We note that the wealth index measure includes access to water and sanitation, which are opportunities that we consider in this study. It would be ideal to have an index that does not incorporate some of the opportunity indicators that we consider in our study, but unfortunately the wealth index is the only available proxy for household income.

- Gender: the gender of the child and gender of head of household.
- Area of residence: urban versus rural.

8.8 Developing a Human Opportunity Index

We aim to measure inequality of opportunity for children by developing a measurement index – an HOI. The HOI can be defined as the proportion of existing opportunities in a given society that are available and have been allocated equitably – the equal opportunity principle. The HOI is a composite indicator that combines two elements: (i) the level of coverage of basic opportunities necessary for human development, such as primary education, water, sanitation and electricity, and

Table 8.2 DHS-V survey characteristics for select countries

Country	Sample size (children aged 5 to 17)	Survey year
Kenya	38,602	2008
Uganda	45,170	2006
Nigeria	47,724	2008
Ghana	46,421	2008
Egypt	89,279	2008
Zambia	35,449	2007

Source: DHS.

(ii) the distance between the distribution of circumstances (beyond an individual's control) for those with access and those without access to an opportunity. The second element can be regarded as a measure of inequality. Examples of these circumstances include, but are not limited to, gender and household characteristics such as the area of residence and the level of education of the head of household. This index assesses both the importance of improving overall access to basic opportunities and also ensuring equitable distribution of those opportunities.

We calculate HOIs by country for a set of opportunities related to education and housing (clean water, sanitation, electricity and durable flooring). These separate HOIs are then summarized via the arithmetic mean or geometric mean into a single overall country index. As noted previously, the HOI combines two elements – the coverage rate (C) and the inequality of access (D) based on differences in circumstances between those who have access and those who do not have access to that opportunity – in a single calculation. In this calculation, the coverage of a basic opportunity is adjusted by how unequally it is distributed.

The coverage rates, that is, average access rates of each opportunity, can be better understood as the ratio of total opportunities available to total number of children. It can also be interpreted as the percentage of opportunities that are available relative to the total number that is needed for universal access. Based on this definition, we see that it represents the level of coverage of available opportunities, but is not reflective of the equity of distribution. It signifies average access to the selected opportunity in each country, but does not take into consideration whether children of a certain gender or area of residence have different access rates.

The second component, which is an inequality measure, is a version of the dissimilarity index widely used in sociology and applied to dichotomous outcomes. We can also refer to it as the D-Index (a measure of inequality of an opportunity). It measures the overall weighted difference between the estimated probability of access to the opportunity for each child (given his/her circumstances) and the probability of access to the opportunity as a whole. If this distance is zero, the implication is that the probability of access is independent of circumstances.

Example A

To illustrate the definition of the D-Index and the usefulness of the index as a measure of inequality of opportunity, we use a simple hypothetical example that takes us through the steps of calculating the D-Index and interpreting it (Table 8.3). For the purpose of our example, we examine

a child's access to education given the circumstance of area of residence (area1/area2). Let $y = 1$ if a child has access to education and $y = 0$ if a child does not have access to education. Let $x = x_1$ if a child lives in area1 and $x = x_2$ if a child lives in area2.

The D-Index can be calculated using the formula

$$D = \frac{1}{2\bar{p}} \sum_{k=1}^{2} \left| p\left(y = 1 \mid x_k\right) - \bar{p} \right| p\left(x = x_k\right) \tag{1}$$

where $\bar{p} = p(y = 1)$ is equal to the proportion of children with access to education. The rationale for the constant $\frac{1}{2\bar{p}}$ in Equation (1) will be made clear in the example that follows.

For the purpose of our example, Table 8.3 represents the distribution of students who attend or do not attend school in each area of residence (area1 or area2, yielding m = 2 groups). Based on the table,

- probability of attending school ($y = 1$) in area1 x_1 is 0.8 i.e. $p(y = 1|x_1) = 0.8$;
- probability of attending school ($y = 1$) in area2 x_1 is 0.3 i.e. $p(y = 1|x_2) = 0.3$;
- probability of being in area 1 is 0.5 i.e. $p(x = x_1) = 0.5$;
- probability of being in area 2 is 0.5 i.e. $p(x = x_1) = 0.5$; and
- probability of attending school overall (overall coverage rate) $\bar{p} = 55/100 = 0.55$.

So the dissimilarity index (D) of access to school as defined in Equation (1) can be calculated as

$$\frac{1}{2 * 0.55}\left\{\left(\left|0.8 - 0.55\right| * 0.5\right) + \left(\left|0.3 - 0.55\right| * 0.5\right)\right\} = 0.227$$

Moreover, if we were to assume that the probability of access is independent of circumstances, that is, probability of going to school is the same in Area 1 and Area 2 that would mean that Area 1 and Area 2

Table 8.3 Example dataset

	Area 1	**Area 2**	**Total**
Student in school	40	15	55
Students not in school	10	35	45
Total	50	50	100

Source: Authors.

should both have 27.5 possible school placings. Our example indicates (Table 8.3) that Area 1 currently has 12.5 excess opportunities, while Area 2 is in deficit of 12.5 opportunities. This is the number of opportunities that needs to be rearranged to restore equality. This number, divided by the total number of school opportunities available, gives us the proportion of opportunities that are not allocated equitably, that is, $\frac{12.5}{55} = 0.227$.

This implies that 23% of opportunities to attend school are not allocated equitably. Equation (1) can be defined for any number m of groups. In the above example, we had m = 2 groups (area1 and area2). This natural interpretation of the D-Index holds because of the factor $\frac{1}{2\bar{p}}$ (see also Barros et al. [2008a], end of section 2.1).

We follow a methodology similar to Barros et al. (2008a) in their construction of the D-Index and the HOI in the case of Latin America. Their methodology is based on the assumption that we have access to a random sample of the population with information on whether a child (i) had access or not to a given opportunity. We also have a vector of variables with his/her circumstances ($x_i = (x_{1i}, \ldots, x_{mi})$). To construct the HOI, we do the following:

1. We estimate a logistic regression to obtain the predicted probability of access $\hat{p}_i$ to an opportunity for each child in our sample. This regression is a function of his/her set of circumstances. That is, access to water is a function of circumstances such as gender of the child, gender of the head of household, education of the head of household and so forth.
2. Given the predicted probability of access ($\hat{p}_i$) from the logistic regression, we can calculate the overall coverage rate $\bar{p}$ for each opportunity, which is defined as
   $\bar{p} = \frac{1}{n}\sum_{i=1}^{n}\hat{p}_i$, where n is the number of children.
   We note that by properties of logistic regression models, $\bar{p}$ also equals the overall probability of access to the opportunity.
3. We compute the dissimilarity index D in access rates:
   $$D = \frac{1}{2\bar{p}}\sum_{k=1}^{m}\left|p\left(y=1\mid x_k\right)-\bar{p}\right|p\left(x=x_k\right).$$
   Details of the D-Index can found in Appendix 8.1.
4. HOI is then equal to the coverage rate multiplied by the similarity in access, that is, $\bar{p}(1 - D)$.

The HOI can thus be interpreted as the proportion of opportunities that are available and have been allocated equitably across circumstances in a given society. Based on the above example, the overall measure of educational opportunity will be given by

$$\bar{p}(1 - D) = 0.55^*(1 - 0.227) = 0.42515$$

Therefore, the overall measure of opportunity for going to school given the area of residence is 0.42515. In other words, 43% of educational opportunities are available and have been allocated equitably across circumstances. A higher HOI implies higher levels of coverage or lower levels of inequality of access.

8.9 Analysis and results

We first consider the opportunity variables (Table 8.4). For the purpose of our analysis (children between the ages of 5 and 17), we recode the education variable into a 1 if the child has access to education and a 0 otherwise. Ideally, children between the ages of 5 and 17 should currently be in school. We use this as a proxy for measuring access to education.

We recode the access to water variable into a binary improved water variable (0 – no access, 1 – access). We follow the United Nations definition of improved water sources, which include house connections, public stand pipes, protected wells, protected springs and so forth by coding these as 1. Types of sources that do not give reasonable and ready access to water, such as tanker trucks and bottled water, are not considered improved, and they are coded 0.

Table 8.4 Opportunities

Opportunity	**Description**	**Group**
Education	Access to education (1 attends school, 0 does not)	Education
Improved water	Access to improved water (1 – access, 0 – no access)	Housing
Improved sanitation	Access to improved sanitation	Housing
Electricity	Access to electricity (1 – access, 0 – no access)	Housing
Durable floor	Durable floor (1 – durable floor, 0 – nondurable floor)	Housing

Source: Authors' compilation.

We also recode the sanitation variable into a binary improved sanitation variable (0 – no access, 1 – access). This is also based on the United Nations definition of improved sanitation, which includes connection to a sewer or septic tank system, flush toilet, ventilated or improved pit latrine. These are coded as 1, while all others are coded as 0.

For electricity, the variable is equal to 0 if a child has no access to electricity and 1 if a child has access to electricity.

Durable floor is measured by looking at the main floor material. Natural and rudimentary materials such as earth, sand, dung or wood planks are considered to be nondurable, while finished floors such as polished wood, ceramic, cement or carpet are considered durable. The variable is set equal to 1 if a child has access to a durable floor and 0 otherwise.

It is important to note here that "access" to these different opportunities does not take into consideration the level or quality of these services. An example is electricity, where a child might be recorded to have access but this does not guarantee uninterrupted 24-hour service or high wattage. Low quality of service would certainly reduce the benefits of having access to electricity. These issues of quality also apply to education, water and sanitation. The fact that water is from a public stand pipe does not guarantee its cleanliness. Also, with regards to education, we do not consider access to the different levels of education relative to circumstances, that is, access to primary education, access to secondary education and so forth. Our dichotomous approach is a limitation, and a possible direction for future research is to expand the opportunity variables from binary indicators to indicators with three or more levels, utilizing multinomial regression as a technique of choice.

With regard to circumstances (Table 8.5), the gender variable is recoded into a binary variable, where a male is coded as 1, while a female is

Table 8.5 Circumstances

Circumstances	**Description / specification**
Gender	Dummy variable (1 – male, 0 – female)
Gender head of household	Dummy variable (1 – male, 0 – female)
Education – head of household	Number of years of education
Area of residence	Urban vs. rural (1 – urban, 0 – rural)
Wealth index	Quintiles – lowest, second, middle, fourth and highest

Source: Authors' compilation.

coded as 0. Area of residence is also coded into a binary variable – urban is a 1, while rural is coded as a 0.

8.10 Coverage of opportunities

We look at coverage rates of each opportunity (Table 8.6). Egypt has the highest coverage rate across the board for all the opportunities. Uganda has the lowest coverage rates for electricity and durable floor. Zambia has the lowest coverage rates for water and sanitation. These coverage rates do not reflect the equality of distribution or whether children with different circumstances have better or less access to these services. They are a reflection of just how many children have access to these services.

8.11 Dissimilarity index: The D-Index

In order to compute the D-Index for the different opportunities (based on the methodology discussed above), we run logistic regressions by country to obtain the predicted probability of access $\hat{p}_i$ to an opportunity for each child in each country. Table 8.7 shows the regression coefficients for the logistic regression for access to electricity for all six countries (tables of the Regression coefficients for the other opportunities can be found in Appendix 8.2; Appendix Tables 8.1–8.3). Our logistic models reveal that the education of the head of the household is an important determinant for access to electricity in all the countries under study, except for Ghana. With regard to electricity, area of residence is also significant for all countries with the exception of Egypt. This is intuitive, as Egypt has 99.5% coverage, so Egypt currently provides universal access to electricity regardless of area of residence. We see that a female as head of household in Ghana is more likely to influence access to

Table 8.6 Coverage of opportunities

Coverage of opportunities (in % for children ≤ 17 years of age)						
	Kenya	**Uganda**	**Nigeria**	**Ghana**	**Egypt**	**Zambia**
Electricity	20	8.1	46	50	99.5	20
Water	61	69	53	78	98	43
Sanitation	45	70	52	60	99.4	35
Durable Floor	38	22	59	79	86	39
Education	55	57	64	55	65	54

Source: Calculated from the Survey Data.

electricity rather than a male head of household. This is an interesting result with regard to Ghana, but contextually Ghana is a matrilineal society, in which descent is traced through the mother and maternal ancestors. In a matrilineal society, an individual is considered to belong to the same descent group as his/her mother. Thus, the female is culturally considered to be the head of the household, and in some cases last names are handed down from mother to daughter.

We compute the D-Index based on the results of the logistic regression. In general, the signs of the coefficients are as expected. It is important to note here that the process is consistent whether we keep or drop the nonsignificant variables in our calculation of the D-Index. We keep the nonsignificant coefficients in the calculation as the – Index was not significantly different without the inclusion of the nonsignificant coefficients. We also keep the coefficients because we want our calculations to be consistent across all countries. That is, the same variables are going into the calculations for each country. Additionally, we keep all the coefficients at their estimated values even if they have signs that are contrary to our expectations. One might argue that, intuitively, one would expect that urban areas should have greater access to opportunities than rural areas. However, in the case of Zambia, for example, our regression coefficients for electricity seem to indicate that access to electricity is more likely in rural areas ceteris paribus. It would be interesting to dig further to see why this is contextually so.

The D-Index enables us to analyze the inequality of opportunity in electricity, education, water, sanitation and durable floor. Given the predicted probabilities of access for each child ($\hat{p}_i$) from the logistic regression, we can calculate the overall coverage rate in each country,

Table 8.7 Logistic regression estimates – access to electricity

	Uganda	Kenya	Ghana	Nigeria	Egypt	Zambia
Gender	–0.013	–0.145*	0.047	0.006	0.075	–0.014
Gender HH	0.095	0.158*	–0.122*	0.020	0.013	0.322*
Educ HH	0.205*	0.248*	0.047	–0.086*	0.179*	0.177*
Area	1.550*	0.635*	0.233*	1.157*	0.130	–0.667*
W – Second	15.213	1.816*	2.304*	2.325*	4.007	15.849
W – Middle	14.986	3.294*	3.978*	3.701*	34.924	15.780
W – Fourth	15.695	5.178*	5.693*	5.642*	35.035	19.684
W – Highest	19.881	7.878*	7.457*	6.786*	34.138	24.031
Constant	–21.432	–7.466	–3.499	–4.167	3.594	–21.567

Note: *Significant at 0.05 level.

Source: Authors' calculation.

which is defined as $\overline{p}=\frac{1}{n}\sum_{i=1}^{n}\hat{p}_i$, where n is the number of children in the country.

Note that for a given country and opportunities, children are split into $m = 2^8$ circumstance groups corresponding to the set of circumstances of the child. Consequently, $\hat{p}_i$ is the same for all children within the same circumstance group, and so, from Equation (1),

$$D=\frac{1}{2\overline{p}}\sum_{k=1}^{m}\left|\hat{p}_i-\overline{p}\right| * (\#of\ children\ in\ group\ k\ /\ n\ )$$

$$=\frac{1}{2n\overline{p}}\sum_{k=1}^{m}\left|\hat{p}_i-\overline{p}\right| \#of\ children\ in\ group\ k$$

It follows that

$$D=\frac{1}{2n\overline{p}}\sum_{i=1}^{n}\left|\hat{p}_i-\overline{p}\right|$$

A lower D-Index indicates greater equity, while a higher D-Index indicates lower equity in the distribution of each opportunity. Recall that we can interpret the D-Index as the share of each opportunity that is not allocated equitably (see Example A). Egypt has the lowest level of inequality of opportunity (electricity), with a D-Index of 2%, while Uganda has the highest, with a D-Index of 77%, followed by Zambia at 66% (Table 8.8).

In light of our interpretation, we can infer that in the case of Egypt, only 2% of the available electricity (99.5% coverage – see Table 8.6) is

Table 8.8 D-Index

	Uganda	Kenya	Ghana	Nigeria	Egypt	Zambia
Electricity	77	63	36	41	2	66
Water	6	15	4	19	1.5	34
Sanitation	12	30	22	21	1.5	37
Floor	64	51	13	33	8	51
Education	35	32	30	32	33	26

Source: Authors' calculation.

not allocated equitably. With respect to the other countries, Uganda shows higher levels of inequality of opportunity for electricity (77%) and flooring (64%). This implies that 77% of the available electricity (8.1% – see Table 8.6) in Uganda is not allocated equitably across circumstance groups. This high level of inequality is associated with low levels of electricity coverage in Uganda (8.1% – see Table 8.6). A country like Egypt, which has high coverage rates, is associated with low levels of inequality. This is intuitive, as countries with high coverage are bound to have low inequality in access because almost everybody has access; there can then be no group that is systematically without access. These selected examples indicate that changes in average access to a basic opportunity may be accompanied by changes in inequality of access.

8.12 Human Opportunity Index

The HOI is the combination of two components: the coverage rate and the index of inequality of opportunity – distribution of access. It allows us to estimate how equitably available opportunities are allocated across circumstances with regard to children in a country. Our results indicate that Egypt stands out with regard to electricity, water and sanitation. These three opportunities exhibit the highest level of both access and equality of access. In Uganda and Zambia respectively, only 2% and 7% of electricity is available and allocated equitably (Table 8.9). This helps illustrate the incidence of high inequality within and between African countries.

The overall HOI is estimated to be the average of all the summary HOI indices (Barros et al., 2008a). That analysis indicates that Egypt has the highest HOI (83%), Ghana is second (48%), while Nigeria is third (39%), followed by Uganda (31%), Kenya (26%) and Zambia (20%) respectively (Table 8.9). This indicates that Egypt stands out, having a much higher degree of equality than the other African countries. Egypt, as with many other northern African countries, has had closer ties to the Middle East and the rest of the world historically, which explains the relatively higher levels of development than other traditional African countries. One might be surprised to see that Ghana has a higher HOI than Nigeria. This is a highly interesting result, given that Nigeria is a richer country due to its oil, and is also the leading African country in terms of GDP growth currently. These ratings, however, also help explain historical circumstances. In the case of Nigeria, for example, decades of military rule and high levels of corruption have ensured that the majority of Nigeria's citizens are very poor and cannot enjoy basic opportunities.

Table 8.9 Human Opportunity Index

	Uganda	Kenya	Ghana	Nigeria	Egypt	Zambia
Electricity	2	7	32	26	100	7
Water	63	51	75	43	91	28
Sanitation	61	31	47	41	100	24
Floor	8	19	68	39	82	19
Education	21	20	19	44	43	21
Overall[a]	31	26	48	39	83	20
Overall[b]	17	21	43	38	80	18

Note: [a]Average, [b]Geometric mean.

Source: Authors' calculation.

Ghana, in contrast, has had a much better track record in democratic institutions despite its earlier years of military rule, and has become one of the fastest-growing economies in Africa since the 1980s.

Alternatively, we see a case for using the geometric mean rather than the average of the HOI indices for our five opportunities to calculate the overall HOI. Our case is based on the premise that if we multiply all five coverage rates, we obtain the coverage rate for all opportunities, and if we multiply all five "(1-Ds)," we estimate the probability that all five opportunities are correctly allocated. We find that the top three countries in our sample remain the same, with Egypt having the highest HOI, followed by Ghana and then Nigeria. The order for the bottom three countries changed, with Kenya having the fourth-lowest overall HOI (in descending order), followed by Zambia and lastly Uganda, with the lowest HOI. Given that we have a small sample size, it would be interesting to see how much of a difference will arise if one uses the geometric mean rather than the average to calculate the overall HOI index when one has much larger sample sizes. An interesting finding is that countries can rank differently when different opportunities are being measured. For instance, Uganda performs relatively well for water and sanitation, but relatively poorly for electricity and flooring. Zambia, however, ranks consistently across most dimensions with the exception of electricity (which is the lowest).

8.13 Some thoughts on opportunities rather than outcomes

Equality of opportunity is about leveling the playing field for everyone from the beginning of his/her life. In a region such as Africa, which is

characterized by pervasive inequality of educational, health, income and health opportunities, to name a few, and where groups of the population are left out of socioeconomic progress, a shift in the debate toward equality of opportunities is long overdue and has a strong potential to be a better guide for public policy. It represents a shift in the attention of policymakers, who recognize that much more progress can be made if countries confer a sense of urgency to the need to give the same chances to all. To do that, measuring inequality of opportunity – better, deeper, and more systematically – is a critical starting point. The HOI is one such measure that provides us with an understanding of the level of equality of opportunity. Equality of opportunity guarantees that basic opportunities necessary for the development and growth of a child are distributed equally regardless of his/her circumstances. It is a critical policy instrument because it guides government and policymakers in not only the provision of basic opportunities but also the equitable allocation of these opportunities.

We have considered five basic opportunities in this chapter. These include access to electricity, improved water, improved sanitation, access to education and durable floor. Predetermined circumstances that we considered here include gender, gender of household head, education of household head, area or residence and the wealth index. We find that parental education matters with regard to access to electricity, sanitation and education. Area of residence is also an important factor for access to electricity, water and sanitation (tables in Appendix 8.2). Our results are consistent with the UN-Habitat study on the state of the urban youth (2010), which finds that predetermined circumstances such as gender, parents' education and father's occupation, as well as area of residence have an impact on youth inequality of opportunity. Low levels of education among parents tend to perpetuate intergenerational underachievement (UN-Habitat, 2010). Here, we quantify these effects further by an application of the HOI to these opportunities and circumstances.

This study has only focused on six countries – Egypt, Ghana, Nigeria, Kenya, Uganda and Zambia. These countries are leaders in many areas both in Africa and within their specific regions. They are thus good representatives for countries in Africa. However, we do not have any Francophone countries in the sample. This study provides a useful base for future studies. It is a good foundation for case study investigation and action. Egypt has been highlighted as a "success" with low levels of inequality. It would be interesting to explore this further through case

studies to determine the factors that have encouraged this growth and how they might be applied to other African countries. Future research should also expand the pool of countries to all African countries. This would enable us to examine results not only on the country level but also on a regional basis within Africa. For example, we can then ask, "Is Egypt a unique case in North Africa or do other North African countries share the same results?" This question can also be applied to the other countries in our sample. Methodologically, this analysis can be improved by expanding the opportunity variables from binary indicators to indicators with three or more levels and utilizing multinomial regression as a technique of choice. Opportunities and circumstance variables can also be expanded.

One of the benefits of the HOI Index is that it highlights the degree of inequality with regard to opportunities and also some of the circumstances that might be inhibiting equality, particularly on an individual country basis. This would be useful for countries and policymakers as they can better formulate policies that reduce inequality within these opportunities. It is clearly time to review targets related to inequality and how they are implemented, especially as they relate to children and young people, particularly in the context of any future agenda-setting if we should accomplish the all-pervasive goal of ensuring equality and prosperity for all. It is important that not only are more resources mobilized to ensure that these targets are met but that they are provided in a way that mitigates inequality, thus taking giant steps in ensuring that the playing field is more level. We suggest that defining goals similar to the MDGs but focusing on reducing the inequality of opportunity for young people would be valuable, and the techniques in this paper would help in that regard. We note that the MDGs focus on the whole population, and a focus on the HOI within the MDG goals would help ensure that the MDGs are met for future adult populations who are currently children.

Appendix 8.1: D-Index

The D-index can also be shown to measure the distance between the distribution of circumstances for those who have access and those who do not, that is,

$$D = \frac{1-\overline{p}}{2} \sum_{k=1}^{m} \left| p\left(x = x_k \mid y = 1\right) - p\left(x = x_k \mid y = 0\right) \right| \tag{A1}$$

Recall that D is defined as

$$D = \frac{1}{2\bar{p}} \sum_{k=1}^{m} \left| p(y = 1 \mid x_k) - \bar{p} \right| p(x = x_k) \tag{1}$$

We now show that Equation (A1) is equation to Equation (1):

$$D = \frac{1-\bar{p}}{2} \sum_{k=1}^{m} \left| p(x = x_k \mid y = 1) - p(x = x_k \mid y = 0) \right| \tag{A1}$$

$$= \frac{P(y=0)}{2} \sum_{k=1}^{m} \left| \frac{p(x = x_k, y = 1)}{p(y = 1)} - \frac{p(x = x_k, y = 0)}{p(y = 0)} \right|$$

$$= \frac{1}{2\bar{p}} P(y=0) \sum_{k=1}^{m} \left| p(x = x_k, y = 1) - \frac{p(x = x_k, y = 0)}{p(y = 0)} \bar{p} \right|$$

$$= \frac{1}{2\bar{p}} \sum_{k=1}^{m} \left| p(x = x_k, y = 1) P(y = 0) - p(x = x_k, y = 0) p(y = 1) \right|$$

$$= \frac{1}{2\bar{p}} \sum_{k=1}^{m} \left| p(y = 1 \mid x = x_k) p(x = x_k) p(y = 0) - p(y = 0 \mid x = x_k) \right.$$
$$\left. p(x = x_k) p(y = 1) \right|$$

$$= \frac{1}{2\bar{p}} \sum_{k=1}^{m} p(x = x_k) \left| p(y = 1 \mid x = x_k) p(y = 0) - p(y = 0 \mid x = x_k) p(y = 1) \right|$$

$$= \frac{1}{2\bar{p}} \sum_{k=1}^{m} p(x = x_k) \left| p(y = 1 \mid x = x_k)(1 - \bar{p}) - p(y = 0 \mid x = x_k) \bar{p} \right|$$

$$= \frac{1}{2\bar{p}} \sum_{k=1}^{m} p(x = x_k) \left| p(y = 1 \mid x = x_k) - p(y = 1 \mid x = x_k) \right.$$
$$\left. \bar{p} - p(y = 0 \mid x = x_k) \bar{p} \right|$$

$$= \frac{1}{2\bar{p}} \sum_{k=1}^{m} p(x = x_k) \left| p(y = 1 \mid x = x_k) - \bar{p} \right|$$

Therefore, Equation (1) is equal to the alternative definition of the D-Index, that is, Equation (A1).

Appendix: 8.2

Table A 8.1 Logistic regression estimates – access to water

	Uganda	Kenya	Ghana	Nigeria	Egypt	Zambia
Gender	–0.024	–0.049*	–0.043	–0.028	–0.025	0.051
Gender HH	0.008	–0.032	–0.150*	–0.143*	–0.174*	–0.107*
Educ HH	0.142*	0.016	–0.029	–0.209*	0.027	0.021
Area	1.165*	0.718*	0.078*	0.472*	1.375*	1.264*
W – Second	–0.283*	0.495*	0.297*	0.642*	0.599*	0.500*
W – Middle	–0.439*	0.809*	1.061*	1.232*	1.029*	0.959*
W – Fourth	–0.159*	1.374*	1.201*	2.134*	2.037*	1.847*
W – Highest	0.421*	2.466*	0.217*	2.589*	0.761*	3.499*
Constant	0.632	–0.561	0.979	–0.902*	3.011*	–2.113

Note: *Significant at 0.05 level.

Source: Authors' calculation.

Table A 8.2 Logistic regression estimates – access to sanitation

	Uganda	Kenya	Ghana	Nigeria	Egypt	Zambia
Gender	0.003	–0.035	0.001*	–0.050*	–0.138	0.015
Gender HH	–0.050	0.043	–0.339	0.269*	0.136	0.045
Educ HH	0.165*	0.124*	0.211*	–0.294*	0.580*	0.101*
Area	0.435*	0.238*	0.313*	0.502*	0.811*	–0.330*
W – Second	0.810*	0.921*	1.481*	0.713*	3.271*	1.757*
W – Middle	1.439*	1.573*	2.281*	0.983*	2.655*	2.504*
W – Fourth	1.708*	2.677*	2.939*	1.873*	2.377*	3.802*
W – Highest	3.519*	3.835*	4.032*	3.463*	33.998	7.348*
Constant	–0.440	–2.218	–1.334	–1.294*	3.453*	–3.697

Source: Authors' calculation.

Table A 8.3 Logistic regression estimates – access to education

	Uganda	Kenya	Ghana	Nigeria	Egypt	Zambia
Gender	0.050*	0.210*	0.136*	0.164*	–0.172	0.145*
Gender HH	–0.466*	–0.548*	–0.266*	–0.454*	0.109	–0.353*
Educ HH	3.953*	3.319*	2.396*	5.406*	7.588	3.198*
Area	–0.360*	–0.243*	–0.027	0.479	–0.101	–0.152*
W – Second	–0.055	–0.105*	–0.343*	–0.103	–0.313	–0.016
W – Middle	0.071	–0.214*	–0.478*	0.571*	–0.489	–0.014
W – Fourth	0.110*	–0.453*	–0.649*	1.248*	–0.539	0.003
W – Highest	0.061	–0.746*	–0.835*	1.501*	–0.560	0.245*
Constant	–3.660	–2.908	–2.140	1.714*	–7.653	–3.301

Source: Authors' calculation.

Notes

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1. The Gini coefficient measures the gap in income between the rich and the poor, and ranges from 0 to 1, with 0 depicting no inequality and 1 reflecting high levels of inequality (UN-Habitat, 2008, p. 64).
2. Access to basic services such as water and sanitation tend to define slum conditions and decent living. In turn, these conditions define the health and hygienic environment in which a person grows up. Similarly, unequal opportunity gap manifests itself in the wide difference in educational facilities that exist in poor and rich environments of a city.
3. The framework is based on that used by Barros et al. (2008a), in their paper entitled "Measuring Inequality of Opportunities for Children," albeit without the policy linkages.
4. All boxes apart from the two having "Inequality due to choice" and "Inequality due to difference in talent and motivation … "
5. For example, Cogneau and Mesplé-Somps (2008) examine the relationship between a particular adult's current income and his/her childhood circumstances to find that unequal circumstances tended to reflect unequal income outcomes.
6. French lawyer and philosopher (1689–1755).

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