DFID Research Project:
‘Enabling Innovation and Productivity Growth in Low Income Countries (EIP-LIC)’

Country Report Tanzania

June 2018

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http://www.tilburguniversity.edu/dfid-innovation-and-growth/
Acknowledgments

In 2013, the Department for International Development (DFID) awarded a grant to Tilburg University and Radboud University Nijmegen for a 6-years research project ‘Coordinated Case Studies – Innovation for Productivity Growth in Low Income Countries’ (PO 5639). The sizeable research project, implemented in cooperation with academic institutions in African and Asian countries, resulted in an extensive series of scientific papers and reports, databases and more practical policy oriented documents. This report presents the findings of the research activities in Tanzania

On behalf of Tilburg University and Radboud University Nijmegen I would like to thank the British people and DFID, in particular the Growth Research Team, for the support in this project. Most if the research output in this report was the result of a fruitful cooperation with the University of Dar es Salaam. We thank our research partners, in particular the head of the Department of Economics, Dr. Jehovaness Aikaeli, and his colleagues Dr. Stephen Kirama, Dr. Otieno Osoro and Mr. Salvatory Macha.

We hope that the report is informative for policy makers within governmental agencies, donors and NGOs involved in the promotion of innovation in manufacturing SMEs in Tanzania and the region. It is also targeted at SME owners and SME branch organisations who could use the report as reference material for reflecting on and formulating the management and business strategies. For the academic community with similar research interests, it may provide useful insights to providing ideas or supporting them to identify and/or validate research questions and hypotheses.

Prof. Lex Meijdam (Dean Tilburg University)

Disclaimer:

This material has been funded by UK aid from the UK government; however the views expressed do not necessarily reflect the UK government’s official policies.

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1 ‘The research project was later renamed into Enabling Innovation and Productivity Growth in Low Income Countries’ (EIP-LIC).
### Basic data of the project

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<td>Project objective</td>
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Executive summary

From 2013 to 2018, the British Department for International Development (DFID) funded a research project on innovation and productivity growth with special reference to low income countries (LICs), implemented by Tilburg University and Radboud University Nijmegen. The project focused on understanding the factors, institutions, and policies that can increase business innovation and productivity growth, particularly in manufacturing small and medium sized enterprises (SMEs). The research was organised within two thematic areas: ‘Innovation Systems’ and ‘Finance for Productivity Growth’. Research teams conducted the field work in ten countries in Africa and Asia, including Kenya, Tanzania, Vietnam, Ethiopia, Uganda, Ghana, South Africa, India, Indonesia and Bangladesh. Various academic institutions and World Bank offices in these countries were actively engaged as partners in the research.

A key feature of the project is the combined quantitative and qualitative research approaches involving enterprise surveys, randomised control trials (RCTs) and case studies. The collection of original data resulted in a series of scientific papers, reports, policy briefs and open-access databases. The research output is targeted at academics in development research as well as at innovation policy makers within governments, businesses and development agencies, with a view to valorising research outcomes and promoting evidence-based policy making.

The research was structured around the following set of research questions, initially formulated by DFID to frame the research:

- What firm-level and regional-level factors hinder or foster the engagement of firms in innovative activities and commercialise the outcomes of their innovative activities?
- What is the impact of in-house innovation activities versus collaborative innovative activities or technology acquisition activities on the innovative performance of firms in developing countries?
- What is the role of economic spillovers within clusters of firms in fostering economic growth and innovation?
- What are the most critical barriers to the process of innovation and the diffusion of technology?
- What types of links between the public/private sectors, universities, governments, NGOs and the private sector are most conducive to innovation activity?
- What is the role of demand side versus supply side policies?

In the course of the project implementation, new research questions emerged. Both original and emerged research questions were addressed in the various scientific outputs.

This ‘Tanzania Country Report’ presents an overview of the scientific output and policy implications relating to Tanzania. The scientific output comprises a qualitative research report, four papers within the ‘Innovation Systems’ theme, and four papers within the ‘Finance and Productivity Growth’ theme. There are more papers that involve multi-country data, from Tanzania amongst others, downloadable on the project website. In Annex 1 a comprehensive list of all research working papers written in the framework of EIP-LIC is presented. The key DFID/World Bank survey findings for Tanzania are presented in Annex 2 and the research addressing the original DFID questions is presented in Annex 3.
Qualitative research

The qualitative report is based on data collected through open semi-structured interviews with owners and managers of SMEs in Dar es Salaam and the surrounding area. The qualitative report provides context to the other research activities to validate, compare and complement existing theory in literature and research design and hypothesis development with contemporary bottom-up realities on the ground in Tanzania, as perceived by manufacturing SME owners and managers. Specifically, the case descriptions illustrate the different ways in which companies in Tanzania introduce new products, processes, technology, or machinery.

Although the innovation in the Tanzanian cases is not ‘new to the world’ high tech innovation, but mostly incremental technology adoption, it is still critical for the firms’ survival and growth. The interviewed owners and managers innovate step-by-step to see what works and what does not. They mention that the skills and knowledge gained through formal education do not match the company’s requirements. No formal support from innovation systems institutions was received in their efforts to innovate. In fact, most owners indicated that formal government institutions, represented by government officials, make their business environment even more challenging.

Innovation systems

The first scientific paper within the ‘Innovation System’ theme discusses effects of knowledge sources on firm level innovation in Tanzania. Researchers from Dar es Salaam and Radboud University Nijmegen investigated knowledge sources and their relevance for innovation. The main finding of the research is that the impact of internal knowledge on product innovation is greater than the impact of external knowledge. The main source of internal knowledge in Tanzanian firms is firm spending on internal research and development. The purchase of equipment, machinery or software is the main external source of knowledge. Furthermore, the development of an internal knowledge base is better undertaken by investing in internal research and development than by acquiring external business and codified knowledge. The sector and age of the firm are differentiating factors: external knowledge acquisition and firm spending on internal research and development facilitates product innovation more effectively for older firms and firms in the services sector than for relatively younger firms. Policies and programmes should focus on developing an internal knowledge base – thus absorptive capacity – as a priority for the optimal use of internal and external knowledge. In addition, it helps to raising awareness or offering management training that emphasises the importance of developing an internal knowledge base and formalising an explicit internal R&D strategy and capacity.

The second scientific paper within the ‘Innovation System’ theme investigates factors affecting engagement and commercialization of innovation activities in Tanzania. The research focused on the relative importance of firm, innovation, and environmental level factors for commercialization and how innovation is linked with commercialization. The team found that several firm-level factors influence a firm’s chances of undertaking product innovation, particularly the availability of equipment, machinery or software and intangible technology. The research shows that the availability of equipment is a critical factor in engaging in innovation activities in Tanzanian SMEs (but this does not apply for commercialization). A similar outcome with regard to equipment is observed in the complementary qualitative research part of the DFID project. The access to technology is perceived as an important limitation, which hampers SMEs to innovate. In fact, locally produced technology is hardly available and of insufficient quality, while imported technology too expensive. Policy interventions geared towards encouraging innovative firms to simultaneously develop marketing strategies are likely to
enhance commercialization of innovations by enabling innovative firms to adapt to changing markets and technologies. The research further shows that product innovation and commercialization are promoted through the enhancement of firm efficiency and internal knowledge base. Policy instruments could thereby focus on improving firm efficiency and building internal knowledge base of firms. Awareness raising, business registration requirements and training could specifically focus on these internal capabilities.

The third paper analyses the relationship between gender diversity and innovation output of firms. The research shows that gender diversity at all levels in the organisation has a positive effect on innovation. Furthermore, the research illustrates that a country’s level of economic opportunity for women plays an important role in the relationship between gender diversity and innovation. Policy makers must acknowledge the value of gender diversity for innovation and create awareness among managers and employees that innovation emerges and blossoms from gender diversity at the firm level. Government agencies could develop special policies and programmes which encourage and support firms to hire a more gender-balanced workforce, secure more female top managers, and develop a gender diverse ownership structure. This could take the form of awareness raising programmes explaining the particular benefit of gender diversity for a firm’s likelihood to innovate. Furthermore, the introduction of tax advantages, subsidies or other incentives targeted at increased gender diversity at all hierarchical levels within a firm could be a driver for increased gender balance. An additional avenue for policy makers is to encourage a social perception of women as being equally valuable members of society, with the same rights and obligations as men.

The fourth scientific paper investigated the bi-directional relationship between innovation and exporting in four countries in Sub-Saharan Africa. The research finds that the relation between innovation and subsequent exporting is positive and significant. The other way around, there is a positive but non-significant relation between exporting and subsequent innovation. The research further indicates that market creation mediates the innovation-exporting relationship because the innovation process entails the introduction of new products and services to the marketplace. Moreover, customer feedback mediates the relation between exporting and innovation to a large extent. Innovation policies aimed at fostering product innovation by providing incentives may be crucial for exporting. Customer feedback mediates the exporting-innovation relation to a very large extent. Therefore, policies focusing on information and communications technology infrastructure investment are vital in enabling faster response to market needs. Additionally, export promotion policies encompassing instruments such as export subsidies are likely to play a key role in stimulating innovation.

*Finance for productivity growth*

The first paper within the 'Finance for Productivity Growth' theme investigates entrepreneurial saving practices and business investment in Tanzania. The study explored how different entrepreneurial saving practices (i.e. saving via formal financial institutions, individually (under the mattress), within the household or within informal arrangements, such as ROSCAs) are related with the likelihood of reinvestment. The team used a novel survey data set collected from MSEs in Tanzania and distinguished multiple saving practices of entrepreneurs as well their earnings retention behaviour. The research shows that saving and the probability of reinvestment are significantly correlated. There is evidence that entrepreneurs who save by giving funds to other household members are less likely to reinvest than formal savers. The difference in the likelihood of reinvestment is significantly higher for those entrepreneurs who potentially have low bargaining power in the household and who are survival type entrepreneurs.
The results have important policy implications for the interactions between enterprise performance and financial access as well. Enterprises that exploit reinvestment opportunities are expected to be more likely to sustain higher productivity levels and survive more often. Access to efficient saving mechanisms in this respect could be key to facilitate enterprise performance in financially developing societies. The research raises also some new issues regarding the implications of savings practices of entrepreneurs. First, why do savers inside households not open a bank account to save? Although the research implicitly shows proximity to banks as an important factor to save in a formal account, identification of all factors is not in the scope of this study. Second, what is the exact role of pressure inside the household that does not allow earnings retention?

The second scientific paper within the ‘Finance for Productivity Growth’ theme, based on the field experiment, investigates the determinants of - and the barriers to - the adoption of a profitable financial technology by SMEs in Kenya, a country comparable to Tanzania in terms of institutional context and mobile phone technology adoption. Specifically, the study involves a field experiment focusing on the adoption of mobile-money as a payment technology by restaurants and pharmacies in Nairobi. The field experiment studied the factors that foster adoption of mobile money technologies by SMEs, and the barriers to its adoption. The research team offered a randomly selected sample of restaurants and pharmacies the opportunity to sign up for mobile-money technology which allows efficient mobile-money based transactions between a business and a customer. The study found that over 60% of restaurant owners/managers signed up for the new technology, whereas adoption rates were about 20% among pharmacies.

The research suggests that policies and programmes to promote new technology adoption could be best designed by addressing (situational) barriers, particularly bureaucratic barriers and lack of information. A government programme providing free mobile technology, a relatively low-cost intervention, would bring substantial commercial benefits for SMEs. Moreover, such an intervention would repay itself in terms of increased taxation revenues. Providing free technology might also result in a ‘tipping point’ being reached, when non-adopting SMEs switch to the mobile technology because it has become common practice. This would also moderate the effect of the status quo bias. Along with providing free technology, an additional policy recommendation is to reduce bureaucracy, particularly the application procedures for mobile banking accounts. These could be offered through a one-stop shop with flexible guarantee requirements, for instance as a package with a trial period. The problem of lack of information can be addressed effectively once the application bureaucracy is eased, through information campaigns to reach out and assist SME owners to apply for mobile banking accounts.

The third scientific paper within the ‘Finance for Productivity Growth’ theme investigates the relationship between bank credit and trade credit in Ethiopia: whether usage of trade credit decreases with access to bank credit, or whether the use of trade credit and bank credit are positively associated. The paper is relevant because trade credit is a common way for business finance in Tanzania too. The findings suggest that bank finance and trade credit are substitutes in Ethiopia. In locations with lesser access to formal bank finance, the use of trade credit is higher. The extension of trade credit by suppliers generates a credible signal to banks with regard to the customers’ creditworthiness, which can make trade credit and bank credit complementary on the individual firm-level. For informal retailers, bank credit acts as a counterpart to trade credit in the sense that higher bank loan exposure is associated with greater access to trade credit. For formal firms, however, the research reveals that having more bank loans is not a significant explanatory factor of the use of trade credit.
Financial inclusion has been a key topic in development policy debates in many underdeveloped countries, but most policy initiatives address the direct effect of bank credit constraints. This research stresses the importance of the role of informality in understanding the association between trade credit and bank credit. Facilitating trade credit and bank credit could mutually strengthen each other, for instance, in combined policy and development programmes integrating the two. Policies to expand financial inclusion by increasing operational transparency might alleviate the agency problems of informal enterprises vis-à-vis suppliers and enable them to obtain not only formal finance from banks but also informal finance in the form of trade credit.

The fourth scientific paper within the ‘Finance for Productivity Growth’ theme investigates interactions between access to finance and employment creation for educated workers in Uganda, a country comparable to Tanzania in terms of labour force characteristics. The research shows that the extent to which micro and small businesses expand skilled employment, as their sales and profits increase, depends significantly on access to external funding. Firms with positive performance and a bank loan will hire more trained and experienced employees. Thus, growing and profitable small businesses create more jobs for trained and experienced workers - which is interpreted as demand for skill - if they have access to external finance. The analysis does not reveal a significant relationship in the case of hiring casual employees or family and friends in the informal context, suggesting that financing constraints are more likely to bind in the context of employment contracts associated with experienced and trained employees with high human capital intensity.

Regarding policy, the research findings underline the importance of well-developed financial systems for policies focusing on job creation. Firms with greater financial flexibility are more likely to hire skilled labour once their performance improves. For policy makers focusing on the challenge of creating formal and permanent jobs in a developing society, devising a complementary financial sector policy is equally important. The policy should go beyond helping firms directly to strengthening efficient financial systems and credit programmes as well. Better access to external funding can thus be an accelerator of human capital investment demand and growth. Policy makers must also acknowledge that firms which are financially constrained save a greater proportion of their additional profits (or pay other expenses associated with financial constraints) and therefore cannot invest further in greater levels of employment. If access to finance is difficult, one could question the optimal effectiveness of employment creation policies. For government, interest rates by state banks would be a first point of attention in policy efforts to create formal employment of higher skilled labour. Against this background, policy monitoring systems for employment creation could include the degree of access to finance. Looking at it from the other side, formal credit policies and programmes could include formal job creation, since the two are linked.

**Highlights of DFID/World Bank EIP-LIC survey Tanzania**

Annex 2 provides the context of innovation in Tanzania by describing the main features of innovation data collected from 543 firms by the Enterprise Survey 2013, Innovation Follow-up Survey which revisited firms already interviewed during the Enterprise Survey to collect firms-level data on innovation and innovation-related activities. The Innovation Follow-up Survey collects data on product innovation, process innovation, organizational innovation, and marketing innovation in emerging and developing countries and thus provides evidence on the nature, role and determinants of innovation in Tanzania.
The Tanzania Innovation Follow-up Survey was administered to a subset of Enterprise Survey respondents randomly selected to get a final sample of 75% of the original Enterprise Survey. A total of 543 successful interviews were performed with 103 firms refusing to participate in the survey. Business owners and top managers were interviewed from October 2013 through February 2014.

The research analysed innovation in Tanzania by focusing on two issues; effects of knowledge sources on firm level innovation and engagement and commercialization of innovation activities of firms with the aim of examining the impact of different sources of knowledge on product and process innovation and the commercialization of innovation in Tanzania.

Research and policy dissemination

Based on the research outcomes, EIP-LIC produced series of policy briefs on promoting innovation in manufacturing SMEs in LICs, targeted at a broad audience of policy makers. Innovation policy makers are usually understood to be government officials and staff within various ministries (S&T, industrialization, higher education and economic planning). However, innovation policies and strategies are equally designed and implemented by managers, business owners and branch organizations in the private sector. Likewise, development agencies, donors and NGOs also consider and integrate (inclusive) innovation policies in their programs and projects. All these actors mutually interact and could be enrolled in networks that promote and enable innovation in manufacturing SMEs in LICs. It is envisaged that all these various stakeholders will make use of the EIP-LIC policy output.

The research output is accessible at the project website www.tilburguniversity.edu/dfid-innovation-and-growth. The output includes the academic reports and papers, the open access databases, a series of policy briefs and videos illustrating some key research findings and policy messages.
1 Introduction

The promotion of innovation in Low Income Countries (LICs) and emerging economies has recently appeared on the agenda of policy-makers and international development agencies. Many agree that innovation is crucial in these countries, because it is fundamental for growth in order to catch up with middle and high income economies (Chaminade et al., 2010). Current research, theory development and policy formulation to promote innovation, however, have mainly focused on innovation in the more advanced economies, whilst investigation of these issues in low income countries to date has been limited.

The 5-year research project ‘Enabling Productivity and Innovation in Low Income Countries (EIP-LIC),’ funded by the British Department for International Development (DFID) and commissioned to Tilburg University and Radboud University, aims to fill research gaps on innovation in LICs from an economic perspective. EIP-LIC aims to deliver robust high quality evidence from Africa and Asia on how to increase innovation and raise productivity in manufacturing SMEs, through a coordinated set of thematic and country case studies providing internationally comparable data. The research has been organized within two thematic areas: ‘Innovation System’ and ‘Finance for Productivity Growth’. The countries of study include Kenya, Tanzania, South Africa, Ghana, Ethiopia, Uganda, Vietnam, Indonesia, India and Bangladesh.

EIP-LIC focuses on manufacturing Small and Medium-sized Enterprises (SMEs) in LICs. Promoting innovation in these enterprises has a particularly positive impact on development (Szirmai et al., 2011): SMEs are usually operating on the boundary of the formal and informal sector and have low levels of productivity and competitiveness. Compared to the agriculture and services sectors, manufacturing in LICs is typically characterised by a limited share of the total GDP. Innovation within SMEs in manufacturing enables these enterprises to raise productivity and grow, resulting in a better-balanced economic structure while generating employment opportunities for poorer groups and contributing to poverty reduction. Moreover, promoting innovation in domestic manufacturing is a way towards import substitution and increases the competitive (export) position of firms on the world market.

The project collected primary data via enterprise surveys in collaboration with the World Bank, conducted randomized control trials (RCTs) and carried out qualitative case studies in all countries of study leading to a series of research papers and articles published in top journals and policy briefs. All written output is available at the project website: www.tilburguniversity.edu/dfid-innovation-and-growth

This ‘Tanzania Country Report’ presents a summary of the key findings of EIP-LIC research of Tanzania and the associated policy implications. Chapter 2 sets out the overall project approach of EIP-LIC. In chapter 3, the report introduces the SME manufacturing sector by providing some key finding and context of the qualitative study. Chapter 4 presents summaries of four research papers and policy implications developed within the ‘Innovation Systems’ theme. Chapter 5 present presents summaries of four research papers and policy implications developed within the ‘Finance for Productivity Growth’ theme. The policy implications in chapter 3, 4 and 5 are intended for government agencies, donors, NGOs, branch organization or others to could take into consideration in their efforts to promote innovation in manufacturing SMEs in Tanzania. Annex 2 and 3 present the key survey findings as well as the data addressing the research question articulated by DFID in the original project proposal.
2 Project approach and methodology

In 2012, DFID identified the need for research in this field, and set the terms of reference for project proposals. Tilburg University’s successful proposal focused on an overall goal to contribute to innovation and growth and raise productivity in low income countries (LICs), leading to job creation and poverty reduction. The project aims to strengthen evidence-based policy making on innovation and productivity issues in developing countries. At the direct operational and output level, its framework comprises three areas of activity:

1. Research: open-access datasets and written research output (working papers, submitted articles and reports) on productivity and innovation applicable to developing countries.
2. Policy and research uptake materials and dissemination.
3. Capacity development, to train and engage researchers in developing countries in policy relevant innovation research. The project includes a capacity building component including PhD seminars on research methods applied in the DFID project.

The approaches and methodologies involved in ‘Research’ and ‘Policy and Research Uptake’ are further described in paragraphs 2.1 and 2.2 respectively. The capacity development component was of lesser importance in the project and is not discussed in this report.

Project organisation

In terms of organisation and implementation, Tilburg University is the lead partner of the project, with Radboud University Nijmegen (RUN) the main Dutch project partner. Within these universities, teams of researchers were formed to prepare and manage the data collection and develop the academic output. In every country of study, the research teams concluded cooperation agreements with academic partners for joint implementation of fieldwork, data analysis, and paper and report writing. This cooperation also incorporated research uptake and policy activities, involving interactions and stakeholder meetings with policy makers within government, donors, NGOs and SME owners/managers. With regard to capacity development, the Dutch project partners organised research methodology seminars for local academic staff and students, in collaboration with their partners in the countries of study.

Partnerships were formed with the University of Nairobi (Kenya), University of Pretoria (South Africa), University of Dar es Salaam (Tanzania), University of Ghana, National Economics University Hanoi (Vietnam), University Indonesia, Ahmedabad University (India), Chittagong Independent University (Bangladesh), and Makerere University (Uganda). A cooperation agreement was concluded with the World Bank for quantitative data collection in the 10 countries of study. For randomised control trials within the ‘Finance for Productivity Growth’ research theme, a collaborative agreement was concluded with The Abdul Latif Jameel Poverty Action Lab (J-PAL) in Jakarta, Innovation for Poverty Action (IPA) in Accra and the National Board for Small Scale Industries (NBSSI) in Ghana, amongst others.

2.1 Research

The first output area of EIP-LIC focuses on the development of high quality research output, data and academic papers, examining ways to increase innovation in manufacturing SMEs in LICs. In particular, the research teams addressed internal capabilities and external institutional factors, institutions and policies that support or hinder the diffusion and adoption of innovation and finance raising productivity.
The research implementation was organised within two thematic areas: ‘Innovation Systems’ and ‘Finance for Productivity Growth’.

The written output of the research is systematically organised in a repository accessible via the ‘Publications and Reports’ menu on the project website. The repository is integrated into the overall Tilburg University repository, established and maintained by its library. In addition, three types of open access datasets are produced: (i) qualitative datasets, (ii) quantitative datasets under the ‘Innovation Systems’ theme, and (iii) randomised control trial (RCT) quantitative datasets under the ‘Finance for Productivity Growth’ theme. These are also accessible via the project website.

**Research methodology challenges: combined qualitative – quantitative approach**

Overall, the project involved a combined qualitative-quantitative research methodology, including qualitative explorations in each country of study into policy and research issues, and quantitative data collected through large scale surveys and RCTs. In the quantitative component, the project took an ‘economics’ perspective on innovation, and involved econometric analysis of a set of variables concerning barriers at firm, regional and national levels and their causalities with the innovative behaviour/capability of entrepreneurs and subsequently innovation and productivity. This constitutes a reductionist and deductive approach in defining variables for analysis, in which the impact of individual factors on innovation is assessed by applying quantitative econometric methods. The quantitative analysis served as a basis for identifying relationships between internal capabilities, external institutional factors and finance on the one hand and innovativeness and productivity growth on the other.

Applying quantitative methods in development research brought some limitations and challenges. In EIP-LIC, conceptual issues emerged, in terms of the definition and measurement of innovation and productivity in LICs. These may seem straightforward variables at first glance, but their measurement can be more complicated in the LIC context. Innovation may be manifested differently, not via high profile technological and radical breakthroughs, usually measured by R&D expenditures or patents (OECD, 2005), but by more incremental adoption and adaptation or new combinations of existing technologies (Szirmai et al., 2011). These forms of innovation are equally important for raising the productivity and competitiveness of SMEs in LICs.

Moreover, innovation research and theory development in recent decades have typically involved empirical material from advanced economies, such as the innovation systems literature of Lundvall (1992) and Freeman (1987), where innovation takes place within a relatively stable institutional and Science, Technology and Innovation (STI) policy context, ‘controlled’ and supported by established innovation system actors and innovation policies. In LICs, however, the contemporary institutional realities and formal/informal dual economic contexts are different and may involve other less visible or less commonly known factors and policies around SMEs affecting their innovativeness and how innovation manifests itself.

Therefore, the theory and associated policies of how innovation evolves within an innovation system in the institutional contexts in LICs may be different, which is increasingly acknowledged in recent innovation systems literature (Lundvall, 2009; World Bank, 2010). For instance, entrepreneurs are innovating by Doing, Using and Interacting (DUI) in fast-changing contexts, enabled by informal institutions and informal (social) learning. Applying the research variables on innovation and productivity in LICs from existing literature and theory (deduction) based on advanced economies, therefore, might not take all relevant variables into account. A more precise identification of variables
might be obtained by complementing the selection with a broader understanding of contemporary realities and context on the ground in LICs.

**Qualitative studies**

In an effort to manage these challenges, EIP-LIC included a complementary qualitative research component, involving an exploration and description of contemporary realities of innovation in manufacturing SMEs in LICs and emerging economies. This sought to inductively identify actual and relevant research and policy issues as input for the EIP-LIC research themes as well as for additional explanatory evidence supporting research outputs. This material could help researchers to validate, compare and complement existing theory in literature and research design and hypothesis development with contemporary bottom-up realities on the ground, as perceived by manufacturing SME owners and managers.

In operational terms, Tilburg University and partners conducted a series of case studies of manufacturing SMEs in each of the 10 countries of study in the project. The holistic case study approach and method involved interviews capturing original insights, views and perceptions of SME owners and managers. A similar report format and comparable data was used for all countries of study in EIP-LIC, enabling cross-country comparison to identify overall trends and patterns in innovation and productivity policy and research issues in manufacturing SMEs in LICs. The qualitative research findings for Tanzania are presented in chapter 3.

In each of the 10 countries of study, 15-20 semi-structured interviews were held with owners and managers of SMEs in manufacturing, textiles, metal processing, food processing etc. The interviews discussed types of innovation, the firm’s history, its innovation processes, internal capabilities, and the external business and institutional context. The owners and managers also shared their stories outside this framework and advanced issues that are relevant and interesting for current scientific work. 170 interviews in total were recorded, transcribed and stored in a qualitative research database. The concluding qualitative reports of all 10 African and Asian countries of study are downloadable from the project website. Chapter 3 provides some key insights from the qualitative study in Tanzania.

In line with DFID’s policy, the original intention was to publish the qualitative database as an open access resource via the project website. However, in contrast to the numerical data, the qualitative data contained some confidential information that owners and managers might not wish to have in the public domain. This ethical consideration means that the interviews and transcripts are not freely available on open access, but may still be used subject to a strict confidentiality agreement, in consultation with Tilburg University.

**Innovation systems research**

The ‘Innovation Systems’ theme focused on understanding innovation in the manufacturing sector in LICs, its processes and critical factors hindering or stimulating its diffusion, including innovation policies and governmental institutions. The research involves the quantitative analysis of a set of variables concerning barriers at firm, regional and national levels and their causalities with the innovation capacity of firms. SMEs in manufacturing find it harder to survive than large firms, which are typically more productive and more likely to innovate in the long term, securing employment and economic growth. Regional conditions and infrastructures differentially affect levels of innovation and technological and industrial development in developing countries.
The ‘Innovation Systems’ team obtained data in close cooperation with The World Bank, particularly focusing on the World Bank Enterprise Survey (ES) and the Innovation Capabilities Survey (ICS). The ES is an ongoing project covering over 155,000 firms in 148 countries, collecting data based on firms’ experiences and enterprises’ perception of the business environment and investment climate. The whole population of the ES data is the non-agricultural economy, comprising firms from the manufacturing, construction, services, transport, storage, and communication sectors.

The ICS is a follow-up and complementary to the ES, comprising a randomly selected subset of respondents from the ES sample. It focuses on the innovative activities and capabilities of manufacturing firms, and is a collaboration between the World Bank, Tilburg University and Radboud University Nijmegen, funded by DFID through EIP-LIC.

The primary and secondary data enabled the ‘Innovation Systems’ researchers to produce a series of working papers downloadable from the project website. The titles and full details of the papers are listed in Annex … The data are available on open access for other researchers at the project website. All working papers have been submitted to high quality journals, with some published and some still under review at the time of writing this report. The primary and secondary data also enabled the team to address the original DFID research questions underlying EIP-LIC, which are presented in chapters 4 and 5.

**Finance for productivity growth**

The ‘Finance for Productivity Growth’ theme focuses on understanding the effects of access to finance in determining the productivity of SMEs and how constraints to investment finance influence growth. The team identified interactions between firm-level characteristics, such as entrepreneurial traits, country-level factors (such as industrial structure, institutional framework etc.) and access to finance.

Contrary to the research approach within the ‘Innovation Systems’ theme, the finance team conducted four extensive RCTs in Vietnam, Ghana, Indonesia and Kenya. The interventions and associated baseline and endline data collection were implemented with local partners including the Abdul Latif Jameel Poverty Action Lab (J-PAL) in Jakarta and Innovation for Poverty Action (IPA) in Accra as well as the National Board for Small Scale Industries (NBSSI) in Ghana. A series of academic papers has been developed from this, listed in Annex 1. The dataset for each country, combining the listing, baseline and endline data, will become available on the project website for future research and follow-up RCTS or endlines.

**2.2 Policy and research uptake**

In following up on the research of EIP-LIC, the dissemination and uptake of the research evidence is essential to justify the value for money of the project. The underlying principle of the project’s engagement with potential users is to ensure that the research insights in the published output are useful, accessible, actively disseminated and communicated in a way that enables potential users to engage and make use of the research information in their own work (research valorisation). There are four target groups of potential users of the EIP-LIC research outcomes:

- Local policy makers of governmental agencies, international donors and development agencies and NGOs, who may gain new insights into promoting innovation and productivity growth in the manufacturing sector.
- SMEs owners and SME branch organisations, who may learn from the management implications of the research.
- Researchers within the academic development research community, for whom the research outcomes serve as a source of ideas and reference to develop their own research questions and methods.
- The general public worldwide interested in development and poverty alleviation issues. The dissemination will inform the public about DFID’s innovation and growth approach to alleviating poverty.

Policy and research uptake strategies

The project includes several strategies to interact with potential users. At the project start, the partners organised a series of innovation policy stakeholder meetings in Kenya, Tanzania, South Africa, Vietnam, Ghana, Indonesia, India and Uganda. Policy makers from government agencies, donors, NGOs and SME owners and managers discussed the relevance of innovation and identified policy and research issues. These issues were then followed up in the qualitative research component of the project.

A further dissemination mechanism has been the production of a series of EIP-LIC policy briefs in which the findings and implications for policy of the academic papers are discussed. Each policy brief is typically a 2-page presentation of key findings, practical suggestions and implications, accessible via the project website.

The final collection of all research outputs is concluded in a series of country reports, which draw together all the research findings for each country and are an important vehicle to disseminate the policy messages. The last chapter of the report includes and elaborates on the country-specific policy recommendations.

Lastly, three short videos were produced, focusing on key research findings and policy messages, using high quality footage filmed in Accra, Nairobi and Kampala. The videos present a policy theme illustrated by interviews with several SME owners and managers, tell the entrepreneurs’ story, provide an idea of the realities they face on the ground, and show the resilience of the SME owners. They provide policy makers with a sense of the difficulties of the local context, and suggest policy solutions from the DFID research findings.
3 Qualitative study in Tanzania

3.1 Case study method

The objective of the qualitative study of EIP-LIC is to identify relevant policy and research issues concerning innovation in manufacturing SMEs within contemporary realities in Tanzania. Applying a case study approach is particularly useful in this respect, since this method is an approach for inductively exploring and identifying concepts, noticeable similarities, trends and patterns of socio-economic phenomena (Yin, 2003).

The case study research in Tanzania involves a series of 12 in-depth interviews with managers and/or owners of manufacturing SME in Nairobi and around. The qualitative data collection through interviews took place from 21 to 31 October 2015. The number of interviews may seem a limited number to justify research validity. However, the approach usually involves in-depth rich and detailed descriptions and a multidimensional analysis of the complexities and linkages of a few cases to gain an understanding of the (socio-economic) mechanisms and processes of the case subject. In the case descriptions, innovation as an economic phenomenon is the case ‘subject’, whereas the unit of analysis is a manufacturing SME. The case description holistically explores the type and basic features of innovation within the SME, and reviews the impact on productivity and competitiveness over the past 2 to 5 years.

The data for the case descriptions are obtained via ‘semi-structured’ interviews with SME owners and managers. Of particular interest is what innovation means in the manufacturing SMEs in their context, and the less known favourable and unfavourable institutional conditions and barriers enabling or preventing it.

The selection criteria are defined in such a way that the selected cases represent the EIP-LIC target group: manufacturing SMEs understood as a company with 10-100 employees. Moreover, the criteria assure a certain homogeneity within the selected cases, which will enable comparison of cases while supporting a certain validity of the identified trends or patterns. At the same time, allowing some heterogeneity, by including deviant cases, provides more contrast, and thus enables the research team to better construct and highlight divisions in the innovation process, linkages, system or mechanisms.

An essential element of the selection is the notion that types of SME innovation in LICs are not confined to technological (radical) inventions resulting from particular R&D investments and efforts. Innovation in manufacturing SMEs in LICs more often encompasses incremental adoption and adaptation or new combinations of existing technologies, products, marketing, management or business practices. Moreover, innovation often does not concern one type only. More often, an initial innovation enables and/or triggers other types of innovation within a firm; a new technology allows the introduction of new products, for instance.

From the eight cases in the comprehensive qualitative report of Tanzania, accessible via the project website, we present three cases below to provide some insight on the daily realities of SMEs in manufacturing.
3.2 Selected cases

Case 1: Agriculture products processing – animal feed (20 employees)

The first case is a manufacturing company producing animal feeds for poultry, pigs, dairy cattle and horses. The two owners started their business 7 years ago as a small venture. Initially, they only traded agricultural raw materials as animal feed. They purchased maize and sunflower cake from farmers around Dar es Salaam. Shortly after starting their business, some customers asked for mixed animal feed. The owners quickly understood that grinding and mixing raw material meant a higher selling price – “when you mix you can get more money.” They started to manufacture animal feed.

The owners first bought a locally produced grinding and mixing machine. They took out a small loan from an SME bank as investment money. The bank loan was difficult to secure – “the main problem in getting loans is having collateral. How many people have collateral?” They did have some collateral, but not enough for the amount they requested. The owners experienced an increasing demand for high quality mix feed – “when we started to process the raw material, the customers kept on coming.” This made them confident about the market opportunities, which justified their investment in the machines.

The owners mix the feeds according to special formulas, mostly developed by themselves. Sometimes customers come with requests for certain types of feed and bring their formula and raw materials. The company has its own brand name, which is printed on the animal feed bags. The company currently has 5 fixed wage earners (workers) in the workshop and another 15 temporary workers, who in fact are quite regular. On average, 20 people work in the company.

The company’s market is in Dar es Salaam and some coastal regions such as Morogoro, Tanga and Kirua. The company has a network of 40 local agents for the marketing and delivery of products. They sell the feed to individual clients, mostly livestock farmers. Most orders come in via these agents. The company has small delivery trucks. The company also sells occasionally to individual clients at their production site in Dar es Salaam. The owners and a marketer also travel by motorcycle looking for new customers and contact potential customers by phone every day – “we are trying to cover everywhere, but we are few in number.”

Before starting this company, one of the owners worked in the animal feed industry at an international level, exporting raw materials to Dubai. This knowledge and experience in identifying market opportunities and satisfying customer demands helps the firm today – “we are sure about the demand in Tanzania and we know the market.” As a veterinary professional, he gained the knowledge and skills required for the animal feed formulas. Formulas are available in books and, with some assistance from an expert, he develops his own formulas to produce feeds with raw material available at the local market.

Only the owners know the details of the formula. The production workers have some familiarity with it, but do not know the compositions in detail. The owners are not really worried that their workers might take the formulas to other competing companies, because the formulas are only one factor in producing high quality feed. The quality of the available input material changes a lot – “so one has to be creative and understand everything behind it.”

The owners underline that quality is a key factor in their business. Animals need a balanced diet, which is critical to their growth. If the company does not carry out proper quality monitoring, then the feeds
will be of lower quality – “we are working in a competitive market, so if you produce low quality feeds then the customers will disappear immediately.” In order to stay in this market, it is all about quality, the owners say – “people don’t care about price, what they care about is quality.”

They have collected a large amount of information about formulas and nutrient contents in raw materials (protein, energy, fibre, vitamins and minerals). Moreover, having been in business for some time, they know what raw input materials are available at the local market, such as fish meal, sunflower, cotton cake, soya meal, corn and rice meal. If there is demand for a particular type of feed, they develop a formula and source the raw materials required.

For the nutrient testing of the input and final product, they bring a sample to a government laboratory in Dar es Salaam. For the owners, this quality monitoring is “not for a government purpose, but for us.” Testing the raw input materials is essential because the nutrient levels found in local raw materials available in Dar es Salaam differ from universally recognised levels. The owners find it difficult to get good local input materials. Once they have the required input, they produce the feed and test the final product again. They change immediately if necessary, before customers complain. In this way, they maintain a good relationship with the customers.

They also test new feeds, in cooperation with the farmers. They provide the feed and observe closely how the animals respond. Sometimes growth is not as expected. In particular in poultry (broiler and eggs), they observe farms every day and assess the colour, quantity and size of the eggs – “if anything happens, maybe the eggs are very small, we add some protein, if maybe the shells are very weak, we put some limestone and some bone meal.” They know that other competitors also visit the farms and do similar ‘after sales’ services.

One recent new development is adding enzymes to their feeds. The enzymes help chickens to digest faster and more efficiently. Apparently, raw materials like sunflower cake cannot be digested easily unless some enzymes are added. They are the first animal feed manufacturer in Tanzania now experimenting with this and “it is safe; chickens can grow very fast using those enzymes.” The enzymes are sourced from the UK and India. An important advantage is that enzymes reduce feed costs for the farmer, because the conversion is efficient and reaches almost 90%, according to the owners – “this is what we are trying to do, to be different from other manufacturers in Tanzania.”

Precisely how the owners manage, add the enzymes and develop their formulas is secret, “because this information is power: if competitors know what you are doing, then they will copy and destroy you.” The owners follow closely what more advanced countries like South Africa, India, Japan and the US do in the field of animal feed manufacturing. The owners are constantly looking for new areas for improvement, such as ‘toxic binders’, which can remove toxin in feeds.

There are more competing animal feed manufacturers today than there were 7 years ago. Most new companies, including some big manufacturers, started 4 years ago – “that’s why previously we were dominating the market.” The bigger companies do not provide very good quality, according to the owners – “the bigger companies use poor input materials at a cheaper price.” Farmers are sometimes disappointed by the feeds of the bigger manufacturers because the quality fluctuates a lot – “one day the clients come to our company and the next day they go to the bigger competitors. This is one of the challenges.” It is difficult to retain customers.
Another problem is that farmers sometimes use good feed, but their farming practices and management are poor – “and they blame it on the feed.” In addition to good quality feed, management of livestock requires a good supply of water, a clean environment and no stress. Feeding procedures may also not be good – “some farmers underfeed the chickens.” The owners of the company also provide advice in this field and conduct outreach activities. The company vet and the sales team travel around Dar es Salaam and the coastal region (Morogoro and Tanga) to see how farmers are doing. They suggest management and farming practices as a side service.

The owners find the institutional business environment “very difficult” in Tanzania. There are many taxes, such as fire taxes, corporate taxes, and payments to the Tanzania Foods and Drugs Authority (TFDA), Tanzanian Bureau of Standards (TBS), Ministry of Agriculture and veterinary officers – “there are more than five people coming to collect different taxes. The problem is that everybody can come and ask for tax. And what are they doing in return for us?” The profit of the company is relatively small compared to the required tax payments. The owners see that the Tanzanian government has a poor policy framework and the regulations are difficult to follow – “in Tanzania, things are not organised, which makes doing business very complicated.” There is very little complete information available about taxes and the legal environment – “we are constantly surprised by someone passing by. Things come randomly.”

Recently, the Tanzania Revenue Authority (TRA) required the company to use the Electronic Fiscal Device (EFD) alongside its financial reports. This machine is designed for use in business for efficient management of sales analysis and stock control which conform to the legal requirements. “The TRA demands that we use the EFD machine and at the same time we have to provide financial reports. That is double work for us, serving no purpose.” The owners find the EFD quite limited and only useful for sales – “it can’t even show purchases, it can’t show costs, but you are forced to use it, and if you don’t use it, they fine you a penalty of five million on the spot.”

The company has contacts with a veterinary centre in Temeke, which is a research station of the Ministry of Agriculture – “if you have a problem, they say they can help, even your tests and everything.” The owners think that these officers have mostly theoretical knowledge and lack practical experience.

With regard to external relations, the company has a good relationship with a company in Pretoria (South Africa) via the International Grain Association (IGA). The chairman came one day to Dar es Salaam and helped the owners a lot – “sometimes after making our feeds, we send a sample to them and they give us good feedback.” The South African manufacturer does this analysis for free. This arrangement is a support project by EICO in America, which supports small enterprises involved in animal feed production all over the world. The project supports the company because some tests cannot be done in Tanzania – “if I want to test my product, I can test it in South Africa, but most of the time we test in Tanzania.”

The company is a member of the Tanzania Animal Feed Manufacturers Association (TAFMA), an independent association “lobbying within the government for better conditions to produce animal feed.” One recent discussion is the new challenge of increasing imports of chicken meat and eggs from Kenya and Europe, which “kills our animal raising market.” The cost of production of imported products is cheaper compared to Tanzanian producers. Many products are imported and sold at a lower price –
“consumers enjoy the lower price but the local manufacturers suffer.” The owners feel that the government needs to step in to help the poultry sector – “there are so many things which we have to settle and solve with the government.” Their problem is that the demand for animal feed will drop if the farmers do not produce. The owners are aware that opening up the market promotes competitiveness, but they say that it is impossible and unfair for local producers to compete with these big international companies. With TAFMA, they are trying to protect the market. Recently, McDonald’s has been trying to come in to Tanzania and sell fried imported chickens from Europe for a cheap price – “so we have to join together and stop this, because we are poor, really, our country is very poor.”

Case 2: Food processing – confectionery (70 employees)

The company manufactures bubble gum. The owner took over the business and brand name five years ago. At that time, the confectionery company belonged to larger manufacturing group owned by their business friends in Tanzania. The company was a small part of the group – “to them, the company was not making good profit, that’s why they decided to sale it off.” The owner considers himself an exception in the Pakistani community in Tanzania because “most Pakistanis, Indians and locals have shops and trade; they import and they sell.” The owner was previously a trader in confectionery items, which he imported from various part of the world. His past trading experience provided him with the trust and conviction to take over the manufacturing company – “we have reasonable experience in market. That convinced us to takeover this company.” Manufacturing confectionery and other stuff locally generates reasonable profit than import, because the import duties and freight charges are very high.

Because of his trading network, the owner experienced little difficulty in gaining market share when he started. He could sell the product at a lower price. Another main factor “is our quality, which is better than the imported products.” Sometimes the owner collects samples from local market to compare their quality with their competitors. He concludes that his locally produced bubble gum is cheaper and better comparing to imported goods. The company uses raw materials of high quality and more gum in its products.

The raw materials such as the glucose and the gum are imported from different countries, mostly from India and Pakistan. Only the sugar comes from Tanzania.

The company has a board of directors: 8 technical engineers from Pakistan, a marketing team of 10 and around 70 production workers. The workers come from the surrounding areas and also more distant places such as Mbagala. There is one foreign chief technician, who knows all the technical details of the production process. The company has engineers mostly from Pakistan. “because we face limited availability of skilled and qualified staff in Tanzania because of our product nature” The university graduates or engineers do not have the knowledge and skills that match the requirements of the company’s technology and machines – “for them it is new thing so they obvious need some time to understand y.” The owner has a contact in Pakistan and India who recruited the Pakistani and Indian
engineers. The expatriates (technicians) train Tanzanian workers to operate the production machines – “it takes time for them to learn but they are trying their best.”

Regarding sales and delivery of the products, the company has an office in the city center for their contacts and sales with customers. They arrange door-to-delivery from several depots in the country with their own trucks. The company occasionally sells to travelling buyers from Malawi, Congo, Zambia, Zimbabwe, but this is not a regular export business.

The bubble gum production machines were expensive investments for the company. The owner purchased the machines from Europe (Germany and Italy), as advised by Pakistani friends who live there. These friends visited machine producing factories and “saw and checked the machines. That’s how we decided.” The owner is not considering buying other machines in the near future – “we think the Tanzanian market for bubble gum is very small, so our production capacity is more than enough.” Regarding the technology, there is little to be gained by new machines, as he already has more or less the state-of-the-art technology in his company.

The company produces according to its capacity and the owner sets his own production plan – “when the production is ready, we receive orders and we deliver. So far we have been happy with the demand in the Tanzanian market.” The company has built a stock to assure delivery of two to three days. This stock avoids delivery problems. The owner sees that the business is doing well and considers the profit good.

Since the owner took over the company, he has tried to introduce new products. Eventually these turned out to be small changes in the shapes, colors, taste and the packaging in their confectionery items – “at the moment there is not much need or possibility to change the production.” The confectionery products and the production process basically remained the same. Regarding the packaging, the marketing department develops new designs and uses sporting events such as the world soccer championship or other popular themes to print on the packaging. An external contractor does the computer design for the packaging.

Recently, the owner decided to introduce candy (roll pops) as a new product, because he sees a market for it, which will enable the firm to grow. In the past, he imported roll pops from India and turkey, so he also knows the market for this product. The owner has already ordered a candy producing machine from India, which is currently being shipped to Tanzania. He is confident that the candy will sell through his existing marketing channels. For the time being, he is not planning to import or produce other products. The owner does not have enough space to enlarge his production for export. He has some space reserved for candy production in his existing company building.

The owner finds the business environment in Tanzania adequate. He has no complaints. Contrary to other manufacturing companies in Tanzania, his business is doing quite well. He thinks that because there are only few bubble gum manufacturers in Tanzania and some imports from China and India, the market is stable. He is happy with his business partners, whom he finds reliable, and with his clients, who pay on time.

The company does not depend on external support, because the owners are against interest – The owner found some business partners who were willing to invest, which provided sufficient funds.
The owner finds the government regulations quite normal and stable. The company has registered its brand as a trade mark with the Tanzanian Food and Drug Authority (TFDA) and makes efforts to comply with hygiene standards – “but the official supervision checks are not so strict.” The company does not receive technical advice from other organizations or technical institutions – “we solve technical problems ourselves.” Regarding government programs, sometimes the Ministry of Finance sends invitations for seminars on innovation, marketing and other business topics. The owner or other staffs often attend – “we listen and consider what the benefit is for us and we try to use or implement the ideas within our system.”

The electric power provided by the government remains an issue for the company. The price of electricity is very high, whereas its supply is not reliable. The company does not have a back-up generator. When there is a power cut, “we have to wait for the electricity to come back. It can take 5 hours some days.” Other than that, the owner considers the government of little importance for the success of his business – “we are a small company and never asked for any help.”

The company is in an industrial area, which the owner considers a good location. The industrial area provides the company with electric power, the port is close and there is a constant supply of water. The industrial area is also strategically located with regard to the main roads and other infrastructure. The premises have several larger manufacturing plants. The company land is rented, for instance.

Case 3: Leather products – shoe making (10 employees)

This small company produces shoes and some other leather products. It is located in a special business area, which is an incubator programme of the Small Industries Development Organisation (SIDO) programme. The business and technology incubator programme is a service centre that supports entrepreneurs to develop their business in a viable way by providing them with work premises, technical advice and access to information. The company joined the SIDO programme in 2010.

The owner received training in shoe making in Mombasa (Kenya), where he went for a 3-month course. Back in Tanzania, he received additional intensive training from a Canadian leather expert. Then he started his own business – “I decided to start this project together with my family and other friends who have helped me.” Since then, the company has produced school shoes, professional working shoes for industries, army boots and several types of sandals. The company employs 4 people and occasionally hires another 6 to handle larger orders. The owner prefers large orders, such as a recent example of up to 3000 pairs for a school in Dodoma– “it takes one and a half months to produce 3000 pairs.”

The owner decided to do leather and shoe making “because it is a good product. We have a lot of leather material in our country.” According to the owner, Tanzania is the first country in East Africa and the third in Africa for leather production. Before starting his business in 2010, the owner was struck by the fact that so many shoes were imported from China, which motivated him to start this business “because everybody should wear shoes from Tanzania.”

The owner aims at high quality and uses pure leather as the input product. The soles are bought from Kenya. The shoes are stitched and glued with a special machine, which assures the quality of the shoe – “you can wear the shoes for three years without any problem.” The owner does not have a trademark.
Sometimes competitors buy his shoes and try to reproduce them without success “because they do not have the special machine.”

To start up his business, the owner needed considerable capital to invest in the machines. During his training, he learned which machines were best and affordable to buy. For the initial investment, he did not get credit from a bank – “I found finance myself through relatives and friends.” The owner does not pay interest to his friends and family members who lent him the investment money. The owner mentions that the formal banking sector is very difficult in Tanzania because of the collateral requirements and the high interest rates of around 24% per year.

Moreover, the banks require that the interest be paid immediately, “even before your business matures.” Nowadays, his main concern is getting working capital, to buy the input material for his production upfront. One way the owner deals with this is to ask for half of the contract volume from a large-order client in advance.

His strategy to survive and to stay in business remains the high quality of shoes – “I am very happy to say I am doing well.” Quality is about the way the shoes are made, how materials are used, the way the sole is attached and how the machines are used. In fact, the owner sees that not many shoe manufacturers have the skills and machines to attach soles firmly, for instance – “that’s why our shoes are more durable. That’s why I survive better than others.”

The customers acknowledge the good quality. The company gets orders via schools, shops and the army sector. The owner only starts production after having received an order. Sometimes he sells small quantities to shops. The director does the marketing himself. He does not have a website, but he does attend promotional events to gain new clients – “we attend international trade fairs, where we display our shoes.” Another way of marketing is to visit large manufacturing companies directly. This also proved an effective way to secure orders. He prefers large orders from schools, the army or wholesalers.

The company is the only shoe making company in SIDO. The owner feels that the SIDO incubator programme provides little benefit in financial terms. The company has to pay rent at a normal rate. Being at SIDO does increase the credibility of the company to a great extent – “if you tell customers that we are in SIDO, then they trust us because it is a government programme. People think that products of SIDO are of good quality.” To join the programme and get a location at the SIDO premises, entrepreneurs have to apply and present their business idea. A key element in the owner’s business plan was to produce leather without using chemicals, including chrome, following the suggestion of an Italian advisor. This idea helped him to convince the SIDO board. A company may stay at the SIDO premises for 3 years, a period which can be extended by further application. An important condition of such an extension is that the business is profitable – “if SIDO finds out that your business is dying, then it is difficult to renew your contract.”
There is little potential for innovation in shoe making other than the designs, according to the owner – “the army boots are usually the same. Sometimes the army wants a different colour.” The owner uses existing designs for developing shoes, or copies ideas and patterns from others, like designs from imported shoes. The owner also draws the designs himself – “I think those designs are better for my business because they are different from others.” The owner designs with the assistance of two of his staff members. There are also customers, from the army for instance, who come and specify a desired design – “we sit down and make a few drawings of how we will do it.” Feedback is given on a couple of test pairs before the whole order is produced.

Regarding technological innovations, the owner plans to manufacture the soles himself, which he currently imports from Kenya. This will require him to import a special machine, which costs about 400,000 USD. There is an Indian sales representative in Tanzania, who is helping the owner to sort out the technical issues and providing advice on securing finance. However, the financial constraint remains challenging. To date, the owner has not been able to find the financial resources to buy it. He is also trying to see political leaders within the government, especially given the imminent general elections, to help him eventually get access to finance.

He hopes to purchase the machine soon because he is very confident about the market. He expects to earn sufficient profit to cover that investment. Once a machine is available to produce the sole in Tanzania, “you have a large market. Many people from Tanzania and out of Tanzania.” He has already calculated the potential of extending production for schools on a large scale, around 100,000 pairs per year, and further calculated that he would hire 300 workers. He has ideas and dreams of developing his small business into a larger industry – “My plan is to become the first firm producing soles in this country. The sole I have in mind is a light sole for ladies’ shoes; you will never buy Chinese shoes again.” The owner is also aware of the risk this plan entails.

The owner encourages his employees to work well. He provides them with a ‘good’ salary – “sometimes I help them too and pay half of their house rent on top of their salary.” The staff are motivated and provide ideas for the shoes too, such as shoes in the market they see. They take pictures and “tell me to take it because it is a good design.”

There are many customers and there is a market for the products. However, the main problem for developing the business is working capital for production. If production levels are low, the revenue will be used to cover daily operating costs, not for investment.

The business environment in Tanzania is very difficult, especially for manufacturing – “if you are not careful, you will fail.” There are quite a number of shoe producers in Dar es Salaam. There are also many imported shoes from China on the market. The owner knows that some friends who were in business stopped shoe making because of a lack of capital and the weak reputation of local manufacturing – “if you tell somebody this is a Tanzanian product, he will ask you so many questions.” The first impression of the Tanzanian consumers is that Tanzanian products are not good; imported
goods from India and China are considered to be better. Even government officials, according to the owner, think that it is not a good time for Tanzanians to go into industrial activities.

The owner is not aware of the innovation policy of the government – “nobody comes to us to tell us about policies or programmes to help small industries.” The government is at a distance, and its formal processes take a long time. He was at the Ministry of Industry to register his company when it was first established. He had to wait for long time and then discuss again at length with government officials to get it registered. Officials sometimes come to the company and inquire about the industry – “they ask questions about how the government can help. After they complete their interview, you never see them again.”

The owner sees the critical importance of developing the manufacturing sector in Tanzania. He has some reservations about how Tanzanian politics deals with it – “in Tanzania, we are rich in terms of raw materials. The problem is the manufacturing to transform raw materials into processed products.” In his view, the political leadership is not well organised and is not solving problems in the best way. The managing director hopes that if the leadership changes, those things will change as well – “the corruption should change and the tax burden is huge.”

The owner is not a member of a business association. He does not expect that such an association could help him in solving technical or business issues. For technical advice, once in a while he sees a friend who stayed in Italy for a long time and has expertise in shoe making – “he tells me to do this and not that.”

3.3 Research and policy issues

The interviewed owners and managers in the case descriptions in the qualitative studies, in different ways, introduced new products, processes and technology in order to improve and expand their business operations. Some would qualify as innovation, while others would not. In advanced economies, innovation is typically measured by R&D expenditures and number of patents (OECD, 2005). From this technology perspective, the Tanzanian cases would not qualify as innovation. Such an assessment would in any case have been impossible because the owners do not systematically record R&D expenditures and have not registered patents.

Taking a broader and economic perspective on innovation, viewing it in terms of incremental adoption and adaptation or of new combinations of existing technologies creating value (Szirmai et al., 2011), it is evident that the new elements introduced in the interviewed companies resulted in improved and expanded business operations. As described in emerging innovation theories on LICs, much innovation depends on an aggregation of small insights and advances through ‘learning by doing’ rather than on major technological inventions (Carayannis et al., 2003).

Despite increasing interest in the literature, the exact definition of innovation in LICs remains a problem in theory (Çapoğlu, 2009) and for its application by the researchers in EIP-LIC. The broadest possible definition of innovation, from an economic perspective, referred to in the qualitative research section, is everything new that the company does to raise productivity and/or to stay ahead of its competitors. For the analysis of the cases in this report, box 1 proposes several definition elements to assess innovation in an LIC context.
Box 1: Innovation newness, process and value creation

A cross analysis of definitions in innovation theory from recent decades (Voeten et al., 2011) shows that innovation is repeatedly typified by three key elements: newness, process and value creation.

Addressing the first element, Kotabe and Swan (1995) argue that innovation can be investigated in terms of both newness to the company and newness to the market or world.

Regarding the second element, the innovation process, all owners and managers themselves initiated, managed and owned the innovation process within the unit of analysis, their company. They developed the idea, sometimes inspired by others, started to run small experiments and trials and eventually implemented the new product or production technique on a commercial scale. As is often the case in incremental innovation in developing countries, this was not a planned and formalised process involving a pre-defined innovation strategy and an R&D department.

The third element, value creation of innovation, is evidenced either through lower input costs or higher sales revenues (Porter, 1985). Higher profit through new premium products of better quality, or appealing to a certain fashion, increases competitiveness.

Regarding the further dimensions of innovation, Kaplinsky and Morris (2001) identify five types of innovation: (i) process innovation, aiming at improving the efficiency of transforming inputs into outputs; (ii) product innovation, leading to better quality, lower price and/or more differentiated products; (iii) business practice innovation, implying new ways to organise the business and attract new clients; (iv) functional innovations, assuming responsibility for new activities in the value chain, such as design, marketing and logistics; and (v) inter-chain innovations, moving to new and profitable chains. These types of innovation are taken into account in the analysis.

In many innovation definition and measurement documents, such as the OECD Oslo Manual (OECD, 2005), an explicit distinction between product, process and other types of innovation is made. However, distinguishing the types of innovation in the cases from Tanzania, Kenya and Ghana was not such a clear and simple process. It is more common to see an integrated combination of several types of innovation, where one type of innovation triggers or enables another, such as the introduction of a new process (technology) that results in the launch of new products. The Tanzanian cases show a combination of new technology, new processes, new products and new clients within the companies.

Analysing the newness, process and value creation aspects helps to assess whether the Tanzanian cases qualify for innovation or not, as follows:

1. The animal feed producers developed their company from initially selling raw materials only, then upgraded to mixed feed production with high quality compositions. Some technological innovations were introduced, such as adding enzymes. Such products are not new to the world, but were new to the firm. This enabled the company to expand their market. The company gained a competitive position and the new products generated value in terms of turnover and profits. The owners are constantly looking for new and innovative ways to produce the feed. This could qualify as an example of incremental innovation.

2. The confectionery company changed from trading in gum into manufacturing bubble gum, which can be considered an innovation. It has recently ordered a new machine to introduce a new product, which could be considered a product innovation. The product is new to the firm but not new to the market. The owner acquired new production machines and technology. This is an example of product innovation.
3. The shoe making company purchased a special machine that enabled it to produce better shoes than its competitors. The question arises as to whether this could be labelled an innovation, or just a product ‘improvement’. The company still produces regular shoes. Although the owner has quite ambitious plans to expand, he has not done this yet, due to lack of finances and an uncertain institutional context.

Compared to the earlier qualitative explorations in Ghana and Kenya for instance, the companies in Tanzania are less innovative in terms of introducing substantial changes to raise productivity and competitiveness. Most of the interviewed SMEs introduced minor product and process innovations in order to survive. Although the new products and processes in the innovative companies are not radical and not ‘new to the world’, they are new for the companies, as units of analysis. The ideas for new products are mainly acquired from the market. Customers come with requests and suggestions, or the owners talk with clients. This is demand-driven innovation. There is no supply-driven innovation happening in the cases.

In terms of these innovation manifestations, Tanzania fits best in the classification of a factor-driven economy, as mentioned in chapter 2, competing on factor endowments, unskilled labour and natural resources. As a country becomes more competitive, productivity will increase and wages will rise with the advancing development. Countries will then move into the efficiency-driven stage (Porter et al., 2002). In the efficiency-driven stage, companies begin to develop more efficient production processes and increase product quality even more because wages have risen and they cannot increase prices. This is not yet the case in Tanzania. The cases do not reveal innovation aimed at increasing productivity by saving on input or labour costs.

Moreover, owners report that manufacturing companies close down because of competition with China and high local costs for production, such as electricity. Chinese products remain cheaper, while some owners mention that these have inferior quality. Interestingly, in such a context, innovation would be one way to make more efficient use of resources and processes and compete with imports on the local market. An innovation focus on quality would be a logical way forward. However, many manufacturing SMEs do not innovate at all and either choose, or are forced, to close down their business in the unfavourable institutional environment.

In all cases, it is the owner who initiates, coordinates and manages the new products and innovation process, including preparations for the innovation, technical details, and the product launch. Only the frozen fish company employs a specialist business development officer; other companies have neither an R&D department nor a specialist employee with this function. Most entrepreneurs have plans and see opportunities in the market, which provide them with ideas for innovation. In terms of employment creation, most owners demonstrate social awareness and see their importance in the community.

The Tanzanian workforce mostly comprises unskilled labourers. Most owners pay their employees based on output, not a fixed salary within fixed contracts. In addition, the workers get rewards and bonuses in most companies, although the actual implementation is not always well managed. Sometimes the employees provide innovative ideas, to a greater or lesser extent. Several owners, however, stress the limited creativity of their workers and refer to a passive attitude. Most owners and managers do train the employees on-the-job, but this does not involve the development of creativity. Getting higher educated staff is a problem since the graduate employees have primarily theoretical knowledge and few practical skills. This is considered a serious constraint, as witnessed by the confectionery company working with engineers from Pakistan.
Typically the companies possess machinery purchased second-hand from Europe or China. The owners often have plenty of ideas and are well informed about technological possibilities though the internet or friends or via a member of an association. However, lack of finance and the uncertain institutional context prevent them from doing so.

All Tanzanian SME owners, except for the confectionery company, indicate that the business environment is challenging. They also indicate that the business and institutional environment in Tanzania prevents them from innovating and growing their business. All mention the issue of competition with imports, particularly from China. The costs of production in Tanzania are high.

All SME owners have more or less the same negative perception of government policies, legal regulations and systems. The government apparently promises a lot but actually implements little. There is no clear regulatory or policy framework for manufacturing SMEs. Many ministries and governmental agencies have different regulations that are not predictable. All the entrepreneurs complain about the high costs of production, such as electricity costs.

There is no innovation policy for SMEs, who do not feel supported by the government. They feel that they have to survive on their own and the past negative perception of entrepreneurs, being ‘economic criminals’, still exists. A few entrepreneurs mention that the government is after a ‘quick buck’ by earning on imports rather than earning tax on manufacturing.

The banking system is not an attractive source of finance for SMEs, and very few have secured credit. They all complain about high interest rates and complex paperwork. Instead, most SME entrepreneurs are funded from their own savings, family members, friends, or informal institutions, and invest incrementally as a result of large orders.

Interaction with technology institutions is virtually non-existent. Many SMEs indicate that they would like to cooperate with universities to undertake research at their premises, sharing the research insights obtained. There is very little spill-over of technology as a result of cooperation between firms, subcontracting or other forms of collaboration within value chains, business clusters or networks.

These findings are confirmed in recent literature. Wangwe et al. (2014) identifies constraints and challenges facing the manufacturing sector in Tanzania. They underscore five broad categories of the major challenges facing the country’s manufacturing sector. A first technical challenge concerns the unreliable power supply, use of old machines and equipment and the lack of proficient manpower. A second administrative challenge ranges from the macro level (policy dimension) to the micro level (firm-specific administrative conditions). With regard to the policy arena, manufacturing is constrained by ineffective policies, particularly because of poor enforcement of laws, complex legal and institutional frameworks, as well as a disapproving attitude towards the use of locally produced goods, which has led to overconsumption of foreign products. A third challenge concerns the difficulty in accessing financial resources and the high cost of capital, which can be explained by the fact that firms operate largely on borrowed capital acquired at high interest rates. Raw material and other inputs, such as energy, are expensive. A fourth challenge concerns the market and particularly competition from products produced abroad. Some imported goods, which are more price-competitive than those made in Tanzania, are low-quality counterfeits. Lastly, the policy challenges and hindrances include tax laws, local government bylaws, environmental legislation requirements, etc., payable to both the central and local governments.
**Policy issues – insights for policy makers to consider**

The cases confirm the picture that SMEs, the ‘missing middle’, are weak in Tanzania because of challenging business conditions: poor infrastructure, inefficient legal systems, inadequate financial systems and unattractive tax regimes. Many firms stay micro and informal and use simple technology that does not require extensive use of the formal institutional context. They prefer to stay at a distance from the formal institutions.

As argued in the introduction of this report, it is desirable to develop innovation within manufacturing SMEs. Some believe that technological innovation is critical for SME development and catch-up in LICs. Technological innovation has, however, been traditionally concentrated in developed countries, given the costs and risks involved in stimulating technological innovation. Foreign sources of technology account for a large part of productivity growth in most countries, as witnessed in the Tanzanian cases. Therefore, the development process in LICs could be supported by tapping existing knowledge and know-how.

It seems that the notion of growth as ‘manna from heaven’ as reflected in convergence theory, see the exogenous growth model of Solow and Swan (1956), might work because of the free and widespread access to knowledge and technologies via the internet. In fact, all owners in the cases are well informed about the technological possibilities of their business. The knowledge itself is available for local companies in Tanzania. The institutional context, providing trust, predictability, stability and access to finance is more of a problem in preventing investment in technology and innovation and thus ‘convergence’ from happening.

How then can the innovative capacity of SMEs in developing countries be increased? According to the World Bank, an efficient innovation policy by governments will address the overall innovation climate, which goes beyond traditional science and technology policy. At the same time, government action can usefully focus on a few generic functions to help SMEs to grow. It can facilitate the articulation and implementation of innovative initiatives, since innovators need basic technical, financial and other support.

The government can reduce obstacles to innovation in competition and in regulatory and legal frameworks. Government-sponsored research and development structures can respond to the needs and demands of surrounding communities. Finally, the education system can help form a receptive and creative population. Regarding actual innovation policy development, there has been a considerable amount of work in developing countries, such as the World Bank (2010) report ‘Innovation Policy: A Guide for Developing Countries’.

The lack of relevant education is a problem for the companies interviewed, who feel there are insufficient skilled workers and operators to work with modern machines. SME owners and managers complain that university and college graduates do not have the required technical and craftsman’s skills, exposure to modern technologies, or an entrepreneurial and creative attitude. One entrepreneur specifically suggested creating establishments that train workers in the use of the latest technology. The enterprises could employ these skilled workers and give the owners the confidence to purchase new equipment and machinery.

As mentioned earlier, several ministries and agencies are engaged in efforts to develop and promote innovation policy, usually labelled as Science, Technology and Innovation (STI) policy. Despite
considerable effort in developing strategies and plans, actual implementation is challenging, due to the limited availability of public budgets and knowledgeable staff.

Moreover, the stories and experiences of the owners and managers raise the issue of whether an STI approach would match the realities of the manufacturing SMEs on the ground. Most of the required technology is already available, but elsewhere in the world. Without too much difficulty, the owners and managers find the technology themselves by drawing on various sources of information (the internet, informal business contacts and trade fairs). Moreover, the companies themselves refine and adapt the existing technology once acquired. So, although setting up technology development projects and programmes may help SMEs, it is not perceived as a barrier to innovation by the owners and managers.

Nearly all SME owners and managers suggest that creating a stable and predictable institutional context would be an efficient and effective way to promote innovation in Tanzania. All kinds of innovation policies and programmes could be developed, but the results of such policies will be undermined by the weak and unreliable wider formal institutional context.

Another policy idea emerging from the DFID project is that several owners and managers suggest not to focus on governmental policy makers only, but on direct advice to SMEs on how to improve their business. One idea is to develop non-governmental business information exchange networks and platforms, establishing contact between entrepreneurs in Africa and beyond, to facilitate discussion and deals within the various sectors. SME owners suggest that the DFID project could establish a network of all SME owners and managers contacted during the implementation of EIP-LIC and create a website for them to stay in touch with each other.
4 Innovation systems

The research within the ‘Innovation Systems’ theme resulted into seven scientific papers with reference to Tanzania. The papers use was existing as well as original datasets collected in Tanzania within the project framework. The associated policy briefs and many others are listed on the project website. Out of the seven papers, four are discussed in this chapter focusing particularly on Tanzania. The remaining three papers involve the analysis of multi-country data, including Tanzania, and are available at the website of EIP-LIC.

The first paper discusses effects of knowledge sources on firm level innovation in Tanzania. The second paper investigates factors affecting engagement and commercialization of innovation activities in Tanzania. The third paper analyzes the relationship between gender diversity in ownership, management and workforce structure at the firm level and women’s economic opportunity at the country level to improve innovation outputs. The fourth paper investigated the bi-directional relationship between innovation and exporting in four countries in Sub-Saharan Africa.

4.1 Knowledge sources and firm-level innovation

The first scientific paper within the ‘Innovation System’ theme discusses effects of knowledge sources on firm level innovation in Tanzania. Ideas and inventions are at the centre of innovation, and these in turn are significantly influenced by knowledge. Knowledge is thus a prerequisite for innovation: the generation, exploitation and manipulation of new forms of knowledge by firms to create new products. There are two main sources of knowledge for innovation that impact innovation differently: internal and external sources.

Internal knowledge development happens within the boundaries of the firm through in-house knowledge dissemination, research and development, and internal education and training. External knowledge acquisition involves the introduction of new knowledge from outside sources via the purchase of machinery and equipment, recruitment of qualified personnel, conferences, training, and licensing. External knowledge acquisition is useful to a firm only if it possesses an existing base of knowledge that enables it to utilise the external knowledge. In the literature, scholars differ in their views of the extent to which different knowledge sources (internal and external) contribute to firms’ innovation performance.

Researchers from Dar es Salaam and Radboud University Nijmegen investigated knowledge sources and their relevance for innovation. The team focused on the impact of internal and external knowledge and the combined impact of both on a firm’s likelihood of introducing product innovations. Their original working paper is entitled ‘Effect of Knowledge Sources on Firm Level Innovation in Tanzania’ (2016) by Otieno Osoro, Godius Kahyarara, Joris Knoben and Patrick Vermeulen.

Research findings

The main finding of the research is that the impact of internal knowledge (ignoring external knowledge) on product innovation is greater than the impact of external knowledge (ignoring internal knowledge). The main source of internal knowledge in Tanzanian firms is firm spending on internal research and development. The purchase of equipment, machinery or software is the main external source of knowledge.
Furthermore, the development of an internal knowledge base is better undertaken by investing in internal research and development than by acquiring external business and codified knowledge. The latter is only effective once an adequate internal knowledge base is already developed. The sector and age of the firm are differentiating factors: external knowledge acquisition and firm spending on internal research and development facilitates product innovation more effectively for older firms and firms in the services sector than for relatively younger firms.

The age effect is probably because younger firms generally have a poor absorptive capacity, which limits their capacity to identify and exploit technological opportunities emanating from outside the firm. The interaction of external and internal knowledge raises the probability that a firm will undertake product innovation because apart from a firm utilising external knowledge to undertake product innovation, it also uses it to enhance the internal knowledge base required to effectively identify and utilise external knowledge for product innovation.

Policy implications

Policies and programmes focus on developing an internal knowledge base – thus absorptive capacity – as a priority for the optimal use of internal and external knowledge. The qualitative studies of EIP-LIC in Tanzania also show that firms undertake research and development in an informal and unorganised way, which does not include a systematically built internal knowledge base. Very few of the SMEs interviewed had a formal R&D department or a systematically organised internal knowledge development base. Business management strategies, policies and programmes should focus on raising awareness or offering management training that emphasises the importance of developing an internal knowledge base and formalising an explicit internal R&D strategy and capacity. The research also suggests that policies and programmes should take into account the age difference in companies.

The qualitative studies of EIP-LIC often show that the SME owner is a technically educated person who is the sole repository of technical knowledge in the company – “they [workers] can’t compete because they don’t have the knowledge, skills and experience that I have.” The fact that one individual holds the entire knowledge base constitutes a risk and a limitation for the company. Policies and training programmes could promote the idea of codifying and institutionalising knowledge into an internal knowledge base within companies, to be shared among the staff.

Staff training is a critical element in the development of such an internal knowledge base, whether formal or on-the-job training. One should also be realistic and acknowledge that staff may leave the company shortly after completing their training, as signalled in the qualitative study – “three former workers, whom I trained, have established their own business, which brings new competition.” This is one reason why owners are reluctant to provide formal training because they are afraid that workers will move to other jobs.

4.2 Factors affecting engagement and commercialization of innovation activities

The second scientific paper within the ‘Innovation System’ theme investigates factors affecting engagement and commercialization of innovation activities in Tanzania. Innovation usually involves generation, exploitation and manipulation of new forms of knowledge in creation of new products or services with an enterprise. As innovation entails translation of ideas or inventions into products with economic value the market demands, it is incomplete until innovative products resulting from innovation are accepted and adapted by the market. Such conversion is termed commercialization of
innovation, which significantly impacts the economy by enhancing market penetration, dominance and exploitation of new markets by firms that promotes economic performance and leads to growth. It should however be noted that although there are many new ideas and inventions, not all are commercialized in terms of successful market introduction.

Given the significance of commercialization and the low success rate of commercialization, as signaled in academic literature, a more complete understanding of factors driving successful commercialization is necessary. Previous studies have explored a variety of antecedents of technology commercialization such as resources, capabilities, networks, entrepreneurial culture and entrepreneurial activities. Nevertheless, the economic theory still lacks a comprehensive perspective on successful commercialization, especially in LICs.

A team of researchers from the University of Dar es Salaam in Tanzania and Radboud University Nijmegen analysed factors determining the commercialization of product innovations in Tanzania. Specifically, the research focused on the relative importance of firm, innovation, and environmental level factors for commercialization and how innovation is linked with commercialization. The original working paper is entitled ‘Factors affecting engagement and commercialization in innovation – Activities of firms in Tanzania’ (2015) by Otieno Osoro, Stephen Kirama, Joris Knoben and Patrick Vermeulen.

**Research approach**

Literature on undertaking product innovation and commercialization indicate existence of a variety of factors that impact commercialization in different directions and magnitude. The team of researchers have analysed the following groups of factors.

1. **Firm-level factors** referring to the availability of complementary assets with an enterprise such as the existing internal knowledge base, knowledge acquisition, and corporate culture. This also concerns the firm structure and ownership and external networks that facilitate firm to access to critical resources, knowledge and capabilities. Furthermore, the previous experience of managers in bringing innovations to market which also impact firm decisions on innovation. Firm-level factors enable to absorb scientific or technological information and enhance commercialization of innovations with higher likelihood of being consistent with market demand.

2. **Innovation-level factors** pertaining to the alignment of that innovation to a firm’s business model, nature of firm’s product, communication costs, and absorptive capacity. There are different phases of technology commercialization as idea generation, technology development, seeking market opportunities, market promotion, and sustaining commercialization. These involve planning, basic and applied research, design, engineering and manufacturing, market strategy, decision making and motives and business planning, pre-launch and test marketing and value assessment.

3. **Environmental-level factors** referring the institutional framework, also referred to as innovation system, facilitating knowledge accumulation, cooperation with other firms, the sector of the enterprise and the availability of markets for technology including the industry structure. With various policy instruments, governments may enhance institutional framework by creation of national innovation systems, reforms in the national research system.

The DFID project research team employed World Bank data on manufacturing SMEs in Tanzania, in particular the Tanzania Enterprise Survey (ES) 2013 and an innovation follow-up survey conducted in 2014. The former provided a wide range of firm-level variables including information on recruitment,
training and R&D practices within the firm. The innovation follow-up survey on the other hand provided evidence on the nature, role and determinants of innovation in Tanzania as well as data on commercialization and commercialization related variables.

Specifically, it contained information on the innovation output, innovation-related activities, commercialization and commercialization related activities such as sales of innovative products, product innovation, process innovation, organizational innovation, and marketing innovation for Tanzanian firms.

Research findings

The research team found that several firm-level factors influence a firm’s chances of undertaking product innovation, particularly the availability of equipment, machinery or software and intangible technology. Innovation is limited by low levels of technological capability that constrain firms’ capacities to undertake adequate internal research and development. A cost-reducing incentive in particular is an important factor impacting both product innovation and commercialization.

A key innovation-level factor concerns firm funding of and investing in external research and development. Innovation-level factors pertain to alignment of a firm’s innovation activities to such factors as a firm’s business model, nature of firm’s product, communication costs, or absorptive capacity. Funding of external research and development is explicitly targeted towards enhancing innovation which in turn enhances a firm’s capacity to absorb further knowledge. This innovation level factor enhances chances of firms undertaking product innovation. However, this firm funding does lower the commercialization of innovations. These investments may deviate attention from factors influencing commercialization such as developing and maintaining cooperation with domestic firms as well as shifting focus from cost reduction to development.

The research team found that within the environmental-level factors group, the sector a firm belongs to enhances chances of undertaking product innovation while cooperation with domestic firms and the cost reducing motive have the greatest impact on commercialization. Marketing factors surprisingly do not influence commercialization of innovations giving an indication that most firms do not pursue a market strategy simultaneously or that market strategies formulated by firms are yet to yield results.

Policy implications

The research shows that the availability of equipment is a critical factor in engaging in innovation activities in Tanzanian SMEs (but this does not applies for commercialization). A similar outcome with regard to equipment is observed in the complementary qualitative research part of the DFID project. The access to technology is perceived as an important limitation, which hampers SMEs to innovate. In fact, locally produced technology is hardly available and of insufficient quality, while imported technology too expensive.

Firm funding of external research and development is a key factor in product innovation. However, limited resources hinder many firms especially small and medium ones from doing so. This is sort of a market failure hence necessitating government intervention in order to reduce the cost of firms in investing in external R&D. This can be achieved through increased government support to vocational education and polytechnics to enhance the capacity of human resources who will undertake R&D as well as reducing credit constraints for firms in order to make it easier for them to finance external R&D. The research also show that externally funding lower commercialization. A policy implication is that
funding external research should take explicit consideration and support for commercialization into account as well.

Cooperation with domestic firms has a significant impact on commercialization. Policies to support this process could be the promoting cooperation among domestic firms via events, platforms and business meetings. SME owners in the in-depth interviews confirmed the fact that they would like more cooperation, be it formal or informal, with other manufacturing SMEs. However, in Tanzania, there are few little opportunities and occasions to do so

Moreover, many SMEs keep their doors closed to outsiders. One important reason is the unfriendly formal government institutions that make the business operation even more challenging unclear and inconsistently implemented regulatory framework.

The research show that marketing factors do not play a role in commercialization of innovations in Tanzanian SMEs because most firms do not pursue a market strategy. One possible explanation is that the development of marketing strategies within Tanzanian firms is still in an early stage.

Policy interventions geared towards encouraging innovative firms to simultaneously develop marketing strategies are likely to enhance commercialization of innovations by enabling innovative firms to adapt to changing markets and technologies.

The research further shows that product innovation and commercialization are promoted through the enhancement of firm efficiency and internal knowledge base. Policy instruments could thereby focus on improving firm efficiency and building internal knowledge base of firms. Awareness raising, business registration requirements and training could specifically focus on these internal capabilities.

With regard to the cost-reducing motive for engaging in product innovation, not all enterprise are aware about the cost-reducing motive, in particular in a factor-driven economy. Policy instruments such as awareness raising, education or training may include could overcome this limitation.

The research revealed a significant variance among the sectors’ impact on the commercialization of innovation. Consequently, policy envisaging to promote commercialization should be sector-specific; ‘one size fits all’ will not work. The research further suggest various areas for research and policy development, in particular with regard to dynamics and trends over longer periods of time. One such area involves the behaviour of firms with regards to commercialization and the sustainability. Analysis of specific characteristics such as sectors, size of firms, and managerial characteristics in order to determine the impact of such factors on commercialization of innovations. The process and evolution of commercialization over time and its impact on subsequent commercialization is another area.

4.3 Innovation and export

The third scientific paper within the ‘Innovation Systems’ theme assesses whether innovation directly influences exporting behavior, because firms apply innovation as a strategy for gaining an international market share. A firm’s ability to successfully compete on the international market is influenced by its capacity of introducing and marketing both new and improved products.

Actually, the link between innovation and exporting has received considerable attention. One strand of research investigates complementarity between exporting and innovation while the other examines the direction of causality. Nevertheless, few studies take into account the possibility of both causalities occurring simultaneously. Furthermore, a majority of these studies have been conducted in developed
countries. For instance, previous studies find evidence of learning by exporting in Sub-Saharan Africa (SSA) implying that participation on international markets facilitates knowledge flows from customers and competitors. Yet, it remains unclear how this mechanism affects the exporting-innovation relation.

In the Fifth paper, a team of researchers from University of Nairobi and Radboud University investigated bi-directional relationship between innovation and exporting in four countries in Sub-Saharan Africa. Specifically, the research addressed the question whether there is a positive relationship between innovation and subsequent exporting and that this relationship is mediated by market creation and with customer feedback mediating this relation. The original working paper is entitled ‘Export and Innovation in Sub-Saharan Africa’ (2017) by By Laura Barasa, Bethuel Kinyanjui, Joris Knoben, Peter Kimuyu and Patrick Vermeulen. The study sample consists of firms located in SSA including Ghana, Kenya, Tanzania, and Uganda.

Research findings

The research finds that the relation between innovation and subsequent exporting is positive and significant. However, we find a positive but non-significant relation between exporting and subsequent innovation. These relations broadly nuance a relationship between innovation and exporting.

We also find evidence that market creation mediates the innovation-exporting relationship since the innovation process entails the introduction of new products and services on the marketplace. The market creation significantly mediates about 32.5% of the effect of innovation on subsequent exporting. In agreement with this, our results suggest that the technology-push mechanism accounts for the relationship between innovation and subsequent exporting in the context of SSA.

Similarly but to a much larger extent, customer feedback is found to significantly mediate about 67.4% of the effect of exporting on subsequent innovation. Furthermore, we find evidence that customer feedback mediates the relation between exporting and innovation to a large extent (67.4%) suggesting that the demand-pull mechanism is very critical in explaining this relationship. Taking into cognizance that the demand-pull mechanism has received scant attention over the past years this finding gives rise to an important theoretical implication arising from the empirical evidence of the demand-pull mechanism in SSA. We argue that the recognition of market needs arising from customers on the export market constitutes a major driving force of innovation in SSA.

Apart from contributing to the debate on the innovation-exporting relationship in the context of SSA, our paper goes a step further to shift focus on disentangling the mechanisms underlying this interrelationship. This is an area of study that has received scant attention particularly in the African context.

Policy implications

The findings reveal that whilst the main effect for the innovation-exporting relationship is significant, the reverse relation remains unclear. Notwithstanding, the positive albeit non-significant relation between exporting and innovation provides some nuanced support for the existence of a bi-directional relationship. Furthermore, the technology-push mechanism underlies the innovation-exporting relation to a medium extent. Hence, innovation policies aimed at fostering product innovation by providing incentives may be crucial for exporting. Such policies may be useful in fostering the development of innovations with a high degree of novelty and are likely to promote exporting through the creation of new market space.
Moreover, the study provides evidence that the demand-pull mechanism underlies the exporting-innovation relationship. Customer feedback mediates the exporting-innovation relation to a very large extent. Therefore, state capital expenditure focusing on information and communications technology infrastructure investment is vital in enabling faster response to market needs. Additionally, export promotion policies encompassing instruments such as export subsidies are likely to play a key role in stimulating innovation in SSA.

4.4 Gender diversity and innovation

In the fourth paper within the ‘Innovation Systems’ them analyses the relationship between gender diversity in the ownership, management and workforce structure at the firm level and women’s economic opportunity at the country level to improve innovation outputs. In present theory, there is an implicit assumption that higher levels of women’s economic opportunity at a country level enable firms to better render the benefits gender diversity can bring for innovation. The original working paper is entitled ‘Gender Diversity and Innovation: The Role of Women’s Economic Opportunity in Developing Countries’ by Daniela Ritter-Hayashi, Patrick Vermeulen and Joris Knoben.

Research Findings

The research shows that gender diversity at all levels in the organization has a positive effect on innovation in the firms surveyed in low and lower-middle income countries in South Asia, Africa and the Middle East - despite their below-average performance on a world-wide scale of measuring women’s economic opportunity. Furthermore, the research illustrates that a country’s level of women’s economic opportunity plays an important role in the relationship between gender diversity and innovation.

On the one hand, the results put forward that the positive effect of gender diversity on firms’ innovation likelihood is amplified with increasingly equal opportunities for women. On the other hand, both gender diversity in the ownership structure and in the overall workforce can have a negative effect on a firm’s likelihood to innovate if the firm is operating in a country with very little economic opportunity for women.

It needs to be however pointed out that, extrapolated from this study, gender diversity only has a potential negative effect on innovation in a handful of countries worldwide, ranging at the bottom of the women’s economic opportunity ranking (lowest 5 countries for gender diversity in the workforce and lowest 15 countries for gender diversity in the ownership structure).

Policy Implications

Based on the research results, it is essential to acknowledge the value of gender diversity for innovation and to create awareness among managers and employees that innovation emerges and blossoms from gender diversity at the firm level. Government agencies could develop special policies and programs which encourage and support firms in hiring a more gender-balanced workforce, having more female top managers and supporting firms with a gender diverse ownership structure. This could take the form of awareness raising programs explaining the particular benefit of gender diversity for a firm’s likelihood to innovate.
Furthermore, the introduction of tax advantages, subsidies or other incentives targeted at increased gender diversity at all hierarchical levels within a firm could be a driver for increased gender balance. Once awareness is raised at the top ranks of firms, it is pivotal that managers initiate a change of attitude and organizational culture top-down, encouraging women to voice their opinion, urging men to value women’s viewpoints and knowledge in the innovation process, and reassuring management on the importance of promoting both men and women based on their performance rather than their gender.

It is crucial to encourage increased levels of women’s economic opportunity at a country level as a prerequisite for gender diversity to benefit innovation. Potential avenues are increased access of women to education to decrease the gap in knowledge between men and women. Governments could initiate country-legislation enabling women to better balance family and work demands such as improved childcare as well as maternity and paternity leave. An additional avenue for policy makers is to encourage a social perception of women as being equally valuable members of society like men, with the same rights and obligations.

On a practical level, supporting networking activities through women entrepreneurship associations seems an effective instrument to strengthen women’s determination to pursue ambitions. Moreover, establishing programs in which women entrepreneurs lend support to girls on their way of obtaining education can be of advantage. This can take the form of financial support and motivational reinforcement for the girls themselves. Similarly, successful women entrepreneurs can serve as a role model to girls’ families, which may be hesitant to invest in their daughters schooling based on traditional gender norms and expectations. Moreover, to change the overall public perception of women entrepreneurs while aiming at a ripple down effect to their immediate surrounding and support system, campaigns celebrating the success of women starting a business can be a further avenue to strengthen their societal position.
5 Finance for Productivity Growth

The ‘Finance for Productivity Growth’ team produced four scientific papers with special reference to Tanzania. The first paper within the ‘Finance for Productivity Growth’ theme analyses entrepreneurial saving practices and business investment in Tanzania. The second paper investigates the determinants of and the barriers to the adoption of a profitable financial technology by SMEs in Kenya, a country comparable to Tanzania in terms of institutional context and mobile phone technology adoption. The third paper investigates the relationship between bank credit and trade credit in Ethiopia. The paper is relevant because trade credit is a common way for business finance in Tanzania too. The fourth paper investigated the role of financial constraints in firms’ skilled labour demand in Uganda, a country comparable to Tanzania in terms of labour force characteristics. The research findings of each paper are discussed and policy implications reviewed in the paragraphs below. The associated policy briefs and many others are listed in the project website.

5.1 Entrepreneurial saving practices and business investment

The first paper within the ‘Finance for Productivity Growth’ theme investigates entrepreneurial saving practices and business investment in Tanzania. Past research identified several factors that could be important for entrepreneurial investment. In developing countries, intermediation costs and enforcement frictions constrain access to external finance by micro and small enterprises - leaving entrepreneurs’ earning retention as a key element for small business growth. But, what explains entrepreneurial decisions to reinvest in their own businesses? Given the limited access to formal financial services, many entrepreneurs use informal mechanisms for saving, borrowing, and liquidity management.

Using this question as a starting point, a team of researchers from Cass Business School and Tilburg University explored how different entrepreneurial saving practices (i.e. saving via formal financial institutions, individually (under the mattress), within the household or within informal arrangements, such as ROSCAs) are related with the likelihood of reinvestment. The original working paper is entitled ‘Entrepreneurial Saving Practices and Business Investment: Theory and Evidence from Tanzanian MSEs’ (2014) by Thorsten Beck, Haki Pamuk and Burak Uras.

Research approach and findings

To this end, the team used a novel survey data set collected from MSEs in Tanzania and distinguished multiple saving practices of entrepreneurs as well their earnings retention behaviour. The survey data was collected by the Financial Sector Deepening Trust Tanzania in 2010 from a nationwide representative cross-section of 6,083 micro and small enterprises. The researchers motivated the empirical research with a simple theoretical model that shows how different saving practices can influence investment decisions. The paper presents a simple theoretical model to show the relationship between entrepreneurial investment decision and savings practices. It shows that entrepreneurs are more likely to invest in their business if they save in a form with easy access to their savings, such as formal savings accounts or personal savings forms.
Actually the research shows three main results. First, the research shows that saving and the probability of reinvestment are significantly correlated. Second, there is evidence that entrepreneurs who save by giving funds to other household members are less likely to reinvest than formal savers. Third, we document that the difference in the likelihood of reinvestment is significantly higher for those entrepreneurs who potentially have low bargaining power in the household and who are survival type entrepreneurs.

The sample of entrepreneurs surveyed covers a large variety of enterprises in different locations, of different gender, educational profile and sectors. The team documented that entrepreneurs’ saving practices do indeed covary with the likelihood of earnings retention at MSEs. The survey design allows us to differentiate between different savings vehicles, including within household savings, saving under the pillow, informal savings club, and formal deposit accounts. The results reveal that the probability of reinvestment is significantly higher for savers and that when compared against formal deposit account holders, entrepreneurs who give their savings to other household members to keep them safe are significantly less likely to reinvest. Specifically, the research finds that when compared the practice of keeping savings within the household against the practice of having a deposit account at a formal financial institution, the latter is more likely to stimulate earnings retention relative to the former.

Policy implications

The findings suggest that the entrepreneurs who need to protect their savings from consumption commitments of other household members may benefit most from the introduction of formal saving instruments in low income areas. Therefore, from a development policy perspective, targeting entrepreneurs who have low decision power in the household as well as survival entrepreneurs and facilitating their access to formal saving instruments could be thought as a priority.

The results have important policy implications for the interactions between enterprise performance and financial access as well. Enterprises that exploit reinvestment opportunities are expected to be more likely to sustain higher productivity levels and survive more often. Access to efficient saving mechanisms in this respect could be key to facilitate enterprise performance in financially developing societies.

The research raises also some new issues regarding the implications of savings practices of entrepreneurs. First, why do savers inside households not open a bank account to save? Although the research implicitly shows proximity to banks as an important factor to save in a formal account, identification of all factors is not in the scope of this study. Second, what is the exact role of pressure inside the household that does not allow earnings retention?

5.2 Technology adoption and mobile money

The second paper within the ‘Finance for Productivity Growth’ theme focuses on technology adoption and mobile money in Kenya. Understanding the constraints that firms in developing countries face to adopt productive technologies is crucial for designing appropriate development policies. Over the last decades there have been important advancements that deepened the understanding of the drivers and the barriers of technology adoption, including mobile technologies. For instance, mobile-money is an emerging phenomenon offering the option money transfers via simple cell-phone text-messages.
This technology was amongst others launched in Kenya in 2007 under the name of M-PESA. Since then, it has quickly reached remarkable adoption rates among Kenyan households. As of 2016 in more than 95% of the households this technology has been adopted. The use of mobile-money among Kenyan businesses, however, is relatively low. Less than 40% of the small and medium sized enterprises (SMEs) report using M-Pesa services when transacting with their customers or with their suppliers.

A team of researchers from Tilburg University investigated the determinants of - and the barriers to - the adoption of a profitable financial technology by SMEs in Kenya. Specifically, the study involved a field experiment focusing on the adoption of mobile-money as a payment technology by restaurants and pharmacies in Nairobi. The original working paper is entitled ‘Technology Adoption by Small and Medium Businesses: Experimental Evidence from Mobile Money in Kenya’ (2017) by Patricio Dalton, Haki Pamuk, Daan van Soest, Ravindra Ramrattan and Burak Uras.

Research approach and findings

The field experiment studied what factors foster adoption of mobile money technologies by SMEs, and what the barriers to adoption are. The research team offered a randomly selected sample of restaurants and pharmacies the possibility to sign up, on their behalf, for a novel mobile-money technology which allows an efficient mobile-money based transaction between a business and a customer. A key feature of M-Pesa is that it is profitable, it does not involve any risk, and it has no registration fee. In short, the intervention eliminates the transaction costs associated with the adoption of the technology.

The study found that over a 60% of the restaurants owners/managers decided to sign up for this new technology, while the adoption rates turned out to be about 20% among pharmacies. Moreover, study provides causal evidence that small bureaucratic hassles and lack of information constitute a major barrier for adopting this profitable technology. The team further found that neither risk, time preferences or trust are important factors. Small situational barriers play a decisive role in preventing people to take advantage of profitable available options.

The motivations of those business owners who decided not to adopt the technology remain somewhat unclear. One plausible explanation of the non-adoption behaviour is status quo bias. If the business took the status quo (i.e. no technology) as a reference point, then any change from the status quo, in this case adopting the novel technology, would be perceived as a loss. If the business owners were loss averse, they would be less likely to adopt.

Policy implications

The research suggests that policy and programs to promote new technology adoption could be best designed by addressing the (situational) barriers, particularly bureaucratic hassles and lack of information. A government program providing the mobile technology for free, which is a relatively low-cost intervention, would bring substantial commercial benefits for the SMEs. Moreover, such intervention will repay itself in terms of increased taxation revenues. Providing the technology for free might also result that at a certain point in time a ‘tipping point’ will be reached; the remaining SMEs switch to the mobile technology because over it has become common practice. This will also moderate the effect of the status quo bias.
Along with providing the technology for free, an additional policy recommendation involves the lowering of the bureaucracy, and likely the application procedures for the mobile banking accounts; A one-stop shop for getting the mobile technology with flexible guarantee requirements, for instance offered as a package with a trial period. The lack of information can be addressed effectively once the application bureaucracy is eased. Information campaign to reach out and assist the SME owners to apply for mobile banking accounts.

5.3 Trade credit and access to finance

The third scientific paper within the ‘Finance for Productivity Growth’ theme investigates the relationship between bank credit and trade credit in Ethiopia. The underlying idea of the paper is based on the fact that many African countries have achieved promising economic growth rates in recent years. However, credit market imperfections are still persistent, resulting in limited access to formal bank credit for many firms, especially small and micro enterprises. Trade credit, as a method of direct ‘in-kind’ business financing, can be popular as an alternative to bank credit in locations with limited financial sector development. From this perspective, trade credit and bank credit can be considered substitutes.

Specifically, the research question of the paper addressed whether usage of trade credit decreases with access to bank credit, or whether the use of trade credit and bank credit are positively associated. The research further highlights the role of formality of firms. The team analysed firm-level data from 5,500 Ethiopian retailers. The original working paper is entitled ‘Trade Credit and Access to Finance of Retailers in Ethiopia’ (2017) by Thorsten Beck, Mohammad Hoseini and Burak Uras.

Research approach and findings

The findings suggest that bank finance and trade credit are substitutes in Ethiopia. In locations with lesser access to formal bank finance, the use of trade credit is higher. The extension of trade credit by suppliers generates a credible signal to banks with regard to the customers’ creditworthiness, which can make trade credit and bank credit complementary on the individual firm-level. For informal retailers, bank credit acts as a counterpart to trade credit in the sense that higher bank loan exposure is associated with greater access to trade credit. For formal firms, however, the research reveals that having more bank loans is not a significant explanatory factor of the use of trade credit. These results could imply that receiving bank credit increases the creditworthiness of informal firms that have less transparent operations and motivates their suppliers to extend them trade credit. Formal firms, on the other hand, are more transparent and the level of obtaining trade credit is mainly restricted by the availability of such sources of external finance in the locality.

Having a relationship with a bank can also act as a signal of the creditworthiness of firms to their suppliers and reduce the agency problems associated with trade credit. An important issue for studying trade credit as a form of financing is its substitutability versus complementarity with respect to bank credit. The researchers find that trade credit usage is more prevalent in locations with lower access to finance, consistent with the substitutability theory. The research, however, also finds that bank credit acts as a complement to trade credit for informal firms who lack transparency and suffer more from agency problems with their suppliers.
Policy implications

Although the link between trade credit and bank credit has been studied in the literature, investigating this relationship in the context of a developing country with low levels of access to finance provides several original insights for policy makers. Financial inclusion has been a key topic in development policy debates in many underdeveloped countries, but most policy initiatives address the direct effect of bank credit constraints.

This research stresses the importance of the role of informality in understanding the association between trade credit and bank credit. Informal firms feature non-transparent operations and rely on cash-based transactions, partly to hide from tax authorities and partly due to the unavailability of bank accounts. Operational transparency is a major element in accessing external finance, because without transparent (formal) accounting standards, creditors cannot determine the quality of borrowers. Informal sector promotion policies could focus on the notions and necessity of transparent operations though awareness, training and education policies.

Facilitating trade credit and bank credit could mutually strengthen each other, for instance, in combined policy and development programmes integrating the two. Policies to expand financial inclusion by increasing operational transparency might alleviate the agency problems of informal enterprises vis-à-vis suppliers and enable them to obtain not only formal finance from banks but also informal finance in the form of trade credit. For the formal sector, however, the research suggests less expected policy impact. Although obtaining a bank loan is positively associated with receiving trade credit for informal firms, the team does not find a similar significant link for the sample of formal firms.

5.4 Finance and demand for skill

The fourth scientific paper within the ‘Finance for Productivity Growth’ theme investigated the role of financial constraints in firms’ skilled labour demand in Uganda. Sub-Saharan Africa experienced a decade of growth between 2000 and 2012, in which average annual GDP growth was over 4.5%. However, recent studies indicate that this growth has not translated into similarly high growth rates in job creation. Current growth comes largely from a small base of industry and the manufacturing sector, which will not come close to absorbing the millions of new workers entering the labour force each year. What is even more challenging is that many educated and skilled workers in Africa fail to find employment. The supply of highly skilled human capital who remain unemployed raises the question of whether there is a shortage of firm-level demand for skill in African economies.

Academic studies stress the importance of access to external funding for firm-level investment decisions, economic development and growth. What about the interactions between access to finance and employment creation for educated workers? There is little research addressing the effect of financing constraints on hiring decisions, especially of skilled workers.

A team of researchers from Cass Business School (City University London) and Tilburg University investigated the role of financial constraints in firms' skilled labour demand. Specifically, using a small business survey from Uganda, the research explored whether skilled job creation rises with access to external finance. The original working paper is entitled ‘Finance and Demand for Skill: Evidence from Uganda’ (2016) by Thorsten Beck, Mikael Homanen and Burak Uras.
Research approach and findings

The research shows that the extent to which micro and small businesses expand skilled employment, as their sales and profits increase, depends significantly on access to external funding. Firms with positive performance and a bank loan hire more trained and experienced employees. Thus, growing and profitable small businesses create more jobs for trained and experienced workers - which is interpreted as demand for skill - if they have access to external finance.

The analysis does not reveal a significant relationship in the case of hiring casual employees or family and friends in the informal context, suggesting that financing constraints are more likely to bind in the context of employment contracts associated with experienced and trained employees with high human capital intensity. The results also suggest that financially constrained firms save their excess resources instead of investing in a more sophisticated and skilled workforce.

Policy implications

The research findings underline the importance of well-developed financial systems for policies focusing on job creation. Firms with greater financial flexibility are more likely to hire skilled labour once their performance improves. For policy makers focusing on the challenge of creating formal and permanent jobs in a developing society, devising a complementary financial sector policy is equally important. The policy should go beyond helping firms directly to strengthening efficient financial systems and credit programmes as well.

Better access to external funding can thus be an accelerator of human capital investment demand and growth. Policy makers must also acknowledge that firms who are financially constrained save a greater proportion of their additional profits (or pay other expenses associated with financial constraints) and therefore cannot invest further in greater levels of employment; if access to finance is difficult, one could question the optimal effectiveness of employment creation policies.

For government, interest rates by state banks. would be a first point of attention in policy efforts to create formal employment of higher skilled labour. Against this background, policy monitoring systems for employment creation could include the degree of access to finance. Looking at it from the other side, formal credit policies and programmes could include formal job creation, since they are linked.

Better performance and financial access do not explain the hiring rates of informal employees, which include casual and family employees. Labour creation policies should thus acknowledge the different policy instruments for creating employment for higher educated and skilled workers on the one hand, and informal employment on the other.

In many developing countries, young people are educated and governments need to find ways to employ these highly qualified workers. With better access to finance, a firm’s workforce can become more permanent and potentially more stable as well. As firms grow and become profitable, employment opportunities will increase for those who are formally trained, educated and more experienced. The policy relevance of such stable employment for higher educated staff centres on greater commitment of staff in firms. This will particularly positively affect firms’ survival and innovation efforts, and is thus a vital issue for policy makers in many nations, and especially in developing countries.
References


### Annexes

**Annex 1: Series of EIP-LIC working papers**

**Innovation systems**

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<td><strong>7.</strong></td>
<td>Daniela Ritter-Hayashi, Patrick Vermeulen, Joris Knoben Gender Diversity and Innovation: The Role of Women’s Economic Opportunity in Developing Countries DFID Working Paper. Nijmegen: Radboud University</td>
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<td><strong>9.</strong></td>
<td>Bos, M. and G. Vannoorenberghe. 2017 Imported input varieties and product innovation: Evidence from five developing countries</td>
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**) Paper is accepted in ‘Innovation and Development’: [http://dx.doi.org/10.1080/2157930X.2016.1195086](http://dx.doi.org/10.1080/2157930X.2016.1195086)
‘Finance for Productivity Growth’


All papers are accessible at the EIP-LIC project website: https://www.tilburguniversity.edu/dfid-innovation-and-growth/
Annex 2: Highlights of DFID/World Bank EIP-LIC survey Tanzania

By Stephen Kirama (e-mail: Ngareni3@gmail.com) and Otieno Osoro

Introduction

Annex 2 provides the context of innovation in Tanzania by describing the main features of innovation data collected from 543 firms by the Enterprise Survey 2013, Innovation Follow-up Survey which revisited firms already interviewed during the Enterprise Survey to collect firms-level data on innovation and innovation-related activities. The Innovation Follow-up Survey collects data on product innovation, process innovation, organizational innovation, and marketing innovation in emerging and developing countries and thus provides evidence on the nature, role and determinants of innovation in Tanzania.

The Tanzania Innovation Follow-up Survey was administered to a subset of Enterprise Survey respondents randomly selected to get a final sample of 75% of the original Enterprise Survey. A total of 543 successful interviews were performed with 103 firms refusing to participate in the survey. Business owners and top managers were interviewed from October 2013 through February 2014.

The research analysed innovation in Tanzania by focusing on two issues; effects of knowledge sources on firm level innovation and engagement and commercialization of innovation activities of firms with the aim of examining the impact of different sources of knowledge on product and process innovation and the commercialization of innovation in Tanzania.

General Data Description

Discussion of general features of the innovation data is for identifying patterns in the data prior to any empirical discussion. Table 1 shows the regional and sectoral distribution of the realized sample for the Enterprise Survey, Tanzania Innovation Follow-up Survey while Fig. 1, Fig. 2 show the distribution of firms by size, and region respectively. The sample was dominated by small and medium firms that accounted for 64 percent and 26 percent of the sample respectively with large forms accounting for only 10 percent of the sample. Dar es Salaam had almost half of the sampled firms followed by Arusha that had about 17 percent of sampled firms. This is no surprise as the region accounts for the largest share of Tanzania’s GDP.
Table 1: Regional and Sectoral Distribution Realized Sample for the Enterprise Survey, Tanzania Innovation Follow-up Survey

<table>
<thead>
<tr>
<th>Region</th>
<th>Food</th>
<th>Textiles and Garments</th>
<th>Furniture</th>
<th>Other Manufacturing</th>
<th>Retail</th>
<th>Other Services</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arusha</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>13</td>
<td>9</td>
<td>10</td>
<td>17</td>
<td>13</td>
<td>30</td>
<td>92</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dar es Salaam</strong></td>
<td>15</td>
<td>16</td>
<td>25</td>
<td>56</td>
<td>36</td>
<td>121</td>
<td>269</td>
</tr>
<tr>
<td>Small</td>
<td>7</td>
<td>6</td>
<td>16</td>
<td>10</td>
<td>30</td>
<td>103</td>
<td>172</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>29</td>
<td>3</td>
<td>7</td>
<td>57</td>
</tr>
<tr>
<td>Large</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>17</td>
<td>3</td>
<td>11</td>
<td>40</td>
</tr>
<tr>
<td><strong>Mbeya</strong></td>
<td>6</td>
<td>13</td>
<td>13</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>56</td>
</tr>
<tr>
<td>Small</td>
<td>4</td>
<td>12</td>
<td>13</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Large</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Mwanza</strong></td>
<td>5</td>
<td>11</td>
<td>13</td>
<td>4</td>
<td>7</td>
<td>12</td>
<td>52</td>
</tr>
<tr>
<td>Small</td>
<td>4</td>
<td>11</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>36</td>
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<tr>
<td>Medium</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td><strong>Zanzibar</strong></td>
<td>3</td>
<td>8</td>
<td>28</td>
<td>14</td>
<td>12</td>
<td>9</td>
<td>74</td>
</tr>
<tr>
<td>Small</td>
<td>3</td>
<td>7</td>
<td>24</td>
<td>12</td>
<td>2</td>
<td>5</td>
<td>53</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td></td>
<td>7</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>42</td>
<td>57</td>
<td>89</td>
<td>97</td>
<td>76</td>
<td>182</td>
<td>543</td>
</tr>
</tbody>
</table>
Fig. 3 shows the distribution of firms by sector. About 48 percent of firms in the sample belonged to retail and other services sectors. This is more or less with contribution of the service sector to the Tanzanian GDP, which is 50 percent.
Descriptive Statistics

Examination of features characterizing the data is necessary prior to discussing empirical results on innovation in order to identify useful data patterns relevant for empirical discussion. Table 2 shows descriptive statistics of variables used in analysing innovation in Tanzania.

Table 2: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>Production innovation</td>
<td>0.21</td>
<td>0.41</td>
</tr>
<tr>
<td>Process innovation</td>
<td>0.29</td>
<td>0.45</td>
</tr>
<tr>
<td>Sales of firm’s main innovative product/service</td>
<td>6.36</td>
<td>17.1</td>
</tr>
<tr>
<td>Firm cooperation with domestic firms</td>
<td>0.007</td>
<td>0.01</td>
</tr>
<tr>
<td>Changes undertaken by firm in promotion of products/services</td>
<td>0.16</td>
<td>0.37</td>
</tr>
<tr>
<td>Changes undertaken by firm in advertising its products/services</td>
<td>0.15</td>
<td>0.36</td>
</tr>
<tr>
<td>Funding for internal R&amp;D</td>
<td>0.22</td>
<td>0.41</td>
</tr>
<tr>
<td>Staff training</td>
<td>0.25</td>
<td>0.43</td>
</tr>
<tr>
<td>Recruitment of staff for innovation purposes</td>
<td>0.23</td>
<td>0.42</td>
</tr>
<tr>
<td>Funding for external R&amp;D</td>
<td>0.04</td>
<td>0.18</td>
</tr>
<tr>
<td>Firm purchase of equipment, machinery or software</td>
<td>0.40</td>
<td>0.49</td>
</tr>
<tr>
<td>Purchase of intangible technology</td>
<td>0.15</td>
<td>0.36</td>
</tr>
<tr>
<td>Cost reducing motive for engaging in innovation</td>
<td>0.27</td>
<td>0.44</td>
</tr>
<tr>
<td>Market share enhancement motive for engaging in innovation</td>
<td>0.55</td>
<td>0.44</td>
</tr>
<tr>
<td>Firm innovative experience</td>
<td>1.32</td>
<td>0.58</td>
</tr>
<tr>
<td>Sector of the economy a firm belongs to</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Firm age</td>
<td>12.92</td>
<td>9.66</td>
</tr>
</tbody>
</table>

Most of the firms began pursuing innovation in 2010 or 2011 and have thus had adequate time to at least attempt to undertake product and process innovations. About half of the sampled firms are involved in manufacturing. Only about a fifth of the sampled firms undertake or attempt product innovation with 8% more of firms engaging in process innovation. The average age of firms is about 13 years indicating most firms have the potential to undertake innovation by virtue of having a potentially adequate knowledge base.
Firms invest about seven times more in internal knowledge and business knowledge than in external knowledge as well as investing more in external technological knowledge via purchase of equipment, machinery or software and tangible technology than in business knowledge through staff recruitment and training. Market factors are important considerations for firms in making innovation decisions. Over half of the firms perceive increased market share as a reason for undertaking product innovation, while decreased costs are the reason for more than a quarter of the firms to undertake innovation. Innovative products account for just over a third of total sales of innovative firms indicating a satisfactory rate of commercialization of innovations. Only a small number of firms cooperate with domestic firms. Less than a fifth of firms undertook changes to the way they promote their products that indicate weakness in innovation promotion, which may hinder commercialization.

Only about a fifth of the sampled firms undertake or attempt product innovation with firms investing about seven times more in internal knowledge and business knowledge than in external knowledge. Firms invest more in external technological knowledge via purchase of equipment, machinery or software and tangible technology than in business knowledge through staff recruitment and training. Market factors are important considerations for firms in making innovation decisions. Over half of the firms regard increased market share as a reason for undertaking product innovation and for more than a quarter of the firms decreased costs are the reason for undertaking product innovation.
Annex 3: EIP-LIC evidence addressing the original DFID research questions

Annex 3 addresses questions relating to firm level factors driving innovation in Tanzania by specifically analysing the role of knowledge sources on innovation and factors affecting diffusion of innovation activities. We specifically address two research questions pertaining to the impact of different sources of knowledge on firm innovation in Tanzania and the factors determining commercialization of innovation activities of firms in Tanzania.

**Impact of Knowledge Sources on Firm Level Innovation**

The analysis examined the impact of different sources of knowledge on firm innovation in Tanzania. We employed cross-sectional data from the Tanzania Enterprise Survey 2013, Innovation Follow-up Survey that provided evidence on the nature, role and determinants of innovation in Tanzania by focusing on objective on the main innovation activities undertaken by firms from fiscal year 2010 to 2012.

The analysis examined innovative products and processes as well as attempts to do so since innovation is a process rather than an instantaneous event. In light of this, the dependent variables are measured as a firm’s attempts to develop innovative products and processes that are dummy variables.

Sources of knowledge are firm internal knowledge (firm funding of internal research and development, business knowledge (recruitment of staff for innovation purposes), and staff training while external knowledge is firm funding of external research and development, firm purchase of equipment, machinery or software and purchase of intangible technology. Apart from the variables pertaining to sources of knowledge at the firm level other independent variables for the study pertain to motives for pursuing innovation (cost reducing motives for engaging in innovation and market share enhancement motives for engaging in innovation, the sector of the economy a firm belongs to (a manufacturing dummy), firm innovative experience in terms of number of years since introduction of an innovative product/process by a firm, and firm age that controls for variation in ability of different firms to innovate.

We used six logistic models for product and process innovation to analyse the impact of knowledge sources on firm innovation with two models analysing the impact of external knowledge on firm innovation ignoring internal knowledge, two models analysing the impact of internal knowledge on firm innovation ignoring external knowledge, and two models analysing the joint impact of internal and external knowledge on firm innovation. Table 3 and Table 4 show the logistic estimation results for production and process innovation respectively.
Table 2: Logistic Estimation Results of Product Innovation

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
<th></th>
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<tr>
<td></td>
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<td>dy/dx</td>
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Number of obs = 89  
LR chi2 (7) = 28.84  
Prob > chi2 = 0.0002  
Log likelihood = -47.266625  
Pseudo R2 = 0.2337  
Probability of positive outcome = 0.494  
*: p<0.10; **:p<0.05; ***:p<0.01  

Number of obs = 89  
LR chi2 (7) = 38.38  
Prob > chi2 = 0.0000  
Log likelihood = -42.49566  
Pseudo R2 = 0.3111  
Probability of positive outcome = 0.516  
*: p<0.10; **:p<0.05; ***:p<0.01  

Number of obs = 89  
LR chi2 (10) = 44.07  
Prob > chi2 = 0.0000  
Log likelihood = -39.647363  
Pseudo R2 = 0.3573  
Probability of positive outcome = 0.523  
*: p<0.10; **:p<0.05; ***:p<0.01
### Table 3: Logistic Estimation Results of Process Innovation

<table>
<thead>
<tr>
<th></th>
<th>Model 4</th>
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<td>-0.12</td>
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<td>0.04</td>
<td>0.01</td>
<td>-0.03</td>
<td>-0.01</td>
</tr>
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<td>-0.005</td>
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<td>-0.91**</td>
<td>-0.23</td>
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<tr>
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<td>-0.77</td>
<td>-0.19</td>
<td>-0.80</td>
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</tbody>
</table>

- Number of obs = 89
- LR chi2 (7) = 23.69
- Prob > chi2 = 0.0013
- Log likelihood = -49.390933
- Pseudo R2 = 0.1934
- Probability of positive outcome = 0.437
- *: p<0.10; **: p<0.05; ***: p<0.01

- Number of obs = 89
- LR chi2 (7) = 29.82
- Prob > chi2 = 0.0001
- Log likelihood = -46.324459
- Pseudo R2 = 0.2435
- Probability of positive outcome = 0.457
- *: p<0.10; **: p<0.05; ***: p<0.01

- Number of obs = 89
- LR chi2 (10) = 36.25
- Prob > chi2 = 0.0001
- Log likelihood = -43.10742
- Pseudo R2 = 0.2960
- Probability of positive outcome = 0.454
- *: p<0.10; **: p<0.05; ***: p<0.01
2.1.1 Impact of External Knowledge on Innovation

Firm expenditures on external R&D and purchasing intangible technology do not influence product or process innovation. Purchase of equipment, machinery or software, however, increases a firm’s chances of pursuing both product and process innovation, which enhance the chances of pursuing process innovation more than product innovation. External knowledge in Tanzania thus emanates more from buying items than from acquisition of external knowledge to supplement internal knowledge in producing innovative products, as such external knowledge enhances their capacity to absorb new knowledge, which is in line with findings from Cohen and Levinthal (1990).

Purchasing machinery, equipment and software is more common than investing in external knowledge to enhance internal knowledge to undertake innovative processes probably because of low levels of technological capability that constrain firms’ capacity to undertake adequate IRD. This finding is consistent with Szogs (2004).

Models 1 and 4 also show the more innovative experience firms have, the higher the chances of undertaking product and process innovation. This indicates firms with less innovative experience mostly engage in innovation by the production of items already existing in the market or by adaptation of existing processes because of the need for time to establish themselves in the market before innovating. Firms must establish themselves in the market prior to engaging in innovation processes because innovation attempts must be accompanied by adequate internal technological capacity acquired through IRD, training and recruitment (Cassiman and Veugelers 2006). However, firms tend to prioritize business sustainability by focusing on quick win activities over long term ones, such as investments in internal knowledge.

It is only after business stability is attained that firms may desire to venture into innovation. Firm age however does not impact innovation in Tanzania. This finding differs from various findings (Klepper 1996; Kim and Marschke 2005) that younger firms innovate more than older firms. The insignificance of firm age on innovation may imply that factors leading to younger firms being more innovative than older firms such as turnover of innovators from older firms, lower per capita cost of innovation for smaller firms, and higher success of first products relative to products introduced later are less pronounced in Tanzania.

Belonging to the manufacturing sector reduces the chances of a firm undertaking product innovation while it does not influence the chances of a firm undertaking process innovation. The size of the service sector is more than four times that of the manufacturing sector in Tanzania, which implies a higher likelihood of product innovation occurring in the service sector than the manufacturing sector. Furthermore, service firms require less capital than manufacturing firms because production in the service sector tends to be less costly than in the manufacturing sector. Product innovation in the service sector thus tends to be less costly than in the manufacturing sector. This is similar to findings by Baldwin and Gellatly (2004) who found service firms require less financial resources to innovate because they tend to have less financial barriers to innovation than manufacturing firms. Furthermore, belonging to the manufacturing sector does not impact chances of a firm undertaking process innovation, probably because undertaking process innovation is usually cheaper than undertaking product innovation.

Finally, Models 1 and 4 show that market factors do not influence a firm’s decision to undertake product or process innovation, which implies that once firms are established, their objective is to gain a foothold in the market through adapting to the situation in the market rather than through introducing innovative products or processes that follows establishment in the market.
Impact of Internal Knowledge on Innovation

Model 2 shows the impact of internal knowledge of product innovation ignoring external knowledge sources. It shows that internal knowledge accumulated from firm spending on IRD is significant in a firm’s decision to undertake product innovation, while business knowledge and codified knowledge does not influence such a decision with it having a slightly higher impact on product innovation than on process innovation. Innovation processes in Tanzania are thus more driven by the internal development of knowledge rather than the internal development of processes and skills.

Firm age does not influence the impact of internal knowledge on innovation indicating younger firms differ slightly with larger firms with respect to attributes that lead to greater impact of internal knowledge on innovation pertaining to innovation costs, better accommodation of innovators, and fresher ideas.

Tanzanian firms preference to generate knowledge through investing in IRD more than through training and staff recruitment is probably because output of IRD tends to be more sustainable than knowledge generated through training and staff recruitment. This is because knowledge obtained from staff training and recruitment may be depleted or totally lost in the face of employee turnover. Such sustainability is essential as it creates knowledge that enhances capacity to utilize external knowledge by increasing a firm’s ability to identify and take advantage of technological opportunities emanating from other firms by generating knowledge to do so. This is in line with Zahra and George (2002) who identified knowledge creation as essential for perpetual enhancement of capacity to utilize external knowledge by increasing a firm’s ability to identify and take advantage of technological opportunities emanating from other firms.

The insignificance of business knowledge and codified knowledge in influencing product and process innovation in firms in terms of training and recruitment may be a result of the fact that firms in the sample have little innovative experience with the most experienced commencing innovative activities in 2010. Such firms first need to develop an internal knowledge base that can effectively enable them to acquire or develop further knowledge. Development of an internal knowledge base is better undertaken by investing in IRD than on business and codified knowledge, which are more effective only after development of an adequate internal knowledge base hence, the influence of IRD on product innovation when external knowledge is ignored consistent with Goedhuys (2007) and Portelli and Narula (2003).

The chances of a firm undertaking product innovation is higher in Model 2 than Model 1, while the chances of a firm undertaking process innovation is higher in Model 5 than Model 4 implying internal knowledge (ignoring external knowledge) has greater impact on both product and process innovation than external knowledge (ignoring internal knowledge). Since external knowledge is usually more advanced than internal knowledge, greater impact of the latter in innovation is an indication of low absorptive capacity of local firms. This is in line with findings by Semboja and Kweka (2001) and Lane and Lubatkin (1998).

Joint Impact of Internal and External Knowledge on Innovation

Estimation results from Models 3 and 6 show the impact of external knowledge on firms’ product and process innovation activities given firms’ internal knowledge levels. The same variables that are significant in explaining product innovation in Models 1 and 2 are also significant in Model 3 while the variables that are significant in explaining process innovation in Models 4 and 5 are also significant in Model 6, namely purchase of machinery, equipment or software, year of firm establishment, sector firm belongs, and internal research and development for product innovation and the same variables except sector firm belongs for process innovation. Marginal effects however reveal much about the joint consideration of external and internal knowledge in influencing product innovation.
First, the impact of firm spending on internal research and development in Models 3 and 6 exceed that in Models 2 and 5 indicating external knowledge complements internal knowledge slightly more for product innovation than it does for process innovation. It furthermore indicates that the more developed a firm’s internal knowledge base, the more effective external knowledge sourcing is in facilitating innovation consistent with findings from Mohnen and Roller (2005) and Cassiman and Veugelers (2006) who found complementarity between internal knowledge and external knowledge in impacting product innovation. Therefore, despite the relative young age of the sampled firms, they have reasonable absorptive capacity necessary for effective utilization of external knowledge. This finding is consistent with Portelli and Narula (2003) who found magnitude of technological upgrading from external knowledge in Tanzania to be determined by capabilities within the industrial base. The fact that the sampled firms belong to the private sector implies they have a say on the nature of external knowledge acquired based.

Firms having a say on the nature of external knowledge acquired is important as it implies firms can acquire external knowledge based on internal knowledge capabilities which is necessary for raising technological capabilities through product innovation. This enhances capacity to adequately utilize external knowledge and thereby takes depth of existing internal knowledge into account which was identified by Wangwe (1983) and Wangwe et. al (2014) as necessary for raising the level of technological capability in Tanzania.

Second, the impact of purchase of machinery, equipment or software on a firm’s decision to undertake product and process innovation in Models 3 and 6 are lower than in Models 1 and 4 indicating lower influence of purchase of machinery, equipment or software in the presence of internal knowledge.

Although the impact of an independent variable shows the magnitude of its impacts on a dependent variable, it is calculated holding values of other independent variables constant. However, various variables may jointly affect the innovation processes implying the effect of a variable may fall short of revealing its actual impact on innovation. We can obtain better insight on the impact of different knowledge sources on innovation by analysing the impact of variation of two independent variables together because such analysis can reveal issues analysis of a single variable cannot. We undertake such analysis by analysing the predictive margins of two independent variables on product and process innovation i.e. joint impact of two variables on innovation.

The impact of purchase of machinery, equipment or software on a firm’s decision to undertake product and process innovation can be explained in the context of the relationship between purchase of machinery, equipment or software and firm spending on internal research and development. Fig.1 and Fig. 2 show the predictive margins of PEQP and IRD for product innovation and process innovation respectively.

**Fig. 1:** Predictive Margins of PEQP and IRD for Product Innovation
Figure 1 and Figure 2 show the effect of the purchase of machinery, equipment or software on a firm’s product and process innovation activities depend on a firm’s internal knowledge base emanating from its internal research and development activities. The increased impact of internal research and development can explain the lower effect of purchase of machinery, equipment, and software on product and process innovation because firms may undertake such purchases not only to facilitate product or process innovation but also to facilitate development of its internal knowledge base via enhanced internal research and development outputs.

Internal research and development and purchase of machinery, equipment, and software thus complement each other in product innovation processes. Figures 1 and 2 however reveal the impact of purchase of machinery, equipment or software given a firm’s level of internal knowledge base is far larger for product innovation than it is for process innovation indicating product innovation is more constrained by lack of external knowledge than process innovation.

Third, the impact of YEAR and SECTOR on innovation in Model 3 exceeds those in Models 1 and 2 implying the joint consideration of external and internal knowledge enhance the impact of these explanatory variables on a firm’s product innovation activities. Fig. 3 - Fig. 5 show the predictive margins of YEAR and PEQP for product and process innovation respectively and SECTOR and PEQP for product innovation.

Fig. 3: Predictive Margins of YEAR and PEQP for Product Innovation
Figures 2 - 5 show external knowledge acquisition through purchase of machinery, equipment, and software is more effective in facilitating product innovation for older firms and firms in the services sector than for relatively younger firms and firms in the manufacturing sector while external knowledge acquisition through purchase of machinery, equipment, and software facilitates is more effective in facilitating process innovation for older firms with the sector a firm belongs to not impacting process innovation. This may be explained by the fact that older firms have begun to undertake measures to develop an internal knowledge base that can effectively enable them to acquire external knowledge or invest in internal research and development that enhances the probability of undertaking product innovation.

Purchase of machinery, equipment, and software furthermore enhances services firms likelihood of undertaking product innovation probably because of their lower capital needs relative to manufacturing sector firms which make them less costly with respect to financial resources to innovate than manufacturing firms. Availability of such resources implies service sector firms are more likely to have more developed internal knowledge bases in
a shorter period than manufacturing firms that lead to greater impact on product innovation than for manufacturing firms. Figure 5 and Figure 6 show the predictive margins of YEAR and IRD for product and process innovation respectively and SECTOR and IRD for product innovation.

**Fig. 6:** Predictive Margins of YEAR and IRD for Product Innovation

![Fig. 6](image)

**Fig. 7:** Predictive Margins of YEAR and IRD for Process Innovation

![Fig. 7](image)
Figures 6 – Figure 8 reveal firm spending on internal research and development has greater impact on a firm’s product and process innovation activities the older a firm is. Furthermore, being in the service sector enhances the impact of firm spending on internal research and development on product innovation. This may be because older firms have had more time to develop their internal knowledge base and are thus in a better position to identify and utilize technological opportunities emanating from outside the firms. In terms of the sector production innovation occurs, services sector firms have lower capital needs relative to manufacturing sector firms which make them less costly with respect to financial resources to innovate than manufacturing firms resulting in them facing less financial barriers.

The chances of a firm undertaking product innovation in Model 3 exceeds the those in Model 1 and Model 2 indicating external knowledge sources complement internal knowledge sources by raising the likelihood of firms to undertake product and process innovation. This is because apart from external knowledge being utilized to undertake innovation, it is also utilized to enhance the internal knowledge base required to effectively identify and utilize external knowledge for innovation. The chances of a firm undertaking process innovation in Model 6 exceeds the chances of undertaking process innovation in Model 4 but is slightly lower than the chances of undertaking process innovation in Model 5 indicating a firm’s internal knowledge base plays a greater role than external knowledge in enhancing process innovation. This finding is consistent with Goedhuys (2007) who found local firms in Tanzania focused more in internal knowledge creation to offset weak linkages with foreign firms.

Figures 6–8 reveal that firm spending on IRD has greater impact on a firm’s product and process innovation activities the more innovative experience a firm has. Furthermore, being in the service sector enhances the impact of firm spending on IRD on product innovation. This may be because older firms have had more time to develop their internal knowledge base and are thus in a better position to identify and utilize technological opportunities emanating from outside the firms. In terms of the sector in which product innovation occurs, services sector firms have lower capital needs relative to manufacturing sector firms which make them less costly with respect
to financial resources to innovate than manufacturing firms resulting in them facing less financial barriers.

The chances of a firm undertaking product innovation in Model 3 exceeds those in Model 1 and Model 2 indicating external knowledge sources complement internal knowledge sources by raising the likelihood of firms to undertake product and process innovation. This is because apart from external knowledge being utilized to undertake innovation, it is also utilized to enhance the internal knowledge base required to effectively identify and utilize external knowledge for innovation. The chances of a firm undertaking process innovation in Model 6 exceeds the chances of undertaking process innovation in Model 4, but is slightly lower than the chances of undertaking process innovation in Model 5 indicating a firm’s internal knowledge base plays a greater role than external knowledge in enhancing process innovation. This finding is consistent with Goedhuys (2007) who found local firms in Tanzania focused more in internal knowledge creation to offset weak linkages with foreign firms.

Factors Affecting Commercialization of Innovation Activities in Firms

The analysis involved examination of factors determining commercialization of innovation activities of firms in Tanzania employing the Tanzania Enterprise Survey 2013, Innovation Follow-up Survey data. The analysis employed a Heckman selection model given commercialization involved two stages, namely innovation and diffusion of the innovation. The first stage (selection equation) defines a binary variable that indicates the category into which the observation falls while the second stage (regression equation) entails estimating the outcome of interest (commercialization) given the first stage provided a positive outcome (innovation).

The dependent variable for the selection equation was firm attempts to develop innovative products while the dependent variable for the regression equation was the percentage of a firm’s total sales represented by sales from its main innovative product or service. The selection and regression equations had the same independent variables. These are the sector of economy firm belong to, firm cooperation with domestic firms, and cost reducing motive for engaging in product innovation which are environmental level independent variables.

Firm level independent variables were knowledge acquisition through purchase of equipment, machinery or software, purchase of intangible technology, changes undertaken by a firm in promotion of its products or services, and changes undertaken by a firm in advertising its products or services. Innovation level independent variables were firm funding of internal research and development, firm funding of external research and development, recruitment of staff for innovation purposes and staff training. Table 4 shows results of selection and outcome equations of the Heckman Model of Commercialization.
Table 4: Results of Selection and Outcome Equations of the Heckman Model of Commercialization

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<td></td>
</tr>
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Number of obs = 543
Censored obs = 424
Uncensored obs = 119
Wald chi2 (11) = 134.23
Prob > chi2 = 0.0000
*: p<0.10; **:p<0.05; ***:p<0.01

rho = -0.5689904
sigma = 15.21377
lamba = -8.656488
Environmental Level Factors

The cost reducing motive for engaging in innovation (MCOST) significantly impact both the selection and outcome equations with it increasing the chances of a firm commercializing the innovative product it produces by about 18 percent. The fact that cost reduction influences both production innovation and commercialization of innovative products indicates firms are concerned about high production costs that negatively impact firm revenue from a given product range. Such firms pursue product innovation to overcome high production costs by innovating and commercializing new products that will lead to increase in revenue.

Belonging to the manufacturing sector reduces a firm’s chances of undertaking product innovation. This is probably because the size of the service sector is more than 4 times larger than the manufacturing sector in Tanzania implying there is a higher likelihood of product innovation occurring in the service sector than the manufacturing sector. Furthermore, service firms require less capital than manufacturing firms because production in the service sector tends to be less costly than production in the manufacturing sector.

Product innovation is thus less costly to pursue in the service sector relative to the manufacturing sector implying less financial barriers to product innovation in the services sector than in manufacturing sector. Although the sector a firm belongs to influences chances of a firm undertaking product innovation, it does not influence commercialization of innovative products. This indicates the production costs differences between manufacturing and service sector firms do not influence commercialization, which is rather determined by firm level and innovation level factors.

Cooperation with domestic firms (CODF) significantly influences commercialization of innovative products although it does not influence a firm’s decision to undertake product innovation indicating domestic firm links do not influence firms’ decisions to undertake product innovation. Cooperation with domestic firms however significantly influences commercialization of innovations by increasing commercialization by about 19.5 percent, which is the highest for the three variables influencing commercialization of innovations. This is because it leads to greater benefits pertaining to building commercialization capabilities that are determined by such factors as marketing, distribution, and sales capacities and are crucial for commercialization. This is consistent with Marx et al. (2014), Datta et al. (2012) and Gans and Stern (2003) who identified complementary assets such as manufacturing, distribution, marketing, sales, and support capabilities as being crucial for commercialization. Domestic links are thus more important to a firm after it undertakes product innovation and has a product to offer than when it is pursuing product innovation because such links enhance commercialization capabilities like marketing, distribution, and sales capacities than it does production capabilities that are more influenced by external knowledge acquisition.

Firm Level Factors

Firms’ knowledge acquisitions through purchase of equipment, machinery or software (PEQP) and intangible technology (PINT) significantly enhance their chances of undertaking product innovation although they do not influence commercialization of innovations. Product innovation in Tanzania is thereby driven more by external acquisition of knowledge through buying technology than investing in internal research and development. This is probably because of low levels of technological capability that constrain firms’ capacities to undertake adequate internal research and development. This finding is consistent with Portelli and Narula (2006) and Szogs (2004).
Marketing factors such as changes undertaken by a firm in promotion of its products or services (PROMOTE) and changes undertaken by a firm in advertising its products or services (ADVERT) do not influence firms’ chance of undertaking product innovation or commercialization of innovations. This indicates most firms do not pursue product innovation market strategy formulation simultaneously that enable firms to adapt to changing markets and technologies and thereby enhance chances of firms successfully commercializing their innovated products.

For firms that pursue product innovation market strategy formulation simultaneously, insignificance of changes undertaken by firms in promotion and advertising of their products or services in influencing commercialization may be due to the fact that implementation of market strategies do not yield results overnight but rather take some time to yield expected results. The period of 3 years that the data focuses on may therefore be too short for a marketing strategy to yield results. However, once firms marketing strategies come to fruition, firms will likely be able to adapt to changing markets and technologies that will likely lead to commercialization of their innovation (Gilson and Shalley, 2004).

**Innovation Level Factors**

Innovation level independent variables are firm funding of internal research and development (IRD), firm funding of external research and development (ERD), recruitment of staff for innovation purposes (RECRUIT) and staff training (TRAIN).

Firm funding of external research and development (ERD) significantly influences product innovation and commercialization of innovations although in opposite direction. Funding of external research and development enhances chances of firms undertaking product innovation by increasing the capacity of internal knowledge to influence product innovation (Portelli and Narula, 2006). Firm funding of external research and development enhances chances of firms undertaking product innovation by enhancing a firm’s internal knowledge base.

Firm funding of external research and development reduces commercialization of innovations by 17.4 percent. This counterfactual result may probably be because funding of external research and development requires a longer-term commitment than purchasing equipment, machinery or software and intangible technology and is thereby more costly and requires more resources to pursue. Funding of external research and development thus tends to crowd out investment in other factors influencing commercialization such as developing and maintaining cooperation with domestic firms as well as shifting focus from cost reduction to development of new products which significantly influence commercialization.

Although shifting focus of firms from cost reduction to development of new quality products may reduce commercialization of innovations in the short run, it is likely to increase commercialization in the long run because quality products eventually attract customers. The negative impact of firm funding of external research and development is thus most likely a temporary phenomenon in the short run as the result of funding of external research and development will likely enhance commercialization of innovations as long as it leads to introduction of quality products.
References


