1 Introduction

1.1 Motivation and Objectives of the Research

Innovation is a major driver of long-term economic growth (Aghion and Howitt, 2009; Lundvall, 2016; Romer, 1990) and sustainable development (UN, 2015). As extensively documented in Fagerberg et al. (2010), two factors have been identified as critical factors in the endogenous economic growth models: adoption of technologies developed elsewhere and indigenous innovative capacity. While science, technology and innovation have received increasing attention in academic research and policymaking, most of the research in this area has been carried out in the context of the developed countries. Our understanding about the determinants and the impact of innovations is therefore obtained in the context of the developed countries.

The nature, the source and the role of innovations in developing countries, especially in low (including both low and lower-middle) income countries, which have similar development levels and economic structure, such as countries in sub-Saharan Africa, are largely overlooked. The levels of economic, technical and institutional development in these countries are significantly lower than those in developed countries. Therefore, our knowledge about innovation in developed countries may not be appropriate for innovation, if any, in low-income countries. Reasons underlining this overlook are not only the lack of data and attention but also doubts which question whether firms and societies in these economies are innovative, and whether innovation is a rich-countries-only business and is therefore not relevant for low-income countries.

Is innovation relevant for low-income countries (LICs)? For some researchers, the answer is a clear 'yes', but other people may argue that

there are other more important issues in LICs, such as food security, water, health and conflict, among others. This history supports the claim that the development process in LICs can be accelerated by tapping existing knowledge and know-how from foreign countries or by facilitating the exchange of both external and local knowledge within a country. Where the technological gap between developed and developing countries is significantly wide, better implementation of basic technologies can have a greater impact in recipient countries than the adoption of new technologies (Prahalad, 2012). The transfer, adoption and adaptation of knowledge to LICs hence constitute an important issue to understand and promote economic growth and global development. Moreover, only innovation and technical progress can provide fundamental solutions to challenges of LICs, such as poverty reduction, environment and resource constraints, and sustainable development. Therefore, innovation should be regarded not as an outcome of development but as a means to achieving it.

Are African economies innovative? Is there any innovation in sub-Saharan Africa? If so, what kinds of innovations are prospering there? Are innovations important to Africa and LICs? Until a decade ago, innovation in LICs was the focus of only a handful of studies every year (Zanello et al., 2013). Until then, innovation was often associated with patents or groundbreaking discoveries. Those are the results of costly, risky and lengthy processes which require intense knowledge and capital investment to create something 'new'. The *Oslo Manual* has been a standard reference for surveys of innovation in advanced economies and, from its third edition, in developing countries. Its definition of innovation as '[. . .] the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations' (OECD, 2005: p. 46) highlights two important features. First, innovation can take a multitude of forms (product innovations, process innovations, marketing innovations, and managerial and organizational innovations). Second, innovation can be developed by an original idea but could also emerge from diffusion, absorption or imitation of the new methods that are observed. Because of that, it could simply be new to the firm and have an impact on productivity and employment.

The recognized growing role of innovation in developing countries has opened new sub-fields of research at the intersection of innovation and management studies and development studies. The collection of work by Lundvall et al. (2011) explored the development of innovation systems in developing countries. Kraemer-Mbula and Wunsch-Vincent (2016)

made an insightful investigation of the informal economy as a hidden engine of innovation in developing countries, based on case studies. In the context of Africa, Juma (2015) is a seminal research study on agricultural innovation in Africa. The effort of African Science, Technology and Innovation Indicators Initiative (ASTII) led by the New Partnership for Africa's Development (NEPAD) made valuable progress on the measurement and the relevant discussions of science, technology and innovation (STI) policies in Africa. The African Innovation Outlook published in 2014 reported that while R&D intensity in most of African countries is still far below the level of 1 per cent, innovation is pervasive (NPCA, 2014).

In recent years, there have been more studies on innovation for the poor. The stream of literature on inclusive innovation focuses on the impact of innovation on the people living in the lowest income groups (Chataway et al., 2014). In particular, it refers to the production or delivery of new products and services for and/or by those people that so far were largely excluded by markets. At the same time, the constrained ingenuity and resilience of the people living on the poverty line have been recognized as an incubator for local innovation. This focus on 'frugal innovation' (Bhatti and Ventresca, 2012) introduces further considerations to understand the sources and impact of innovation in LICs. In order to effectively access new markets, companies may need to re-think the production and delivery of goods, often re-engineering products in order to reduce the complexity and cost of production. The innovation process could involve reverse diffusion (Govindarajan and Ramamurti, 2011), when an innovation is adopted first in LICs before spreading to advanced industrial economies; *jugaad* innovation (Gulati, 2010), in the case when the innovation involves arrangement or workaround and is born out of lack of resources; or design thinking processes, in which consumers are involved in the design of a product or services. Alongside these developments, in a study of innovation in the emerging Asian economies, China and India in particular, Kaplinsky (2011) and Kaplinsky et al. (2009) suggested that 'innovation for the poor and innovation appropriate for production in low-wage and poor-infrastructure environments has increasingly become an arena for profitable production'. According to them, such 'appropriate technologies below the radar' observed in China and India are likely to become the dominant sources of innovation for the poor.

While all these studies made valuable progress in advancing our knowledge of innovation for the poor and have great relevance for Africa, most of these findings are discovered in the context of emerging Asia, especially in India and China. While the evidence published by NEPAD of

innovation in Africa is valuable and encouraging, most countries, except South Africa and Uganda, did not use a stratified random sample or project the sample results to the population of firms for the surveys of innovation in 2008–2010 (NPCA, 2014). Although the NEPAD surveys also adopt the *Oslo Manual* definition of innovation, which is a step forward from only relying on R&D and patents, these surveys have not moved further in localizing the sources of innovation in the Africa context.[1] Moreover, the diffusion mechanisms of innovation to and within African countries were not its focus and hence received limited attention. What is more important, the informal economy is not covered in the NEPAD survey. Innovation in the informal economy remains under-researched, especially that based on large survey data. Finally, our understanding of the origin and diffusion of non-technological management innovation in Africa remains limited. These are important gaps in the literature that await investigation.

In a continent that rarely has formal R&D labs and has invested less than 1 per cent of the world's total R&D expenditure, what is the nature of the innovations created there? What are the major domestic and foreign sources of these innovations? What are the important mechanisms for the diffusion of these innovations? How do African firms manage to innovate given the resources, skills and institutional constraints? Are the innovations purely created through the frugal process? To what extent does the informal sector innovate? How do informal firms innovate? What are the scale, the nature, the sources and the constraints of the innovation in the informal sector? Moreover, what are the sources of non-technological, management and marketing innovations in the African firms, especially the informal firms? What is the role of innovation in the informal sector? Finally, what is the role of government policy? Which policies have effectively benefited the African firms? Where are the problems? Our understanding of innovation in the African continent is limited. Broadly speaking, as a published review on the origins and evolution of the field of science policy and innovation studies points out, innovation studies are a consolidated research field in the developed world, while innovation studies in developing countries have not received much attention so far (Fagerberg and Verspagen, 2009; Martin, 2012).

Defining innovation as a new product or process, or new management, organizational or marketing practices (where 'new' means new to the world or new to the country or the firm), using evidence from firm-level

[1] For example, the pattern of innovation expenditure is categorized following the European Community Innovation Survey, into intramural (in-house) R&D, extramural (outsourced) R&D, acquisition of machinery and acquisition of external knowledge.

surveys in Ghana and Tanzania, plus in-depth case studies in Ghana and Kenya, this book aims to fill this knowledge gap by exploring the nature of innovation in Africa, the determinants and transmission channels for effective innovation creation, diffusion and adoption in these countries under institutional, resource and affordability constraints, and opportunities and challenges of the Fourth Industrial Revolution for innovations in Africa. In particular, it aims to

- understand the nature and type of innovations in Africa, in both the formal and informal sectors;
- examine the sources and strategies of innovation creation and diffusion in Africa, comparing the formal and informal sectors;
- analyse the channels of external knowledge diffusion to Africa and their effectiveness;
- explore the sources and diffusion mechanisms of management innovation in Africa;
- investigate the opportunities and challenges of the Fourth Industrial Revolution for innovations in African economies; and
- discuss the space for innovation policy in LICs.

In order to achieve these objectives, the book carries out a systematic, comprehensive yet pioneering analysis of the nature and type of innovations in Africa, the internal and external sources of innovation in these countries, using economic, management, development and evolutionary theories, institutional analysis and political economy. It provides unique survey-based evidence on innovation in the informal sector, which is very important for the African economies while being seriously under-researched. It is one of the first systematic and in-depth academic studies of innovation in Africa that covers both the formal and the informal sectors. In particular, it presents the first large survey-data-based evidence of innovation in the informal economy in the LICs; it also delivers some pioneering analysis of the origin and diffusion of innovative management practices in Africa, using evidence at both organizational and individual levels.

Findings from this research have wide and important policy and practical implications for innovation in other LICs.

Innovation can be developed from an original idea but also emerges from diffusion, absorption or imitation of the new methods that are observed. Admittedly, fundamental innovation is costly, risky and path-dependent, and to date, important innovative work is highly concentrated in a few wealthy countries, with specific forms of research capacity, and amongst a few companies. Therefore, external sources of technology account for a large component of productivity growth in most developing countries. If foreign technologies are easy to diffuse and adopt, a country

with meagre technological capacity can follow a catch-up strategy to acquire and more rapidly deploy the most advanced technologies (Bell and Pavitt, 1993). In the current times, this is one emerging insight from the broad diffusion and impacts of mobile technologies and affiliated value-adding financial and health services (Aker and Mbiti, 2010). This view is also supported by evidence from the European industrialization process in the nineteenth century and the Japanese economic reconstruction after the Second World War. Soete (1985) showed how during the first Industrial Revolution, the United States and other European countries successfully reduced the technological gap with the United Kingdom, the main innovator at that time, thanks to a successful imitation and catching-up process. Again, after the Second World War, the reconstruction and growth of the Japanese economy was absorptive in nature and based on integrating foreign technologies (Blumenthal, 1976). Similar paths to imitate the Japanese growth and structural changes were attempted in the past decades by other Asian countries as well, with South Korea and Taiwan being success stories (Biggart and Guillen, 1999).

However, technology diffusion to and adoption by LICs is costly and conditional on factors that support the process (Keller, 2004). It relies on substantial and well-directed technological efforts (Lall, 1992) as well as sufficient human and financial resources and absorptive capacity in firms and industries (Cohen and Levinthal, 1989; Keller, 1996). It also requires appropriate institutions and policies to guide incentives and facilitate the process, in addition to strong local capabilities to identify the right technology and appropriate transfer mechanism, and to absorb and make adaptations according to local economic, social, technical and environmental conditions (Fu and Gong, 2011).

Therefore, unlike most other innovation studies which focus on the inputs and outcomes of innovation activities, this book puts special emphasis on the transmission mechanisms of knowledge diffusion and detailed processes and provides unique and important analysis and evidence in this important regard. Moreover, different from most other research which is based on case studies of a particular industry, the studies reported in this book cover a wide range of industries that are important in Africa and in other LICs.

The results of this study challenge the opinion that innovation may not be relevant in Africa, and a much more diverse picture emerges. Firms in Africa are innovative and there are wide ranges of creative activities taking place. These include significantly improved products and production practices as well as novel marketing and management practices. The innovations in Africa are clearly not R&D-based, as are those that are

often observed in industrialized countries. They are also not purely frugal. Nor are they all the so-called inclusive innovations that serve the base of the pyramid. However, they share some common characteristics, which suggest innovations in Africa are mostly innovations 'under-the-radar'. Most of these activities are incremental in nature and based on organizational or individual learning and adaptation, practice or individual creativity in the countries under study. They are often demand-led, learning and non-R&D based, low-cost innovations as a result of the constraints that the African firms face and the responses that they made to survive and grow. They are visible in new or significantly improved products or processes, but more than that, they are just everywhere in non-technological areas such as management and marketing practices used by the African firms. They do exist in Africa and other LICs, but they are not detectable by the traditional innovation indicators such as R&D investment and patent application/grant numbers. They do allow the African firms to survive and grow. But the clear limitation of the lack of inputs from modern science and engineering makes it difficult for the African firms to catch up with the firms in the industrialized countries which are supported by rapid progress in science and technology.

This concept of 'under-the-radar innovation' based on research in Africa has its roots in what Kaplinsky (2011) identified as 'innovation below the radar' in the Asian Drivers. It argues that much of the previously dominant innovation value chains are either ignorant of the needs of consumers at the bottom of the pyramid or lack the technologies and organizational structures to meet these needs effectively. It also argues that innovation for the poor and innovation appropriate for production in low-wage and poor-infrastructure environments has increasingly become an arena for profitable production. It goes further to fully elaborate the meaning of 'under-the-radar innovation' in the low-income or lower-middle-income context and how this is created and diffused in such an eco-social and physi-technical context.

The study reported in the book also finds that the diffusion of foreign technological and managerial knowledge to these counties is limited, especially at inter-organizational level. The limited collaboration between businesses was also stifling creativity. The new information and communication technologies have facilitated the innovation diffusion but could have played a more significant role. The opportunities for Africa in the Fourth Industrial Revolution will only be genuine and substantial when policies and international co-operations are in place to build up the digital competencies in the African continent; not only skills but also infrastructure and an enabling environment. Otherwise, they will miss the opportunities and face significant challenges. The role of policymakers should

therefore be aimed at implementing policies that build national and international business networks, create incentives for innovators and provide funding to overcome common financial restraints.

1.2 Research Design

The book uses the rigorous statistical analysis of purposely designed surveys as well as in-depth case studies of representative cases. But a systematic approach is adopted: an analytical framework of an open national innovation system approach is introduced to organize the analysis that coherently spans a wide array of perspectives. Economic and management theory of innovation, development and evolutionary theory, institutional analysis and political economy are used to explain the nature, motivation, sources, obstacles and policy measures of innovation in the context of LICs, and the roles played by the domestic and international actors, the market and non-market institutions.

To capture the diversity of innovation in LICs, this book uses a broad definition of the term 'innovation' as previously stated. This includes not only the adoption of new product or process but also new management and marketing practices (where 'new' means new to the world or new to the country or the firm). On the one hand, this accounts for the different innovation activities and isolates their impact on the business of the firms. On the other hand, this book discusses innovation that could simply be new to the firm and have an impact because it is so. Importantly, this allows the research to distinguish groundbreaking novel innovation from imitative and incremental innovations.

1.2.1 Choice of Country for the Study

With regard to the country choice for the case study, Ghana is regarded as one of the most promising cases of industrial development in West Africa (AfDB et al., 2014). The country recently moved up from a low-income country to a lower-middle-income country. The development level and stability of its institutions and education system provide a potentially fertile soil for innovation in an LIC setting. Innovation has also been at the core of Ghana's long-term strategic political vision of being at the frontline of African development. In 2010, the Government of Ghana established an Industrial Policy, which was accomplished through a comprehensive and inclusive process based on analysis and wide consultation with stakeholders (Government of Ghana, 2010). In 2013, Ghana's industrial sector contributed 29 per cent of the total GDP. In the same year, agriculture accounted for 22 per cent of GDP and the

remaining 49 per cent was the contribution of the services sector. Apparel and food processing are major manufacturing industries in its industrial sector. The contribution of the construction industry also increased from 5.7 to 8.6 per cent between 2006 and 2010. All these make Ghana a good case for the study of innovation in Africa (and also innovation in LICs).

Tanzania, being an East African country and a low-income country, is a good case to complement Ghana. Tanzania is among the countries in sub-Saharan Africa that have shown a sustained high growth rate in recent years (between 2009 and 2017), with an average growth at between 6 per cent and 7 per cent.[2] In terms of economic structure, the country is not very different from Ghana. Just like Ghana, it has service sectors as a major contributor to the GDP, contributing 47.6 per cent, with agriculture contributing 23.4 per cent and industry (mining, construction and manufacturing) contributing 28.6 per cent.[3] However, in terms of the industrialization process, that is the contribution of the manufacturing sector to GDP, the country is not doing very well – the contribution has never exceeded 10 per cent in the long history of attempts to industrialize since independence; it was as low as 5.6 per cent in 2016. The country has however, renewed its industrialization vigour and it is the country's top development agenda. Currently, the country has a development vision that envisions the country to be semi-industrialized by 2025, that is, the manufacturing contribution reaching 23 per cent of GDP, up from 5.6 per cent; the President himself is spearheading the industrialization agenda. Moreover, Tanzania is one of the very first African countries to realize the role of science and technology in the industrialization process; its first science and technology policy came into effect in 1986. The policy has been reviewed twice since then. Currently, the Global Innovation index 2018 report shows Tanzania to be the top-ranked low-income country, holding the 92nd position globally, having moved up four positions from the previous report. Notably, the report showed Tanzania to have achieved high innovation output scores relative to its input scores.[4] A lot is happening in the country, and this makes Tanzania an interesting case representing emerging low-income resource-rich countries and the economies in East Africa.

[2] Index Mundi, 2018 – www.indexmundi.com/tanzania/economy_profile.html retrieved on 2 January 2019.
[3] Ibid.
[4] www.sipotra.it/wp-content/uploads/2018/09/GLOBAL-INNOVATION-INDEX-2018.pdf retrieved on 2 January 2019.

1.2.2 Methods

This book attempts to fill a gap in the literature and the market by providing the first systematic and comprehensive analysis of the creation and diffusion of innovation in Africa through an in-depth study of innovation in Ghana and Tanzania. It also provides a valuable, large survey-based analysis and evidence of innovation in the informal economy, which is also rarely researched. Therefore, it uses a mixed methods approach, which combines both qualitative case studies and statistical analysis of data from large firm-level surveys, to understand the overall innovation performance in Ghanaian and Tanzanian firms and the process of creation and diffusion of innovation in these firms. The quantitative and qualitative approaches are used to triangulate the results and provide a more complete picture of the current innovation activities in Ghana and Tanzania.

Such a research design using survey evidence from two representative countries in East and West Africa over time, instead of a single-country cross-section survey, allows us to identify the major characteristics and key sources as well as linkages for innovation in sub-Saharan Africa which are common to different countries and robust over time. This is then supplemented by a case study in a third country, Kenya, and some general analysis in the context of LICs. In this study, we emphasize the shared characteristics and factors that are common in a wider African context, instead of comparing the differences. The institutional and economic factors that underline the differences between these countries are not the main focus of this study due to the space limit of this book. This leaves space for future studies, which I will discuss in the concluding chapter.

The advantage of such a research design is that it offers us an opportunity to discover the general patterns of innovation, the sources and diffusion mechanisms in sub-Saharan Africa through in-depth and systematic studies without the heavy cost of demanding firm-level surveys in each of the African countries. It also offers the advantage of in-depth and systematic analysis of each major case-study country and avoids the limitation of having to narrow the analysis of innovation in each country into one or two chapters. I have to admit, at the same time, that the study may have not covered all the major types of innovations in Africa. Hence caution should be exercised when drawing strong arguments about innovation in the African continent.

In analysing the creation and diffusion of innovation in Ghana and Tanzania, it is important to recognize the structural peculiarities of most of the developing countries, where a dual economy system coexists, and