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Title

ICT and Entrepreneurial development in Low and Lower-Middle Income Countries

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Summary

Entrepreneurship is considered as important factor of economic growth and development and has recently gained the attention of politicians and policy makers in developed and developing countries alike. Yet the existing literature of entrepreneurship development is concentrated in developed countries. This study sheds light on what drives entrepreneurial development in the form of new business formation in low and lower middle-income countries.

Investigation of the abilities of individuals to spot entrepreneurial opportunities has been the focus of previous studies of entrepreneurship. Recently, the focus of entrepreneurship studies has shifted towards exploring the role of knowledge spillovers and complementarities in opening entrepreneurial opportunities. ICTs serve as the main tools of knowledge management and diffusion in today's knowledge based and globalized economies. The aim of the study is to investigate the role of ICTs in fostering new business creation in the low and lower middle-income countries. It also attempts to identify which forms of ICT are most important to which regions. The role of the institutional factors namely business regulatory frameworks, transparency and accountability of the public sector, cost of start-up procedures, access to finance and time to start a business are analysed. The study uses the World Bank development indicators and doing business datasets for 42 low and lower middle-income countries. The data is analysed using IV fixed effects and GMM regression techniques.

The study finds that internet, measured by density of fixed broadband subscriptions, has positive effect on new business formation in low and lower middle-income countries. This indicates that entrepreneurial knowledge could be disseminated through usage of ICTs which intern promotes exploitation of new business opportunities. This finding supports the theory of opportunity entrepreneurship. Dissection of the results by region shows that access to internet can foster entrepreneurship in Asia while access to ICT goods is important in Africa. This could be due to relatively more pronounced knowledge spill-over in Asia because of the existence of large modern industries in countries like Japan, Korea and China, while improving data management and communications using computer and cell phone, for example, is more important in Africa.

The result in general supports the entrepreneurship theory of knowledge spill-over, which postulates that knowledge production and spillover creates entrepreneurship opportunities, and that ICTs play important role in the dissemination of entrepreneurial knowledge. Moreover, ICT could also promote entrepreneurship by enabling better work organization and information communication even in regions, such as Africa, where there is limited possibility for knowledge spillover.

Keywords: New business formation, Entrepreneurship, Information and Communication Technology, Knowledge spillover.

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Dedication

I dedicate this thesis to my lovely kids Rushdi and Remli, my husband, and my parents.

Foreword

This thesis is part of one-year MSc. program in Urban Management and Development at the Institute for Housing and Urban Development (IHS), Erasmus University Rotterdam, Netherlands. The purpose of this study to analyse the impact of ICTs usage on density of entrepreneurship in low and lower middle-income countries.

Abbreviations

AfDB	African Development Bank
FBB	Fixed Broad Band
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
GMM	Generalized Method of Moments
GNI	Gross National Income
ICT	Information Communication Technology
HIS	Institute for Housing and Urban Development
IV	Instrumental variable
LAC	Latin American and Caribbean
LLMI	Low and Lower Middle-Income
OECD	Organization for Economic Cooperation and Development
SMEs	Small and Medium Scale Enterprises
SSA	Sub-Saharan Africa
UNDP	United Nations Development Program

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Chapter 1: Introduction

1.1. Background of the study

Many theorists consider new business creation as entrepreneurship (Mises 1949, Baumol1993, Van Praag, 1999, Wennekers and Thurik, 1999, Audretsch et al., 2006, Anokhinet al. 2008). There is also growing empirical evidence about the contribution of entrepreneurship for growth and promotion of innovation (Dejardin 2000; Acs et al. 2008). Definition of entrepreneurship in the Schumpeterian literature is mostly viewed by the intrinsic features of the 'entrepreneurs' who own the process. The entrepreneur bears risk and uncertainty to function in circulation of economy and balance supply and demand of the economy (Jennings, 1994; Van Praag, 1999). Accordingly, entrepreneurs take risk to form new business enterprise, to develop new products or to use new production method. This distinct way of revolutionizing existing systems of doing business generally is called Entrepreneurship (Schumpeter, 1934, Naudé, 2011). Different factors drive entrepreneurship and these factors can be categorized as pull or push factors. Pull factors such as opportunity to innovation, expected possibility of growth of income (Sriram and Mersha, 2010) and spillovers (Iandoli, 2008) may attract individuals to start new business. On the other hand, factors such as frustration with current job or unemployment may push one to entrepreneurship (Masurel et al., 2002).

In the most recent theories of entrepreneurship, opportunity and environment of entrepreneurship has gained attention (Venkataraman, 1997; Shane and Eckhardt, 2003). The prevailing approach holds entrepreneurial opportunities as exogenous and given while the nature of opportunities varies which could also explain why some individuals choose to start entrepreneurship, while yet others do not (Shane and Eckhardt, 2003; Audretsch and Keilbach, 2007). Difference in access to information and financial and human capital can explain why entrepreneurial drive is different across individuals or regions (Audretsch and Keilbach, 2007). Audretsch and Keilbach (2007) stated that "the existence of a perceived entrepreneurial opportunity and the intent to act on that opportunity triggers entrepreneurship." One of the crucial pull factors that determine entrepreneurship level is technological advancement. Technological innovation and diffusion, in turn, is facilitated by the development of information and communication technology (ICT) infrastructure (Asongu and Nwachukwu, 2018). ICT is a speedily diffusing technology globally and can foster innovation in developing countries by providing firms and individuals opportunity to acquire new knowledge (World bank, 2016). Innovation helps firms to improve their productivity and national economies to develop through creating employment and increasing export density. ICT enhances the performance of business firms by facilitating transfer of knowledge, reducing transaction cost and promoting innovation (Baliamoune, 2003; Vu, 2011).

While ICT could generally foster economic development, it may, however, reinforce the gap between the developed and the developing countries (Baliamoune, 2003; Robson et al., 2009). This could occur due to limited access to ICT and lack of necessary infrastructure and institutional capability to make effective use of ICT technology. Developing countries in

general have lower concentration of ICT (Tanburn et al., 2001; World Bank, 2016). For example, only 31 percent of the population in developing countries had access to internet in 2014, while the figure was 80 percent in high-income countries (World Bank, 2016). Such limited access to ICT concentration might have contributed to the slow growth of entrepreneurship in developing countries, such as, Sub-Saharan countries, compared to developed countries (Sriram and Mersha, 2010; Naude,2009).

Significant efforts have been made, so far, to analyse the impact of ICT development on firms' productivity. There are some empirical evidences suggesting the positive role of ICTs in promoting entrepreneurship both in formation and early stage development; and productivity of existing firms (Chew and Han Ei, 2011; Asongu and Nwachukwu (2018). Now days, the internet is becoming an alternative opportunity to explore new ways and ideas for youth entrepreneurs. However, limited research is done on the role of ICT for business innovation and development of new firms in economically emerging countries. This study is intended to address this research gap by analysing the role of ICT on business formation in low and lower middle-income countries.

1.2. Problem Statement

It is estimated that 29 million youth would join the labour force in Africa each year between 2015 and 2030 (AfDB, OECD., and UNDP, 2017). Youth unemployment rate is also high in urban areas of sub-Saharan Africa (Fox et al.,2016). Absorbing such a considerable number of new entrants would pose a major challenge to most governments of developing countries. Thus, fostering entrepreneurial capability and entrepreneurship should constitute part of the developmental packages of these countries.

Success and promotion of entrepreneurship are determined by several factors such as indigenous knowledge and expertise, business environment and policy support from governments (Cunningham et al., 2016). Robson et al. (2009) argued that promotion of entrepreneurship and innovation in developed countries widened the gap between the living standards of the developed and developing world. One of the reasons might be that developing countries have not been exploiting the growth potential of entrepreneurship. However, the driving factors of entrepreneurship could be different in these economies.

The institutional and economic environment in less developed nations is claimed to be unfavourable to entrepreneurial development. In contrast, there are more entrepreneurial potentials and demand for entrepreneurship in these countries (Naudé, 20011). Such a high demand could be driven by the high market demand, low GDP per-capita, high level of poverty and high level of urban unemployment rate among others. Thus, enterprise creation is becoming a vigorous element in the economic development of developing countries (Drucker 1995).

Modern technologies are shown to be the promises for exploiting new ways of doing business and emerging new sectors. Some of the biggest cities of Africa, for instance, Cape Town, Lagos and Nairobi, are evolving as centres for new international business ventures (AfDB, OECD, and UNDP, 2017). In this regard, ICTs have been viewed as a driver of economic growth in the emerging knowledge-based economy. In most countries usage of ICT is associated with promotion and growth of business and inspiring competitiveness in global economy. ICTs are pervasive, and they can positively impact economic development in many ways both supply and demand sides. ICTs facilitate the transfer of knowledge and diffusion of technology, foster innovation, reduce transaction costs and facilitate automation, which together enhances incubation of new firms and their productivity (Vu, 2011). Nelson and Pack (1999) argued that the miraculous economic growth achieved by the "Asian Tigers" during the last half-century was nurtured by export oriented public policy, acquisition of external knowledge, innovation and learning by doing. It is, therefore, increasingly felt that developing countries should enhance their global competitiveness through the acquisition of knowledge and usage of ICTs.

Despite the large body of literature on the impact of ICT on productivity and economic growth, there is considerable concentration of the studies in developed countries. Moreover, most studies focused on the ICT's role on productivity of existing firms not on its potential for creation of new businesses. Generally, little is known about the economic impact of ICT, specifically on new business formation, in developing countries. As a result, there is a dilemma among policy makers about whether to extend scarce public fund to the building of ICT infrastructure or concentrate on other basic and pro-poor sectors such as health, water and housing. Hence, more studies based on rigorous methodologies are needed, especially in low income countries. This study, therefore, is motivated to fill this research gap.

1.3. Research objectives

The general objective of the study is to investigate the influence of ICT on new business formation in low and lower-middle income countries.

1.4. Research questions

The proposed study was aimed to answer the question 'to what extent has ICT usage impacted business start-ups in developing countries?'

1. What is the trend of ICT usage in low and lower-middle income countries?
2. What is the trend of new formal business formation in low and lower-middle income countries?
3. To what extent has ICT impacted formation of new formal business ventures in low and lower-middle income countries?

4. Which form of ICT impact the formation of new formal businesses in low and lower-middle income countries?
5. Which institutional factors determine the role of ICT on formation of new formal businesses in low and lower-middle income countries?

1.5. Scope of the study

The study was limited to analysing the impact of ICT usage on intensity of entrepreneurship in low and lower-middle income countries. ICT usage of nations and density of new business formed per year have been used. The impact of ICT on productivity, survival and performance of firms will not be studied. Geographically, the study will focus only on Africa, Asia and Latin America and Caribbean and use the World Bank datasets from year 2006 to 2016. Since the available data used is not composed by entrepreneurial sector and entrepreneurial drive, the present study is based on aggregate density of business ventures, and not on sectoral composition.

1.6. Limitation of the study

Although the research scope was well defined, the researcher has faced some unavoidable limitations regarding the data and methodology used. The available datasets have missing data of the identified variables which could distort the result of the analysis. To minimize the influence of this challenge, the variables with missing values were interpolated using linear interpolation method that constructs new data points within the range of a separate set of known data points. The nature of the data and research question were prone to country heterogeneity and reverse causality problems respectively. Several tests and two estimation techniques namely instrumental variable regression using fixed effect and system generalized method of moments (GMM) estimation were used to address the mentioned methodological challenges. In addition, possible effects of sectoral differentiation of new business ventures are not taken in to account which could direct to more precise policy recommendations.

1.7. Significance of the study

The main contribution of this study is that it provides empirical insight on the impact of ICT development for entrepreneurship in developing countries where the entrepreneurship literature is limited. The study especially has explored the micro-foundations of the link between ICT and business start-ups. It complements previous studies that show positive role of ICT on entrepreneurship promotion (Giaoutzi and Vescoukis 2006; Leitao and Baptista 2011; Tiarawut 2013; Viju2010Alderete, 2017, Asongu and Nwachukwu, 2018). The result of the study sheds light on how to exploit ICT to direct the entrepreneurial development in developing countries as it identifies the form of ICT that influenced business formation for the last decade. The finding of the study is also informative for public policy makers of developing countries since it identifies the institutional factors that determine the impact of ICT in promoting new business ventures.

Chapter 2: Review of Literature

This chapter of the study discusses the theoretical bases of entrepreneurship and the empirical evidences about how ICT and development of doing business correlate. It presents the key concepts shaping the study. In the chapter, the essence and drivers of entrepreneurship, the entrepreneurship ecosystem which determine entrepreneurial activities and the role of ICT in promoting entrepreneurship are discussed. It also includes the trend of entrepreneurship in developing countries.

2.1. Essence of Entrepreneurship

The entrepreneurship literature calls the formation of any new business organization entrepreneurship. For example, Gartner (1989) stated that firm start-up is typical form of entry in an industry. Lumpkin and Dess (1996) also asserted that "new entry is the act of launching a new venture, either by a start-up firm, through an existing firm or via internal corporate venturing". The Global Entrepreneurship Monitor (GEM) measures the degree of entrepreneurial development of a region or economy by the total early-stage entrepreneurial activity (TEA) rate. TEA measures the proportion of adult individuals, who are in the age range of 18 to 64, the population that are engage in entrepreneurship and ownership of new firm (Kelly et. al, 2012).

Entrepreneurs are considered as innovators. The entrepreneur as the innovator transforms ideas and innovations into productive entity (Baumol, 1993). For example, a recent study shows that new start-ups and firms younger than 5 years were the main net job creators during 1980-2005 in the United States (Haltiwanger, Jarmin, & Miranda, 2009).

Entrepreneurs can be driven by necessities or opportunities (GEM, 2017; Margolis, 2014). Necessity-driven entrepreneurs start a business because they lack other feasible opportunities for wage employment and sufficient income sources. They are not considered as true entrepreneurs since they use already available tools and process, and do not have innovative ways of production or market potentials (Margolis, 2014). Opportunity-driven entrepreneurs, on the other hand, track the returns and work freedom they would gain. They are ambitious and innovative with strong growth motivation (GEM, 2017; Nagler and Naudé, 2017).

Margolis (2014) argues that the prevalence of choice and necessity-driven self-employment in an economy is a function of several factors. Firstly, the presence or absence of "formal and informal social protection" which determines individuals' access to alternative income sources. Countries with weak social protection system tend to have necessity driven entrepreneurship. Secondly, countries with high information friction in their labour market are likely to have a greater number of citizens who have difficulty of finding wage jobs. Thirdly, the capability of employers to provide employment depends on the business environment such as access to capital, tax system, level of corruption and effectiveness of legal framework, business

registration or licensing procedure and labour market regulations. When the business environment constrains employers to hire more workers, the share of self-employment tends to have high necessity-driven entrepreneurs (Margolis, 2014).

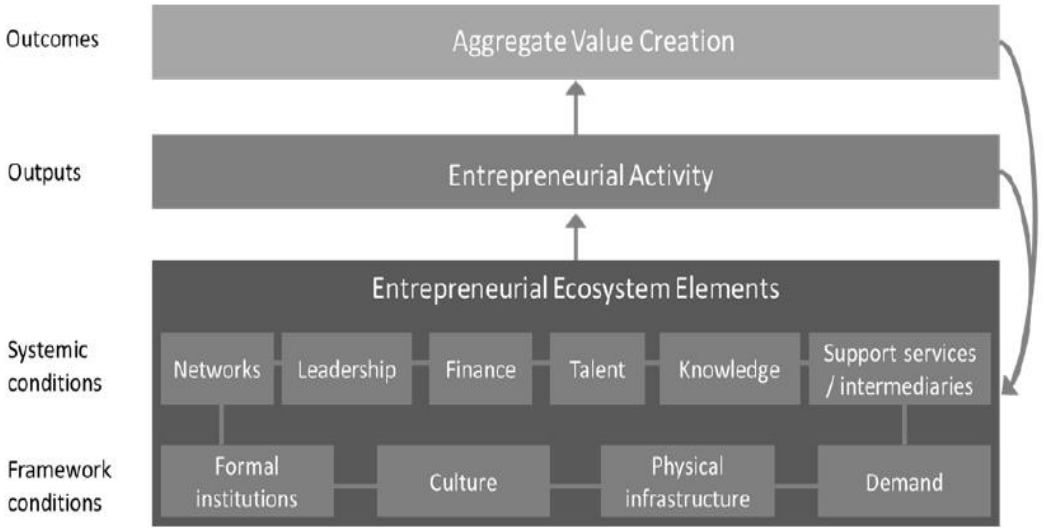
Empirical evidence shows that entrepreneurs in developed countries tend to focus on innovative start-ups which could add value to the country's economy (Leitão and Ferreira, 2007; Iandoli, 2008). In contrast, most entrepreneurs in developing countries engage in the provision of low-cost goods that are already available in the market and less innovative. Thus, the start-ups can be directed to innovative by knowledge transfer from large firms, skilled human capital, financial capital and regional and global networks among others.

2.2. Entrepreneurial Ecosystem

Starting a business is a function of several individual, institutional and systemic factors. Wennekers and Thurik (1999) argue that the crucial factors of entrepreneurship development include access to starting capital, entrepreneurial capability and economic environment. The economic environment of regions and cities determines entrepreneurship to exist and function as entrepreneurs are highly reliant on their environment. The entrepreneurial ecosystem involves interaction of independent actors enabling or hindering entrepreneurship. The Global Entrepreneurship Monitor (GEM) (2017) describes entrepreneurial ecosystems as "…dynamic institutionally embedded interaction between entrepreneurial attitudes, abilities and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures." When the entrepreneurial ecosystem is healthy, the process will lead to efficient uses of resources. Vogel (2013, p. 446) also pronounces this system as "an interactive community within a geographic region, composed of varied and inter-dependent actors (e.g. entrepreneurs, institutions and organizations) and factors (e.g. markets, regulatory framework, support setting, entrepreneurial culture), which evolves over time and whose actors and factors coexist and interact to promote new venture creation".

As developed by Stam and Spiegel (2016), the Figure 1 depicts the elements of entrepreneurial ecosystem which are categorized as framework conditions and systematic conditions. The framework conditions are composed of institutions, societal culture, physical infrastructures influencing social interactions and extent of demand for goods and services. Institutions have significant role for intensity of ICT usage as institutions set the framework for the utilization of several factors of production through different mechanisms (Martinez and Williams, 2010). When "institutional voids" exist in a society, taking the risk of doing business become uneasy, restraining global competitiveness of national economy (Khanna and Palepu, 1997). The physical infrastructure includes some of forms of ICT which interact with demand, culture and formal institutions (Isenberg, 2011).

Figure 1: Key elements, outputs and outcomes of the entrepreneurial ecosystem



Source: Stam and Spiegel, (2016)

The second element of the ecosystem includes the network and leadership ability of entrepreneurs, access to finance and knowledge and support services. Network of entrepreneurs affords information flow. This enables distribution of knowledge and human and financial capital (Audretsch and Keilbach, 2007; Stam and Spigel, 2016). These interactions have ultimate impact on output of entrepreneurial activities and welfare outcomes as indicated by Stam and Spigel (2016). The systemic conditions, especially network and knowledge, are accelerated by ICTs (Audretsch and Keilbach, 2007; Leitão and Ferreira, 2007). ICT technologies promote dissemination of entrepreneurial knowledge and information through their platforms. Ease in accessibility of information reduces market information asymmetry and thereby cost of doing business. Networking through ICT technologies reduces geographical barrier between various actors of the entrepreneurial ecosystem. Since the focus of the present study is the role of ICT, a more detailed account of the literature on the impact of ICT on entrepreneurship development is provided in the following section.

2.3. Impact of ICT on Entrepreneurship

Recently in the field of entrepreneurship, there is an approach shift from focusing on individuals with entrepreneurial intentions (equilibrium-approach) towards emphasizing the nexus of these individuals with opportunities (opportunity-approach) (Venkataraman, 1997; Shane and Eckhardt, 2003; Audretsch and Keilbach, 2007). Venkataraman (1997) argued that

'knowledge and information difference, cognitive and behavioural' difference, potentials factors of opportunity exploitations, have been ignored from entrepreneurial researches. Following this argument, in their proposition of opportunity-based approach, Shane and Eckhardt (2003) stated that "the basis for entrepreneurial activity is rooted in an economic system in which information is unevenly distributed across people. It is the possession of idiosyncratic information that leads to the existence and identification of entrepreneurial opportunities, opportunities to obtain and use resources in the search for profit." Knowledge spillover theory of entrepreneurship postulates knowledge as key source of entrepreneurial opportunities Audretsch and Keilbach, 2007). According to the theory, entrepreneurial opportunities are not given and static but rather systematically formed by "investments in knowledge which is created in an incumbent firm or organization but not completely or exhaustively commercialized by that organization" Audretsch and Keilbach, 2007, p. 1253). Thus, more entrepreneurship opportunities exist in contexts where there is higher knowledge Audretsch and Keilbach, 2007). Different forms of ICT play important role in disseminating this kind of knowledge and information, the most valuable commodity in today's economic and market society. Wennekers and Thurik (1999) argued that ICT eases market entry, thereby promotes entrepreneurial development and innovation by enabling more firms start business Thus, ICT as a one pulling factor is important to promoting opportunity-driven entrepreneurship in developing and emerging economies.

ICT is increasingly considered as the driver of economic growth in the new knowledge-based economy. ICT is a general-purpose technology (GTP) referring to "technologies that are used for collecting, storing, editing and passing on (communicating) information in various forms" (Kundishora, 2014, p. 3). ICT enhances the opportunity for firms to acquire external knowledge which will foster development through promoting innovation, export, enterprise development and creation of employment opportunities for the mass (Nelson and Pack, 1999). More recently, ICT is also believed to influence macro-economic transformation such as the development of the private sector. In many OECD considered, ICT served as "a powerful agent for economic development and transformation" through its direct and indirect impact of cost reduction enhancing trade flows in the service and production industries (OECD, 1989, p. 12).

Based on Schumpeter's (1940) theory of creative destruction, many studies including Barras (1990), Evangelista (2000) and Miles (2005) considered ICT to be a driver of innovation which fosters dynamic process of creative destruction. Schumpeter's theory of creative destruction proposes that new innovative firms and products displace the existing non-innovative ones. ICT's role in determining entrepreneurial activities also has recently gained the attention of other researchers (Leitão and Ferreira, 2007; Iandoli, 2008; Alderete, 2017 and Asongu and Nwachukwu, 2018). ICTs, contribute in breaking geographic barriers in today's global economy. Information also becomes a valuable commodity in today's competitive global market. Wennekers and Thurik (1999) argued that entrepreneurship becomes more important than it has been because of globalization and ICT. Though ICT is a GPT, not a direct production technology, it can also play as a production technology for some industries for example online business and marketing.

Though the relationship between ICT and entrepreneurship does not seem to have been well studied, there are some empirical evidences suggesting a positive relationship between the two concepts. Based on their investigation of three Polish companies' rate of new product development and market creation, company permanency and growth of employment, Janson and Wrycza (1999) concluded that the deliberate use of information technology is positively related with entrepreneurship concentration. Similar evidence was also found in Leitão and Ferreira (2007), a comparative study on ICT investment between German and Portugal firms using Vectorial Autoregression (VAR) model. The study revealed the existence of significant and positive effect of public regulations aimed at reinforcing investment in ICT, on levels of new business and employment rate. Another study by Asongu and Nwachukwu (2018) showed that ICT is important in influencing openness to facilitate business start-ups. According to the study the time required to start a business was shown to be decreased when ICT interacts with openness in sub-Saharan African countries (Asongu and Nwachukwu, 2018). Alderete (2017), using GEM dataset for both developing and developed countries for the period 2007 to 2012, also found that mobile broadband penetration at country level has a positive and significant role in determining entrepreneurial activity.

Despite the evidence on the positive impact of ICT on business start-up, it may also displace existing firms. In this regard, Iandoli (2008) showed that ICT and inward FDI have net negative impact on business ownership rates. This study was a comparative analysis between Finland and Portugal and suggested that any positive influence of the mentioned variables is exceeded by their effect on displacing the existing inefficient and less-innovative firms by more competitive new enterprises. However, the study measured entrepreneurship only as "proportion of business owners in the labour force" which does not account the number of new businesses and their growth potential in these countries.

The above theoretical links and empirical evidences indicate that ICT could foster entrepreneurship growth. Some factors such as institutions and business environment could also cultivate ICT to influence the development of entrepreneurship (Margolis (2014).

Now days, more individuals in developing countries own a mobile phone than ever before (World Bank, 2016). The concentration rate reached 70.1 percent in 2010 (International Telecommunication Union, 2011). The number of internet users also has grown from 1 billion to 3.2 billion between 2005 and 2015 (World Bank, 2016). Despite this, only about 1 percent of the work force is engaged in the ICT sector in these countries (World Bank, 2016). Even though ICT concentration in developing countries is insufficient compared to the developed countries, some countries are benefiting from its potential to their development. For example, the Indian software industry has grown speedily, contributing 10 per cent of the growth in India's GDP (Tanburn et al.,2001).

2.4. Entrepreneurship in low income countries

Rate of business start-ups vary in different industries and regions. This could be an important factor behind the disparities of economic performance across regions and countries (Naudé and Gries, 2009). Audretsch (1995, p. 63) stated that, "due to differences in the underlying knowledge structure, new-firm start-ups tend to be more important in industries that can be characterized as having an entrepreneurial technological regime. New firms tend to be less important in industries with a routinized technological regime". Dess and Lumpkin (1996) stated that innovativeness shows business owners capability to involve in and support new ideas or processes. The nature of innovation could differ, though, "innovativeness represents a basic willingness to depart from existing technologies or practices and venture beyond the current state of the art" (Lumpkin and Dess, 1996, p. 143).

Developing countries are generally less innovative and their economy is dominated by agriculture compared to developed countries. This lack of innovativeness and dominance of traditional agriculture results in small, fragmented and weak markets which in turn lessens the return on investment. Low and lower middle-income countries have less than 1 density of new business density (as measured by number of newly registered companies with limited liability per 1,000 people aged 15-64), 0.21 and 0.94 respectively (Cala et al., 2015). Less than one fifth of Africa's adults who are engaged in running new businesses are engaged in producing new goods and services which is lowest from other regions of the world (AfDB, OECD, UNDP, 2017).

Entrepreneurship in developing countries is also constrained by weak institutions and lack of enabling environment. Such lack of appropriate infrastructural and institutional arrangement hampers diffusion of technologies. This situation also increases the costs of doing business (Szirmai, Naudé and Gries, 2009). A study by the International Finance Corporation and the World Bank (2013) on "Doing Business in the East African Community", indicates only 10 of Sub-Saharan African countries rank in the top 100 out of 185 countries in cost of starting and doing business. Moreover, studies revealed that starting and running business in Sub-Saharan Africa is associated with uncertainty and takes longer time and procedure (Asongu and Nwachukwu, 2018). Inefficient and ineffective government policies and regulations are blamed for Africa's entrepreneurial challenges.

While most studies consider entrepreneurship as a choice in developed economies (Margolis, 2014; Stam and van Stel, 2009), the essence of entrepreneurship is viewed differently in the context of less developed economies. Most studies revealed self-employment in developing countries is driven by push factors mainly absence of opportunities of wage-jobs. Roy and Wheeler (2006) found that the main reason for starting business in the four urban areas of West Africa, namely Benin, Burkina Faso, Niger and Togo, is necessity or poverty instead of opportunity.

Although entrepreneurship, especially opportunity oriented one, remains low in developing countries, the importance of the private sector has been recently growing. This change is evident in the increased recognition of the importance of SMEs in creating jobs for the growing labour force of the continent (Lyakurwa, 2009). For instance, small firms with less than 20 employeesand younger than 5 years provide the most jobs in the formal sector of Africa (AfDB, OECD., and UNDP, 2017). Similarly, SMEs accounted 18% of the GDP of Kenya in 2003 (Benzing and Chu, 2009) and almost half of South Africa's GDP (Robinson, 2004). Nagler and Naudé (2017), using the World Bank's LSMS-ISA dataset for Ethiopia, Malawi, Niger, Nigeria, Tanzania and Uganda, also revealed that 38% of households in these countries run own business. According to this study, non-farm entrepreneurship is dominant in these countries, however, it's contribution to employment creation is very limited as most household enterprises do not employ workers.

2.5. Conceptual Framework

Most entrepreneurship studies focus on the performance and survival of enterprises, ignoring what drives entrepreneurship. Which factors foster, or limit entrepreneurship would be equally important because other factors remaining constant, the rate of new business and rate of survival of these businesses are proportional in certain scenarios, the greater number of new businesses, the more survived business. However, more business formations could also be associated to business failure due to excess market and supply. Thus, understanding the drivers of entry with success prospect is important for policy formulation. Studies about what drives the formation or emergence of a firm are specifically rare because the history of a firm before its formation is literally non-existent. Moreover, data on the history of owners of a firm before the formation of the firm is also hardly available. Therefore, studies on the drivers of entrepreneurship, like this one, rely on macroeconomic factors of entrepreneurship formation.

According to the opportunity entrepreneurship theories discussed in previous chapters, entrepreneurial opportunities exist and enterprising individuals with cognitive behaviour such as risk taking, ambitious utilize these opportunities to form and run new businesses. The entrepreneurial approach of Stam and Spiegel (2016) also framed social culture, physical infrastructures, institutions, market demand, networks, leadership, access to finance talent and knowledge and other supporting services as main elements of entrepreneurship. This study focuses on ICT infrastructure, knowledge and institutions element of entrepreneurial ecosystem to meet the research objectives. The remaining elements are not measured as data on these elements are limited and incompatible with the research questions. Hence, the channels that exist between ICT and new business formation which stimulate innovation /growth- oriented entrepreneurship considered for this study are the following.

1. Knowledge acquisition

In addition to government policies, individual ingenuity, capability and certain resources are critical for the successful new business start-up. Individual level insights and motivations can influence levels of entrepreneurial activity (Bygrave and Hofer, 1992). Venkataraman (1997) argues that individual level insights are not enough reasons for individuals to exploit

opportunities of entrepreneurial activity; "opportunities rarely present themselves, they need to be discovered and packaged". Knowledge of opportunities is in the first place to exploit profit opportunities (Dubini and Aldrich, 1991; Venkataraman, 1997; Shane and Eckhardt, 2003).

Individuals who have entrepreneurial motive could use ICT tools to gather information and knowledge about the feature of their passion product or business. Usage of ICT enables those people who wish to run their own business to obtain such information and knowledge. In this regard, dissemination of valuable knowledge is usually accelerated by ICTs (Wennekers and Thurik, 1999). For example, internet provides direct resources for entrepreneurial information and skill from other entrepreneurs' experience and practices. Mobile technologies could also provide important positive externalities in arbitraging valuable opportunities (Gruber and Koutroumpis, 2011). Baliamoune (2003) also argued that "a reduction in information asymmetry that enhances deficiency and access to knowledge for all would prevent one party from monopolizing opportunities for profit (gain) and at the same time allow participation of previously excluded groups."

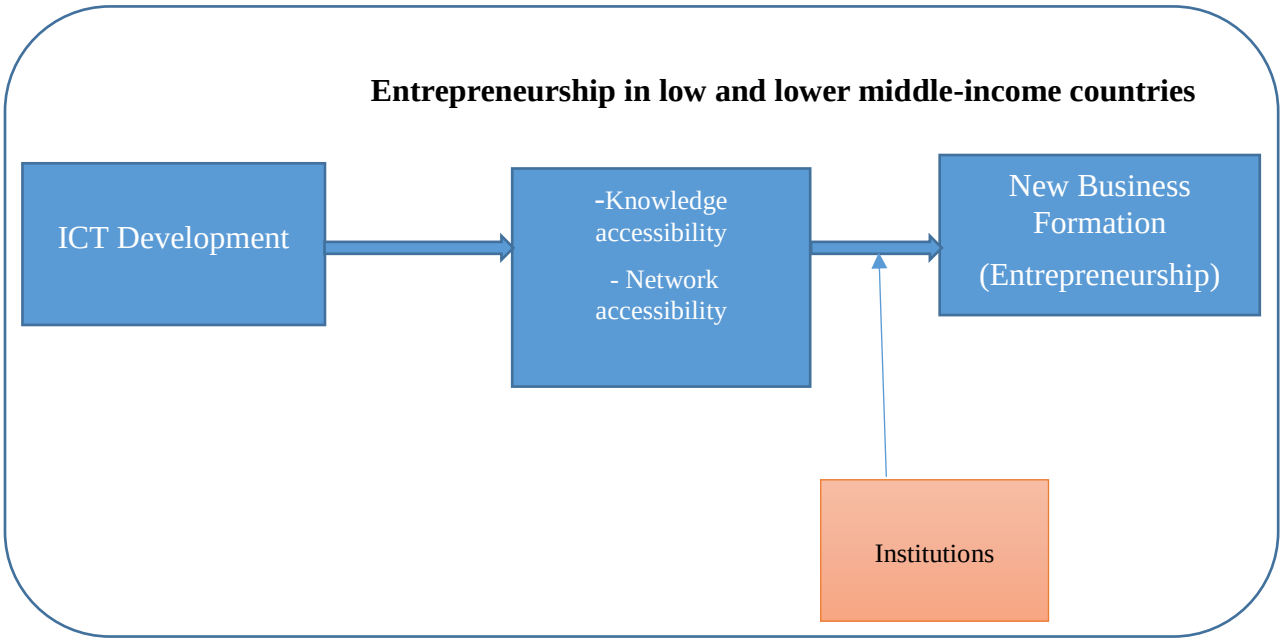
2. **Networks:**

Following the opportunity-approach of Shane and Eckhardt (2003), it can be argued that entrepreneurs can benefit from social interactions (network) through the media to develop a social network which enables them to build trust and to collaborate with potential business customers and partners. Focusing on Danish context of technology- or knowledge-intensive SME, Madsen et al., (2004) showed that social network plays key role in fostering entrepreneurship in knowledge-intensive sector. ICTs are recognised in facilitating such social networks in many empirical studies such as Blanchard and Horan (2000) Ferlander (2003), and Pinkett (2003). Moreover, ICT facilitates fast access to local, regional and global networks and markets (Alderete, 2017).

3. **Lower entry barrier**

ICT reduces entry cost because it minimizes cost of location and transportation because of virtual connectivity with suppliers and customers which lessens geographic, political and cultural barriers (Alderete, 2017). As a result, now days there are a number of online business owners including app developers. ICTs reduce cost of doing business, transaction and marketing enabling one to reach many customers (Kutnjak, Zekić and Rupčić, 2007; Vu, 2011; World Bank, 2016).It promotes closer relationship between firms and customers and suppliers, (Kutnjak, Zekić and Rupčić, 2007). This ease of doing business motivates entrepreneurs to form new business. Based on the literatures reviewed, the interaction of identified variables is predicted to be as follows.

Figure 2: conceptual framework



Source: Author compilation.

Chapter 3: Research Design and Methods

This chapter presents the research design used to characterize the role of ICTs on intensity of entrepreneurship. It provides information on operationalization of concepts and variables, research strategy, data collection tools and sources of data, method of analysis, validity and reliability of the study and overview of the study area.

3.1. Research Questions

The main aim of the study is investigating the impact of ICTs on new business formation in LLMI countries. The extent of ICT diffusion could be influenced by macro level policies of countries which suggests looking for quantitative and country level data. Entrepreneurship is considered as among the major economic indicators of a country. Data on number of new business registration is better found at country level as the focus of the study is on formal new businesses formations. The study, thus, uses existing quantitative data on the variables selected to insight the policy relevance of adopting ICTs.

The research design is intended to answer the following sub-research questions.

- What is the trend of new formal business formation in low and lower middle-income countries?
- What is the trend of ICT adoption in low and lower middle-income countries?
- To what extent has ICT impacted formation of new formal business ventures in sub-low and lower middle-income countries?
- Which form of ICT impact the formation of new formal businesses in low and lower middle-income countries?
- Which institutional factors determine the role of ICT on formation of new formal businesses in low and lower-middle income countries?

3.2. Operationalization of concepts and variables

The definition and indicators of concept and variables understudy are presented in Table 1 and 2. The variables are categorised based on their use in the regression analysis namely dependent variable, independent variables, explanatory and control variables.

Dependent variable

The dependent variable entrepreneurship is measured by intensity of new business ventures (number of registrations of new limited liability per 1,000 people ages 15-64 per year) in this study. This is consistence with the very definition of entrepreneurship in most literatures of entrepreneurship presented in the previous chapter, for example, Gartner (1989) and lumpkin and Dess (1996). Since the data available is only for these businesses which are registered

legally by concerned body of the governments and have limited liability, the scope of this study limited to analysing the formal business.

Table 1: Operationalization of concepts

Concept	Definition	Operational definition
Entrepreneurship	"an activity with the objective to change the system, by increasing the productivity of the system, decreasing the cost of part of the system, producing accrual of personal wealth and/or producing an increase of social values." Shapiro (1983:85)	Entrepreneurship is defined as formation of new business
Institutions	"Institutions are rules, enforcement characteristics of rules, and norms of behaviour that structure repeated human interaction" (North, 1989 p. 1321). "The general and common understandings developed by persons and by groups – i.e. culture – are the basis for the design of frameworks of more specific rules that govern human behaviour. Rules that constitute institutional frameworks affect human behaviour" (Keizer, 2008).	the formal setting and regulations of countries that affect entrepreneurship intensity

Source: Author's compilation, based on literatures.

Independent variables

In line with Penard et al. (2012), the main independent variable ICT is measured by internet, mobile and ICT goods concentration in the countries. Accordingly, fixed broadband subscriptions and population share of individuals using internet are used as a proxy for internet penetration. Mobile cellular subscriptions were also used for measuring mobile concentration. Import share of ICT tools is also used as independent variable which include computer, communication and consumer electronic equipment. The conceptual framework of the study assumed that ICT promotes entrepreneurship through enabling absorption of entrepreneurial knowledge and information and accessibility business networks based on literatures discussed. However, there is data limitation to measure how much knowledge and network ICT created at country level. Thus, number of subscriptions of fixed broadband and mobile; and population

of individual internet users can be proxies to capture the knowledge absorption and network accessed. To account population difference of the countries, densities of these ICT tools per a given number of persons has been used in the regression. Mobile and FBB are measured by subscription per 100 persons, while ICT goods imported, and internet users are measured by percentage share from total goods imported and percentage share from total population, respectively.

Table 1: Operationalization of Variables

Variables	**Indicators**	**Operational Definition**	**Source**
Dependent (entrepreneurship)	New formal businesses ventures	Number of new limited liability business per 1000 persons per year	World bank (doing business data set)
Independent (ICTs)	Fixed broad band subscriptions	Number of fixed broadband subscribers per 100 persons per year	World bank (development indicators dataset)
	Mobile cellular subscriptions	Number of mobile subscribers per 100 persons per year	
	Individuals using the internet	Population percent of individuals using internet per year	
	ICT goods import	Percentage share from total goods imported yearly	
Explanatory (institutional variables)	Business regulatory environment	rate of business regulatory environment per year (1 lowest to 6 highest)	World bank (development indicators dataset)
	Cost of business start-up procedures	cost of business start-up procedures (percent of GNI per capita)	
	Time required to start a business	Number of days required to start a business	
	Transparency and accountability	transparency, accountability in the	

		public-sector rating (1=low to 6=high)	
	Access to finance	Borrowers from commercial banks (per 1,000 adults)	World bank (development indicators dataset)
Control variables	GDP per-capita	GDP per capita (constant US$)	World bank (development indicators dataset)
	Education	Net percentage of secondary school enrolment	World bank (development indicators dataset)

Source: Author's compilation.

Explanatory variables

As presented in Table 1, institutional variables included in the analysis are rate of business regulatory framework, cost to start business, transparency and accountability, access to finance and time to start a business. The institutional variables are among the important factors that affect intensity of entrepreneurial activities (Kiggundu, 2002; Stam and Spigel, 2016). In this study, the variables business regulatory framework, transparency and accountability, access to finance are assumed to explain the influence of ICT on new business formation and included in the both IV and system GMM regression analysis. Thus, interactions between indicators of ICT usage and institutional factors are intended to shed light on potential pathways between ICT development and entrepreneurial development.

Control variables

To address omitted variable biases, GDP per-capita (constant 2010 US$), education and the lagged dependent variable (new business density) are used as control variables. Net secondary school enrolment is used as a proxy of education as it is measured by the ratio of children of official school age who are enrolled in school to the population of corresponding official school age. It is intuitive that GDP per-capita and previous years intensity of businesses could affect the dependent variable, new business formation. Education is recognised to have positive effect on entrepreneurship by Oseifuah (2010) and Gerba (2012).

3.3. Research Strategy

To answer the research questions, secondary quantitative research strategy has been employed. Accordingly, existing data about entrepreneurship and ICT is analysed. The choice of strategy is mainly motivated by the nature of the research question. In addition, the scope of the study

focuses on broader analysis of variables (Theil 2015). To this end, longitudinal data on both dependent and independent variables is used to characterize their relationship. However, using existing secondary data has its own disadvantage such as missing values. This study used linear interpolation method to address this challenge.

3.4. Data collection Methods and Sources of Data

The study used panel data from 42 low and lower-middle income countries on the specified variables covering the period of 2006 to 2016.The number of samples is motivated by the availability of data on the outcome variable (new business density) for the countries. The data is obtained from the World Bank doing business data set and the World Bank development indicators as presented in Table 2. The data for the main outcome variable, density of new business ventures per year in a country, and institution-related explanatory variables were obtained from the World Bank doing business dataset. The data for the main explanatory variable, ICT usage per year in the countries, is obtained from the World Bank development indicators dataset.

3.5. Method of Analysis

The study used both descriptive and inferential regression techniques to analyse the data. Descriptive analysis of the data was used to explore the trends of entrepreneurship and ICT that answered the first two sub-questions of the study. Descriptive techniques such as graphs, tables, mean and percentage are used to understand simple dynamics of the variables over time.

Inferential analysis using instrumental variable regression and dynamic panel regression were employed to investigate the impact of ICT on new business ventures and to identify the ICT tool which influences formation of new businesses.

1. **Instrumental variables regression (using fixed effect):** The two estimation issues with the data that the selected estimation strategy needs were addressed using this estimation technique. First was the potential reverse causality between the number of entrepreneurial ventures and the number of ICT users in a country. It is theoretically possible that ICT development could foster entrepreneurial development. Conversely, the demand for ICT services could increase due to the growth of business activity, which in turn is related to entrepreneurial development. The study used instrumental variables to address the potential endogeneity problem arising from such reverse causality by using lagged values of the proxies of ICT in the countries. The lag values of ICTs are used as an instrumental variable for the number of ICT users each year. Such instrumentation is intuitive because knowledge and experience acquired in the past shape the entrepreneurial drive of individuals and sharpen their entrepreneurial capability. Normally, ICT usage may not be immediately translated into entrepreneurial capability; formation of social capital and implementing business idea takes time. The number of entrepreneurial ventures of a country at time t does not affect

the number of ICT users at time $t-1$ or earlier period. Thus, the lag instrumentation effectively addressed the effect of reverse causality.

The other concern to be addressed was the unobserved country heterogeneity. Apparently, different countries could have unique socioeconomic and political features that possibly influence entrepreneurial development. To this end, the IV regression used fixed effects estimation to eliminate unit level fixed effects as the initial regression result from Hauseman test indicated the heterogeneity is not random.

Generally, the estimation specification is given by:

$$y_{it} = \alpha + \sum_{k=1}^{N-1} \beta_k I_{i,t-k} + \sum_{k=1}^{N-1} \gamma_k T_{i,t-k} + \delta X_{i,t} + \sum_{k=1}^{N-1} \xi_k X_{it} * I_{i,t-k} + \sum_{k=1}^{N-1} \eta_k X_{it} * T_{i,t-k} + u_i + \varepsilon_{it} \quad \text{---------- (1)}$$

Where y_{it} is the number of entrepreneurial ventures in country i at year t. The terms I and T denotes the number of internet users and number of telephone users, respectively. The Xs represent other explanatory variables. N is the number of years for which data is available for a country. The terms, β ,γ , δ , ξ and η are unknown parameters to be estimated. Finally, u_i and ε_{it} denote country fixed effects and error terms, respectively.

2. **System GMM regression**: Since the nature of the dependent variable seems to be dynamic and persistent depending on its own previous values, dynamic panel regression model is used to investigate the influence of ICT on entrepreneurship overtime in addition to the IV regression (Roodman, 2006).In addition to this, the assumptions of the system GMM estimation that suggest using this estimation tool are; the time period used is less than the number of countries, some of the independent variables are endogenous, some are predetermined for example the lagged value of new business formation and there is heteroscedasticity (Roodman, 2006).This is done to show if the results can be consistent with the IV-fixed estimation result.

   The estimation specification is given by the equation:

$$y_{it} = \sum_{k=2}^{N-1} \rho_k y_{i,t-k} + \sum_{k=1}^{N-1} \beta_k I^{j}_{i,t-k} + \delta X_{i,t} + u_i + \varepsilon_{it} \quad \text{---------- (2)}$$

Source: Author's computation based on Roodman (2006)

Where y_{it} is the number of entrepreneurial ventures in country i at year t, and $y_{i,t-k}$ are lagged values of the number of entrepreneurial ventures where k is an integer that is greater or equal to 2. The term j denote ICT related goods and services including mobile subscription, broadband subscriptions, ICT goods imported, and individuals using internet. The Xs represent the control variables. N is the number of years for which data is available for a country. The terms, β , δ , ξ and u are unknown parameters to be estimated. Finally, u_i and ε_{it} denote country fixed effects and error terms, respectively. The panel regression was also estimated with the explanatory variables (cost of business start-ups, time required to start business, level of transparency and accountability and business regulatory environment). The specified model is estimated using dynamic panel technique specifically system GMM estimator. GMM

eliminates the country fixed effects (unobserved heterogeneity), u_i through first differencing and label information.

3.6. Validity and Reliability of the Study

The credibility of the data source (World Bank) assures the validity of study. The panel regression model also secures the validity as it covers many year trends of the variables under study. In addition, the indicators of used are determined from the theoretical and empirical literatures contributing to measurement validity of the study.

The results of the study can be generalized to low and lower-middle income countries as the employed estimation strategies control possible heterogeneity among the sample countries. Though several countries are excluded from the analysis because of data limitation, some methodological measures were done before and during the regression. Hauseman test was done to determine which estimation strategy to use; between random and fixed effect. As a result, the significant result of the test which indicates that the variables vary across country leads to use fixed effect estimation. Country and time fixed effect were controlled in the IV and system GMM regressions. In addition, both issues of endogeneity, omitted variable bias and reverse causality(simultaneity), were addressed through addressing the country and time fixed effect, the internal instrumentation of the lag value of the variables as indicated in the IV regression and differencing in system GMM regression. This increases the accurateness of the regression results. Moreover, the sample countries have almost similar economic characteristics (emerging economy) with the remaining countries. Furthermore, the study provides consistent result with similar studies based on different contexts on the role of ICTs on entrepreneurship.

3.7. Overview of the study area

The study aimed to investigate the problem in all low and lower middle-income economies, however, due to insufficient data for the dependent variable, only 42 countries are included out of 81 LLMI countries. 20 African countries, 19 Asian countries and 3 Latin American and Caribbean (LAC) countries are included in the study (see the name of the countries included in annex 1).

Chapter 4: Result and Discussions

This chapter presents the research results and interpretations based on the descriptive and inferential analysis in two sections. Sub-section 4.1 includes the results of descriptive analysis which shows the trends of entrepreneurship and ICT in the sampled countries. The extent of impact of ICT on entrepreneurship in these countries is presented in sub-section 4.2 based on the finding of the panel regressions. Sub-section 4.2 also presents the institutional factors which affect the relationship between ICT and new business formation in the sampled countries.

4.1. Descriptive analysis

4.1.1. Trends of new business formation in low and lower-middle income countries

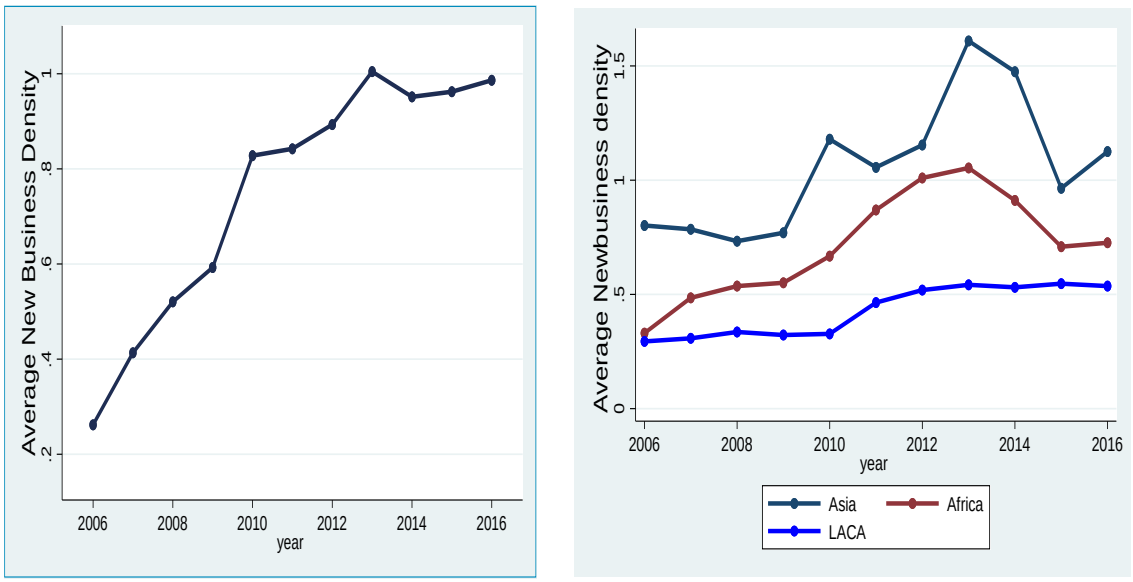
The study used number of newly registered companies with limited liability per 1,000 people aged 15-64 to measure the density of new business formation for each country. The trend of new business density in low and lower middle-income countries is analysed based on data of 42 countries (around 50 percent of the LLMI countries).

Figure 3a presents the trend of new business formation for the period between 2006 and 2016. As the result of the descriptive analysis shows, new business formation in the low and lower middle-income countries has grown very sluggishly over the last decade. The countries have different new business density pattern implying that there are factors other than time affecting the formation of new businesses. For example, between 2007 to 2009, there was no significant change but rather a decreasing trend as the global economic recession happened affected these countries. Emenike (2013) found that the global recession, which happened between 2007 to 2009, had a common declining impact on entrepreneurship in all regions but with varying rate of influence. According to the study, the crisis resulted in limited access to credits for entrepreneurs which was the major factor for decreasing rate of entrepreneurship. This was because the immediate victims of the crisis were the financial sectors in most countries of the world. Access to finance and loan which depend on financial market institutions is among the factors determining level of entrepreneurship in the literatures of entrepreneurship (Gries and Naudé, 2009; Stam and Spiegel, 2016). Thus, the declining trend of new business formation in the low and lower-middle income countries could be associated with this global crisis.

Figure 3b shows the temporal dynamics of intensity of new business formation by the regions. The trend shows that Asian countries have a greater new business density than Africa and Latin America and Caribbean for the last decade. This could be because of the spill-over effects of large firms located in some countries of the region such as China, Japan and South Korea. The positive externalities could arise from regional knowledge spill-overs, especially for knowledge-based entrepreneurships (Audretsch and Keilbach, (2007) and agglomeration (Audretsch and Keilbach, 2007; Griesand Naudé, 2009). LAC remain the region with the lowest new business density among the regions studied. As presented in the Table 3, summary statistics, the lowest business density was recorded by Niger and the highest was by Georgia;

8 in 2006 and 0.002 number of limited liability business registrations per 1000 working people in 2016 respectively.

Figure 3: Trend of new business formation in low and lower middle-income countries
Panel a: based on Panel data of all countries Panel b: based on regions of the countries

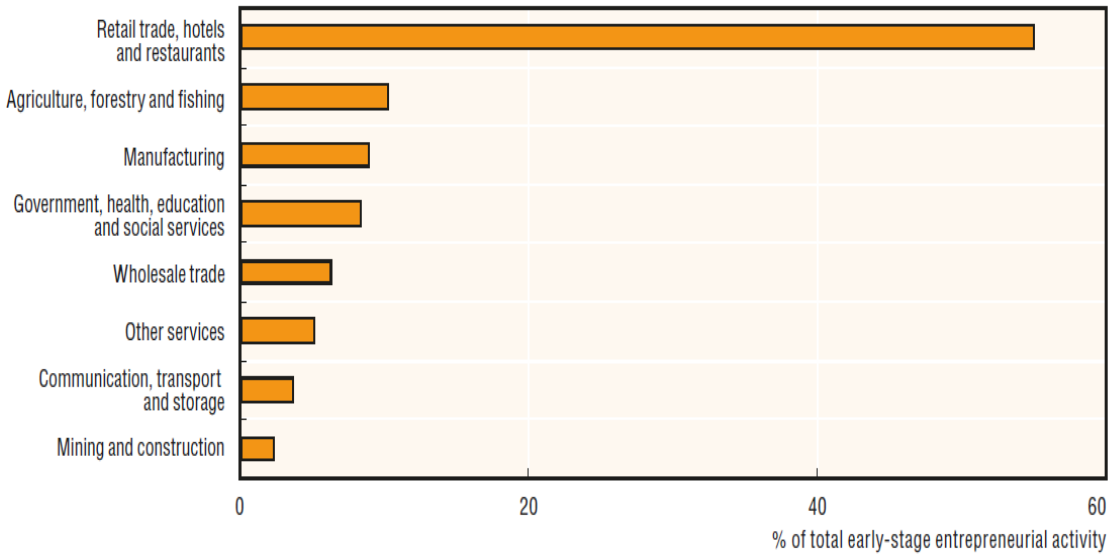


Source: Author's computation based on World Bank doing business data, 2018.

In Africa, formation of new business has been growing until 2013. As indicated by GEM (2017) in Figure 4, Africa's sectoral composition of early-stage entrepreneurial activity is highly dominated by retail trades, hotel and restaurants followed by agriculture, forestry and fishing, which require low innovative activities. In the words of Kiggundu (2002, p.246) "most of the businesses in Africa are small operations in the easy-to-enter sectors which is less profitable and innovative."

In Latin America and the Caribbean countries, wholesale and retail trade are the major sectors early-stage entrepreneurs choose start, while more than half operate in this sector in Asia (GEM, 2017).

Figure 4: Sectoral composition of early-stage entrepreneurship in Africa, 2012-2016



Source: working-age population of 18 African countries (GEM, 2017).

Though the trend of new business formation of the selected low and lower middle-income countries shows a growing pattern, sectoral composition of entrepreneurship in regions where the samples located indicated that the business formed in these countries are mostly necessity-driven entrepreneurship. As discussed in the review of literature section of this paper, innovation-driven entrepreneurship lends better contribution for economic growth than the factor driven entrepreneurship; for example, average employment expectations in the next five years (as % of TEA) in 54 economies is higher in the innovation driven countries at 22.2% while it is 11.3 for factor driven countries (GEM, 2017). In the report of GEM which studied entrepreneurial activities of 62 countries, the entrepreneurial ecosystem is strongest overall in the innovation-driven economies, while necessity-driven groups report several unfavourable conditions (GEM, 2017). This implies that in the necessity-driven entrepreneurial activity, the entrepreneurial ecosystem is weaker and unfavourable for innovative and efficiency-driven business activity which calls for identifying the potential elements in the ecosystem.

4.1.2 Trend of ICT in low and lower-middle income countries

More recently, countries' usage of ICT tools is witnessed to be growing as nations are influenced by global trends mainly globalization. Among the ICT tools, mobile phones are prevalent in many countries. For the time covered in this analysis, number of mobile subscriptions, measured as a public mobile telephone service that provide access to the PSTN using cellular technology, in low and lower-middle income countries, is rapidly growing. As shown in Figure 5a, the number of mobile subscriptions was doubled in four years between 2006 and 2010. Between 2014 and 2016, the trend of growth for LAC appears to be slightly slower as the ratio of mobile cellular subscription exceeds one. For Asia, the trend is still

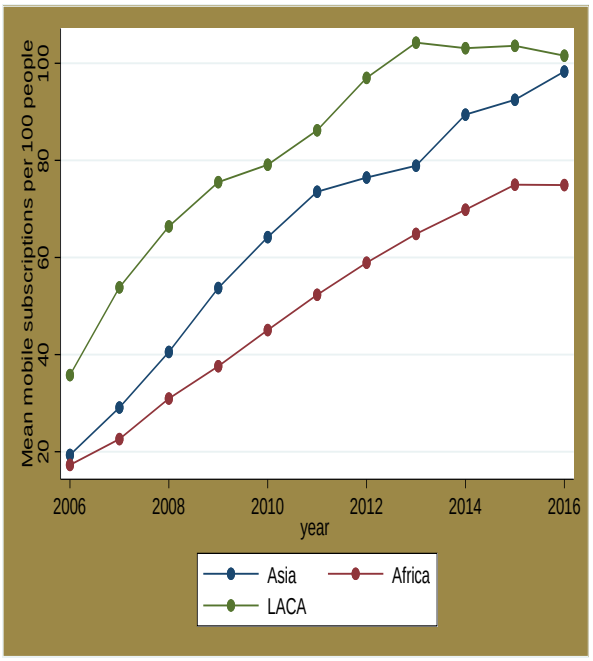
growing and approaching to one to one rate of subscription. Though the growth rate is high, for Africa the average number of mobile subscriptions per year was the lowest compared to Asia and LAC. The result supports the report of the World bank (2016) which indicated the lowest mobile penetration is in Sub-Saharan Africa (73 percent) in 2014. This might be because of disparity in rate of urbanization. Technology adoption especially ICT technology are highly associated with level of urbanization since agglomeration, concentration of economic activities, and spatial concentration takes place in mostly urban areas. This concentration of economic activities leads to concentration of demands including bulk data processing for production and administration. In addition, cost of provision is lower because of availability and easily accessibility of complimenting technologies, for example electricity, in urban areas. Moreover, knowledge based economic activities which require symmetry of information for production are mostly located in urban areas.

Fixed broadband internet as an indicator for use of internet was measured by number of fixed subscriptions to high-speed access to the public internet per 100 persons. As indicated in the summary statistics presented in table 2, 8 subscriptions were recorded as highest number in 2016. Figure 5b shows that the average number of fixed broadband subscribers is increasing in all regions though density is sparse where the maximum average subscription for the period 2006 to 2016 is less than 4 per 100 persons. In Asian countries, it is growing by increasing rate, however, the rate in African countries has no significant change since year 2011. On the other hand, for LACs FBB subscription declined in 2008 to 2010 and start rising after 2011. The effect of the global recession could explain this braked trend as it requires relatively higher financial investment for producing or importing the inputs for this service. Africa has the least number of FBB subscriptions compared to the other two continents. The main reason is that the price of FBB in Africa is the highest with the average fixed price of 64 per cent of gross national income per capita, while the world average remains 22.1 per cent (ECA, 2017). In addition, there is very limited availability of the service in some countries of the continent (ECA, 2017).

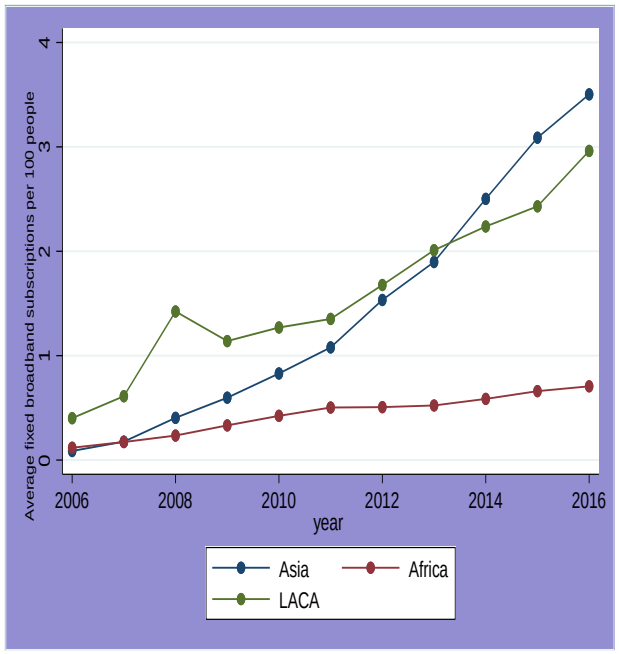
The usage of internet measured by the percentage of internet users using a computer, mobile phone, personal digital assistant, games machine, digital TV and others has been generally growing in all three continents since 2006 as indicated in Figure 5c. Yet there is considerable difference in the patterns of change across the regions. As usual, LAC starts higher in terms of the percentage of people using internet in the year 2006 but ended up second to Asia in 2014. Another salient feature of the trend is that although Asia started with the least number of secure servers in 2006, it surpassed LAC in 2014. Africa and Asia have had similar figures up to 2009, but the later become the clear better performer after 2009. Asia experienced the highest overall growth rate while that of LAC started to stagnate since 2013.

Figure 5: Trend of ICT usage in low and lower-middle income countries

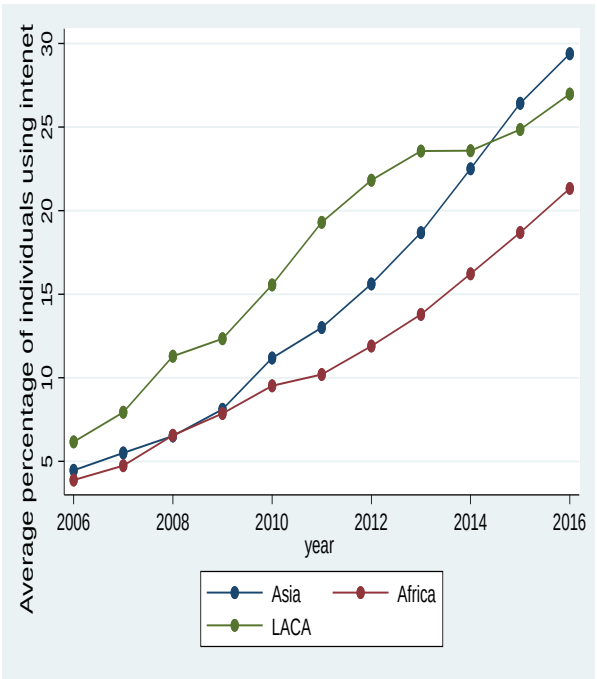
Panel a: Mobile subscription by region



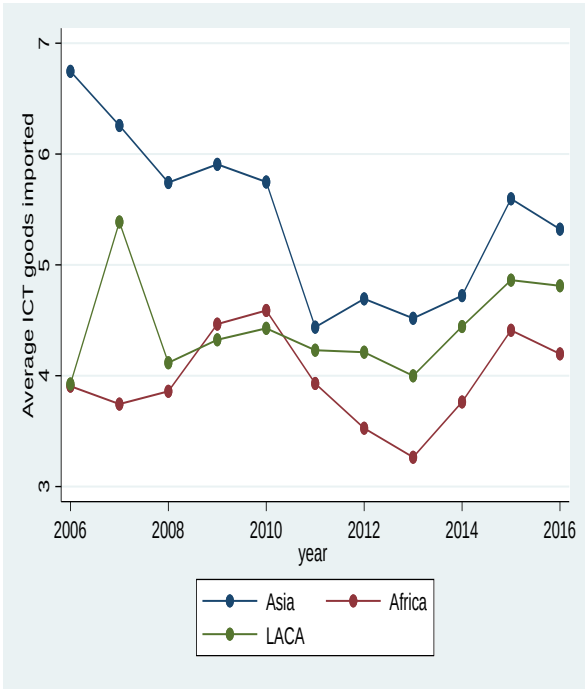
Panel b: Fixed broadband Subscription by Region



Panel c: Population share of internet users



Panel d: Share of ICT goods imported



Source: Author's computation based on World Bank development indicators data, 2018.

Figure 5d shows the trend of ICT goods imported in the low and lower middle-income countries across Africa, Asia and LAC. The figure shows that the share of ICT goods imported was high in 2006 and started declining afterwards until around 2012. Generally, the trend seems cyclical for all regions. The initial trend could imply the high demand for ICT goods and around the period of great recession, the countries reduced importing ICT goods. The recession period influenced amount of imports in most countries. The other reason could be that countries started producing ICT goods that can substitute the imports. The trend shows the similar pattern for all regions and turns steeper in 2013 and onwards particularly. Generally, in terms of relative dynamics, it seems the growth of level of import of ICT goods is the slowest in Africa. The summary of all variables is presented in Table 3.

Table 3: Summary statistics

Variables		**Mean**	**Std. Dev.**	**Min**	**Max**	**Observations**
New business density	Overall	.84	1.31	0.00	8.37	N = 362
	Between	1.21		0.00	5.36	n = 42
	Within	0.53		-2.36	4.71	T-bar = 8.61
FBB	Overall	1.04	2.10	0.00	17.57	N = 421
	Between	1.58		0.00	8.31	n = 41
	Within	1.37		-6.67	10.29	T-bar = 10.26
ICT goods imported	Overall	5.26	5.07	0.00	44.18	N = 333
	Between	4.37		0.24	28.97	n = 37
	Within	1.98		-10.54	20.48	T-bar = 9
Internet users	Overall	13.51	12.47	0.18	58.27	N = 453
	Between	9.47		1.47	45.21	n = 42
	within	8.20		-11.93	41.14	T-bar = 10.78
Mobile subscriptions	overall	59.48	35.33	0.44	151.89	N = 457
	between	25.52		18.74	126.34	n = 42
	within	24.84		-11.75	131.80	T-bar= 10.88
Cost of start-up procedures	overall	74.11	143.25	0.30	1314.60	N = 415
	between	100.97		3.25	508.33	n = 42
	within	102.44		-404.91	1097.73	T-bar = 9.88
Time to start a business	overall	33.28	35.89	2	224	N = 415
	between	27.99		4.36	149.27	n = 42
	within	21.39		-53.99	109.83	T-bar = 9.88
Transparency & account	overall	2.89	.59	1.5	4.5	N = 376
	between	0.56		1.77	4.36	n = 37
	within	0.23		2.07	3.66	T-bar = 10.16

Business regulations	overall	3.26 .65	1.5	5.5	N = 376
	between	0.64	1.68	5.31	n = 37
	within	0.24	2.46	4.04	T-bar = 10.16
GDP per-capita	overall	1516.77 1099	251.05	4271.33	N = 440
	between	1086.57	354.40	4072.05	n = 40
	within	233.32	555.70	2338.45	T-bar = 11
Education	overall	50.04 21.10	4.76	95.50	N = 231
	between	22.46	4.84	87.73	n = 37
	within	5.47	31.35	70.20	T-bar = 6.24
Access to finance	overall	90.22 133.60	0.13	723.89	N = 270
	between	115.07	1.41	436.58	n = 31
	within	55.56	-248.48	377.53	T-bar = 8.70

Source: Author's computation based on World Bank development indicators data (2006-2016).

In Table 3, the terms N, n and T-bar represent number of observations, number of countries and average number of years in which data was available per variable, respectively.

Table 4 shows the correlation coefficient between the response variable, new business density, and explanatory variables. Since a panel dataset is used for the study, the coefficients are computed for the sum of yearly-values of the variables per country. Accordingly, as indicated in the table, new business density is strongly and positively correlated with fixed broadband subscription and access to finance. Both new business density and FBB subscriptions have slower rate of growth as presented in Figure 4b and 5b.The strong correlation with access to finance might be because almost all business formations involve initial investment of financial resource. In low income countries, own resource is limited, and entrepreneurs opt to borrow from financial intermediaries. It is correlated moderately and positively with GDP per-capita, weakly and positively with numbers of internet users and mobile subscriptions. This is because the trend of new business formation is not as dynamic as mobile subscriptions and number of internet users.

Generally, though ICT usage in Asia and LAC indicates an increasing trend, Africa is lagging considerably in all forms ICT. The dynamic and knowledge intensive sectors in Asia, for example software industry in India, electronics and manufacturing industries in China and South Korean, allow high knowledge and information absorption in the region. Furthermore, locational proximity of the sample countries of Asia to these large technological industries might enable using the knowledge spill-overs. However, in Africa, the dominant sector is agriculture which mainly uses traditional inputs of production. This stagnant feature of the sector and low availability of knowledge-based industries might result in low demand for and usage of knowledge and information. Asongu and Tchamyou (2016) in their study on "the impact of entrepreneurship on knowledge-economy of Africa" concluded that forming

conducive environment for starting business can considerably enhance the scope of knowledge-economy in the continent.

Table 4: Correlation Matrix between new business formation and ICTs

	New business	ICT goods	FBB	Internet users	Mobile subscription	GDP per-capita	Access to finance	Education
New business	1							
ICT goods	0.01	1						
FBB	0.67	0.23	1					
Internet users	0.37	0.36	0.65	1				
Mobile subscriptions	0.40	0.33	0.67	0.75	1			
GDP per-capita	0.52	0.23	0.59	0.69	0.75	1		
Access to finance	0.65	0.07	0.80	0.33	0.60	0.51	1	
Education	0.16	0.08	0.40	0.38	0.49	0.38	0.44	1

Source: Author's computation based on World Bank development indicators data (2006-2016).

4.2. Inferential Analysis

This section presents the impact of intensity of ICT usage of a country on the rate of new business formation in the context of low and lower middle-income countries. The analysis is based on regression employing fixed effects estimation using instrumental variables and system GMM estimation technique. Both the IV-based fixed effects and system GMM estimation techniques can address potential endogeneity problem that may arise from possible simultaneity between ICT and entrepreneurship as well as country heterogeneity. Both regression techniques have their own strengths and weakness. GMM estimation model has an advantage, over the IV-based fixed effects model, of exploiting more information about the variables of interest using their lagged values (Roodman, 2006). However, the method is data intensive as it includes several internal instruments and may not be very suitable for analysing a dataset with a lot of missing values, which is the case in this study. They are used here for augmenting each other's weaknesses as well as to validate result consistency across comparable estimation techniques.

Tests of the assumptions of regression models employed, including linearity, normality, multicollinearity, heteroscedasticity, and model specification (Hausman test) were performed before analysing the data. Non-linearity and skewed variables were transformed to log and square roots. However, since the transformed pattern of the variables could not improve the

result, the regression is done with non-transformed variables. Variance inflation factor (VIF) tests is tested and none of the variables were multicollinear (all have less than 10 VIF result). Heteroscedasticity and autocorrelation tests are also done and since the error term is heteroscedasticity based on Breusch-Pagan / Cook-Weisberg test, the models were treated by using cluster robust standard (vce robust) at country level. Missing values in the variables of interest were treated using linear interpolation method that constructs new data points within the range of a separate set of known data points (Chow and Lin, 1971).

Sub-section 4.2.1 and 4.2.2 provide the results found regarding the relationship between new business density and the ICT tools. Sub-section 4.2.1 presents the regression results on the influence of the ICTs on business density. Sub-section 4.2.2 provides the results of the institutional factor that could determine the impact of ICT on business formation. The results are reported with 5% level of significance and with cluster robust standards errors.

4.2.1. Impact of ICTs on new business formation

As already mentioned in above, ICT has different components. This study tests the effects of such ICT components, access to internet (measured by umber of fixed broadband subscriptions and percentage share of population using internet), mobile subscription and access to ICT goods. Internet provides online access to information which enterprising individuals can convert them to valuable knowledge. Now days, social networking becomes easier through the internet as number of users of the online social media is growing. Social networks could also help enterprising individuals build valuable connections with their potential business partners.

The results from both IV-based fixed effects and GMM techniques presented in Tables 5 and 6, respectively, show that FBB has significantly increased new business density in the sample countries. In the IV model, (Table 5, column 2), indicates that a unit increase in FBB subscription increases, on average, density of new business formation by 0.15. The result from the GMM model presented in Table 6 column 3, is also equivalent: a one unit increase in FBB increases new business density by 0.16. The system GMM model produced a larger coefficient because, as explained above, it utilizes more information regarding the explanatory variable (Roodman, 2006).

This result supports the opportunity-approach of Venkataraman, (1997) andShane and Eckhardt (2003) which argued that reduced information asymmetry about entrepreneurial opportunity can boost entrepreneurial drives of individuals. Attentive entrepreneurs arbitrage opportunity of access to information.

Table 5: Regression results based on IV estimation

Dependent Variable:	**New business density**					
	(1)	(2)	(3)	(4)	(5)	(6)
Lag of new business density	0.731***	0.753***	0.755***	0.738***	0.674***	0.665***
	-0.0273	-0.0413	-0.051	-0.0575	-0.0902	-0.0847
ICT goods imported	-0.0201	-0.02	-0.00909	-0.00823	-0.0027	-0.00613
	-0.0204	-0.0297	-0.0297	-0.0287	-0.0289	-0.0309
FBB	0.124***	0.125***	0.128***	0.136***	0.148***	0.150***
	-0.0214	-0.0183	-0.0259	-0.028	-0.0283	-0.0266
Internet users	-0.0121	-0.0138	-0.0165	-0.0139	-0.0142	-0.0134
	-0.00642	-0.0088	-0.0126	-0.0133	-0.0147	-0.0143
Mobile subscriptions	0.0041	0.00326	0.00278	0.000919	0.000175	-0.00038
	-0.00329	-0.00361	-0.00508	-0.00593	-0.00597	-0.00577
Log GDP per-capita		0.476	0.517	0.592	0.645	0.579
		-0.436	-0.421	-0.366	-0.496	-0.504
Education		-0.00767	-0.0105	-0.0133	-0.0138	-0.0132
		-0.00693	-0.00896	-0.0101	-0.0126	-0.0122
Access to finance			0.000213	0.000107	0.000337	0.000351
			-0.00036	-0.00036	-0.00045	-0.00044
Cost of business start-ups			-0.00057	-0.00052	-4.6E-05	-0.00011
			-0.00096	-0.00088	-0.00088	-0.00086
Time to start business				-0.00164	-0.00507*	-0.00507*
				-0.00205	-0.00252	-0.00235
Transparency and accountability					0.00588	0.0045
					-0.0679	-0.0659
Business regulation						0.101
						-0.115
Year dummies	Yes	yes	Yes	yes	yes	yes
Constant	0.194	0.56	0.726	0.986	1.209*	0.863
	-0.131	-0.303	-0.413	-0.513	-0.596	-0.803
N	316	255	190	190	172	172
number of countries	36	31	22	22	22	22
Adjusted R-sq	0.9089	0.8897	0.8961	0.8991	0.9166	0.9114
Robust Standard errors in parentheses						
*** p<0.05, ** p<0.01, *** p<0.001**						

The other salient feature of the dynamics of new business formation is that it has been significantly influenced by time required to start business and transparency, accountability and corruption in the public sector of the sample countries. As presented in Table 6 column 3, a one unit increase in the rate of transparency and accountability, increases density of new business by 0.38, which is equivalent to registration of four units of new businesses per every 10000 working age population. Table 5 columns 5 and 6 show that a reduction in time to start a business by one day increases new business density by 0.005.

Table 6: Regression result based on system GMM estimation.

Dependent Variable:	**New Business Density**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag of new business density	0.8***	0.8***	0.8***	0.9***	0.8***	0.8***	0.7***
	(0.024)	(0.052)	(0.049)	(0.060)	(0.068)	(0.069)	(0.069)
Lag of mobile subscription	-0.007	-0.001	-0.001	0.000	0.001	0.001	0.001
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Lag of ICT goods imported	-0.002	-0.003	-0.004	-0.002	0.020	0.019	0.029
	(0.004)	(0.004)	(0.004)	(0.004)	(0.029)	(0.029)	(0.037)
ICT goods imported	-0.008	-0.011	-0.011	-0.010	0.006	0.002	-0.009
	(0.005)	(0.007)	(0.007)	(0.007)	(0.014)	(0.012)	(0.018)
FBB	0.13***	0.1***	0.12***	0.09***	0.078*	0.066*	0.0331*
	(0.020)	(0.027)	(0.026)	(0.026)	(0.035)	(0.033)	(0.044)
Internet users	-0.001	-0.001	-0.001	0.000	0.009	0.012	0.009
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.010)
mobile subscription	0.005	-0.0004	-0.001	-0.001	-0.004	-0.005	-0.005
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Log GDP per-capita		0.740	0.739	0.604	0.601	0.603	0.281
		(0.433)	(0.433)	(0.391)	(0.452)	(0.448)	(0.322)
Education		-0.017	-0.018	-0.014	-0.012	-0.014	-0.001
		(0.015)	(0.015)	(0.013)	(0.014)	(0.013)	(0.012)
Cost of start-ups			-0.001	-0.001	-0.001	-0.001	-0.001
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Time to start a business				0.004	0.001	0.002	-0.0001
				(0.002)	(0.002)	(0.002)	(0.002)
Transparency and accountability					0.289*	0.267*	0.313*
					(0.127)	(0.133)	(0.129)
Business regulatory framework						0.123	-0.032
						(0.117)	(0.157)
Access to finance							0.002
							(0.001)
constant	0.19***	0.965	1.102	0.753	-0.113	-0.379	-0.46
	(0.058)	(0.675)	(0.721)	(0.601)	(0.643)	(0.781)	(0.853)
Number of observations	350	282	282	282	242	242	190

Robust Standard errors in parentheses
*** p<0.05, ** p<0.01, *** p<0.001**

The results from the system GMM estimation model, presented in Table 7, also show that the influence of FBB varies across regions. Table 7 provides the regression results for the effect of ICT on business formation by region. The number of countries included in the model declines

when the variable access to finance is included to the model because of many missing values in the variable. Despite this, the coefficient of FBB does not show much variation for Asia. Accordingly, Asia's new business formation has been influenced positively and significantly by fixed broadband subscriptions and rate of business regulatory framework as indicated in columns 1 and 3. In Africa, import of ICT goods has positive impact on new business creation. Since the number of countries declines and becomes lower than the number of years when access to finance is included in the specification, the GMM coefficients without controlling the variable access to finance are used for interpretation. Yet, the qualitative implications of the coefficients do not change, though the values change, with and without controlling for access to finance. Accordingly, for Asia, one unit of FBB subscriptions lead to registration of one new business per 10,000 working age population (aged 15 to 64). In Africa, a 1% increase in the proportion of ICT goods from import increases new business registration per 25,000 working age population by 1 unit.

The coefficient of mobile cellular subscription does not turn significant both in the overall regressions and the regional regressions. This might be due to the importance of telephone to maintain existing social networks instead of helping individuals create a new social network. Maintaining already existing social networks for long time buttress trust, thereby cooperation and partnership in doing business. However, sticking in already existing social network may prevent individuals to join new social networks where they could access new and innovative business knowledge. Therefore, the effect is theoretically ambiguous, and the actual effect depends on the relative importance of trust or collaboration and new knowledge. In low income countries where knowledge is scarce, but people are already socially well connected (Chuang and Schechter, 2015.), the effect of mobile subscription, as found in this study, is likely to be insignificant. However, mobile subscriptions may have significant impact on entrepreneurship through fostering social networks and collaborations in developed countries where knowledge is abundant but social networks tend to be weaker. For example, Alderete (2017) found a positive influence of mobile concentration based on analysis on a mixture developing and developed countries. Nagler and Naudé (2017) also found that number of phones per household increases the likelihood of forming new business in Ethiopia, Malawi, Nigeria, Tanzania and Uganda.

The finding that access to internet, measured in FBB subscriptions, is not a significant factor of entrepreneurship in Africa might be due to low internet penetration in the region. The report of broadband commission (2017), least developed countries (LDCs) have lowest rate of household internet connectivity which is 14.7 percent while the world has reached 53.6 percent. The rate also varies between 18 percent for Africa and 48.1 percent for Asia and pacific in 2017. The figures show that Africa has lower rate of household internet connectivity. Low over all internet penetration in the region might have led to insufficient variation of access to internet across the African countries. Such insufficient variation in data might have hindered discerning of the effect of internet using regression analysis in this study.

Table 7: Regional regression results

Dependent Variable:	**New Business Density**			
	Asia	Africa	Asia	Africa
	(1)	(2)	(3)	(4)
Lag of new business density	0.767***	0.767***	0.791***	0.835***
	(0.102)	(0.032)	(0.095)	(0.084)
mobile subscription	-0.002	-0.005	-0.003	-0.001
	(0.004)	(0.004)	(0.003)	(0.002)
Lag of mobile subscription	0.002	-0.001	0.004	-0.004
	(0.004)	(0.004)	(0.004)	(0.003)
ICT goods imported	-0.007	0.038**	-0.023	0.035*
	(0.005)	(0.015)	(0.019)	(0.015)
Lag of ICT goods imported	-0.005	0.033	0.006	0.037
	(0.004)	(0.040)	(0.018)	(0.045)
Fixed broadband subscriptions	0.111***	-0.007	0.083*	0.779
	(0.030)	(0.182)	(0.039)	(0.647)
Internet users	-0.013	0.011	-0.007	0.006
	(0.007)	(0.012)	(0.011)	(0.007)
Log GDP per-capita	0.173	0.498*	0.061	0.543
	(0.209)	(0.247)	(0.123)	(0.425)
Education	0.015	0.005	0.005	-0.009
	(0.010)	(0.009)	(0.010)	(0.010)
Cost of start-ups			0.001	-0.001
			(0.002)	(0.001)
Time to start a business			0.001	0.002
			(0.002)	(0.004)
Transparency and accountability			0.123	0.084
			(0.119)	(0.141)
Business regulatory framework			0.261***	-0.222
			(0.067)	(0.250)
Constant	-0.581	0.021	-1.335*	0.936
	-0.47	-0.37	-0.63	-1.41
N	141	121	121	111
Robust Standard errors in parentheses				
*** p<0.05, ** p<0.01, *** p<0.001**				

The results from both the IV and GMM estimation models confirm the opportunity theory of entrepreneurship which emboldens the potential role of access to information for promoting knowledge spillover and absorption of entrepreneurial knowledge. The results are also generally consistent with previous empirical findings on the effect of ICT on entrepreneurship, for example Leitão and Ferreira (2007), Alderete (2017) and Asongu and Nwachukwu (2018). These studies indicated that intensity in usage and policy direction on ICTs are related to level of entrepreneurial activities. Leitão and Ferreira (2007) found that regulatory framework which

is targeted to reinforcing ICT investment promotes entrepreneurial activities in European countries. The study of Alderete (2017) specifically indicated that mobile penetration has a positive influence on intensity of entrepreneurship at country level. Asongu and Nwachukwu (2018) also found that ICT improves trade openness there by promoting business start-ups.

4.2.2. Institutional factors influencing the relationship between ICT and entrepreneurship

The quality of institutions, access to finance and availability of infrastructure among others, may influence the effect of ICT on entrepreneurship. ICT could be a more effective vehicle of promoting entrepreneurship development when there is conducive environment for entrepreneurship. Hence, the effect of ICT on business formation could be larger under in countries with better institutional quality, access to finance and other complementary infrastructures. Based on the entrepreneurship ecosystem model developed by Isenberg (2016) and Stam and Spiegel (2016), the present study has tested the moderating effects of five institutional variables namely business regulatory frameworks, transparency and accountability of the public sector, cost of start-up procedures, access to finance and time to start a business.

The interaction effect between ICT and transparency and accountability is presented in Table 7. Based on the model specifications in column 3, FBB subscription; and transparency and accountability have positive and significant impact on density of new business with coefficients 0.064 and 0.4, respectively. The incorporation of interaction term increases the effect of FBB subscriptions to 0.087. This implies that higher public sector transparency and accountability raises the effectiveness of fixed broadband on business formation. Entrepreneurs interact with government agencies in multiple incidences such as business registration and licensing, utilization of public utilities, payment of tax on their returns, etc. Unaccountable and less transparent institutions are prone to corruption. Cost of doing business could be higher in business environments where public corruption level is higher. The conduciveness of the business environment is, therefore, influenced by the level of transparency and accountability of public institutions. As a result, the finding that the level of public sector transparency and accountability moderates the effect of ICT on new business formation may not be as such surprising.

Table8**: ICTs interacting with transparency and accountability**

Dependent Variable:	**New business density**			
	(1)	(2)	(3)	(4)
Lag new business density	0.599***	0.593***	0.576***	0.792***
	(0.118)	(0.137)	(0.148)	(0.054)
Mobile subscription	-0.006			
	(0.005)			
Transparency and account	0.442	8.689	0.406*	0.108

	(0.260)	(6.941)	(0.205)	(0.133)
Log GDP per-capita	0.411	0.658*	0.353	0.716
	(0.453)	(0.298)	(0.276)	(0.579)
Education	-0.002	0.000	0.001	-0.014
	(0.010)	(0.010)	(0.013)	(0.010)
Mobile* transparency	0.008			
	(0.004)			
Internet users		-0.004		
		(0.011)		
Internet users* transparency		0.009		
		(0.007)		
FBB subscription			0.064**	
			(0.021)	
FBB* transparency			0.087**	
			(0.033)	
ICT goods imported				-0.022
				(0.121)
ICT goods* transparency				0.022
				(0.056)
Year dummies	**yes**	**yes**	**yes**	**yes**
Constant	-0.648	-24.78	-0.924	0.646
	(0.994)	(20.230)	(1.018)	(0.978)
Number of observations	244	244	230	178
Number of countries	30	30	29	26
Adjusted. R-sq	0.77	0.75	0.79	0.88
Robust Standard errors in parentheses				
*** p<0.05, ** p<0.01, *** p<0.001**				

The moderating effect of business regulatory framework is also tested by interacting it with different ICT measures. Business regulatory framework refers to the legal, regulatory and policy framework of a country that applies to starting and operating business entity in a country. The incentives and disincentives set for businesses by the government, and the degree of business confidence and protection of property rights influences the effect of ICT on entrepreneurship development. Table 9 column 3 presents the moderating effect of business regulation on the effect of mobile subscription on new business formation. The result shows that the coefficient of the interaction effect of business regulatory framework and mobile subscriptions is positive and statistically significant. The independent effect (coefficient) of mobile subscriptions was and is not statistically significant by itself. Accordingly, improvement of business regulation (indexed 1 to 6) by 1 unit increases the effectiveness (coefficient) of mobile subscriptions by 0.007. Although it is difficult to make accurate judgement of the economic significance of the coefficient as business regulatory framework is measured by a unitless composite index, the effect of mobile subscription seems to have only small effect on business formation. The possible reasons are already explained above.

The interaction of number of internet users and business regulation is also presented in Table 9 column 5. The result shows an increment of the index of the quality of business regulatory framework of a country by 1 unit, increases the effect of intensity of internet usage on new business density by 0.021. The independent effect of the intensity of internet usage (number of internet users), however, is not statistically significant implying that intensity of internet usage is conditional on the quality of regulatory framework. This might be because of the fact that all types of internet usage is not meant for searching of new business knowledge. Knowledge search would involve non-random and deliberate usage of internet which is more likely to be systematically related to FBB subscriptions than the total number of internet users in a country.

Table 9: **ICT with cost of start-up procedure and business regulation**

Dependent Variable:	**New business density**				
	(1)	(2)	(3)	(4)	(5)
Lag New business	0.552***	0.585***	0.635***	0.639***	0.586***
	(0.162)	(0.158)	(0.141)	(0.105)	(0.147)
FBB	-0.139				
	(0.130)				
Education	-0.003	-0.012	0.000	-0.003	-0.001
	(0.012)	(0.008)	(0.008)	(0.006)	(0.008)
Log GDP per-capita	0.547	1.281**	1.190*	0.348	0.559
	(0.322)	(0.435)	(0.526)	(0.506)	(0.422)
Cost of start-ups	-0.00743*	-0.49	-0.001		
	(0.004)	(0.339)	(0.003)		
FBB*cost of start-up	-0.004				
	(0.002)				
Internet users		-0.032			-0.007
		(0.028)			(0.009)
Internet users* cost of start-up		(0.001)			
		(0.000)			
Mobile subscription			-0.003	-0.005	
			(0.006)	(0.005)	
Mobile* cost of start-up			-0.00001		
			(0.00004)		
Business regulations				0.211	19.93*
				(0.191)	(8.460)
Mobile* business regulation				0.007*	
				(0.003)	
Internet users*business regulations					0.021*
					(0.009)
Constant	0.904	35.07	0.363	-0.138	-65.00*
	(0.547)	(23.830)	(0.365)	(0.713)	(27.960)
Year dummies	Yes	Yes	yes	yes	yes

Number of observations	256	271	271	244	244
Number of countries	33	34	34	30	30
Adjusted R-sq	0.81	0.69	0.69	0.82	0.80
Robust Standard errors in parentheses					
*** p<0.05, ** p<0.01, *** p<0.001**					

Finally, the moderating effect of access to finance is presented. Access to finance is crucial particularly for the poor and youth to convert their knowledge and skills to business that produces usable goods and services. Isenberg (2016) and Stam and Spiegel (2016) have included access to finance in their respective entrepreneurship ecosystem model. The influence of access to finance could be huge in low income countries as most of the start-ups are necessity-driven businesses. Entrepreneurs in necessity- driven category tend to solve their shortage of money to start a business by taking loans from financial intermediaries. Thus, their success in entrepreneurship could be influenced by availability and accessibility of loan for business.

As indicated in Table 10 column 2, access to finance is found to be a statistically significant moderator of the effect of intensity of internet usage. The result shows that although intensity of internet usage does not have independent effect on entrepreneurship, its conditional effect access to finance is statistically significant. The joint regression coefficient shows that increment of number of borrowers from formal financial institutions by 1000 persons per 1 million adult population, increases the effect of intensity of internet usage by 2 new businesses per the same population base (1 million adults). Similarly, column 2 of Table 10 shows that increment of number of borrowers from formal financial institutions by 1000 persons per 1 million adult population, increases the effect of mobile subscription by 5 new business registrations.

Table 10: **Interaction of ICT with access to finance**

Dependent variable:	**New business density**		
	(1)	(2)	(3)
Lag of new business density	0.586***	0.574***	0.62***
	(0.163)	(0.160)	(0.145)
FBB subscriptions	-0.030		
	(0.054)		
FBB* access to finance	0.0004		
	(0.0003)		
Education	-0.009	-0.003	-0.012
	(0.009)	(0.013)	(0.013)
Log GDP per-capita	0.161	0.247	0.202
	(0.443)	(0.466)	(0.393)
Access to finance	-0.0004	-0.002	-0.0002
	(0.002)	(0.003)	(0.002)

Internet users		-0.002	
		(0.009)	
Internet users* access to finance		0.0002*	
		(0.000)	
Mobile subscription			-0.0008
			(0.002)
Mobile* access to finance			0.00005*
			(0.000)
Time required to start business			
Constant	0.93	0.70	0.96
	(0.611)	(0.662)	(0.624)
Number of observations	240	250	250
Number countries	24	25	25
Robust Standard errors in parentheses			
*** p<0.05, ** p<0.01, *** p<0.001**			

Generally, the moderator analysis shows that institutional factors can influence the relationship between ICT and new business formation. The results are consistent with the ecosystem model of entrepreneurship developed by Isenberg (2016) and Stam and Spiegel (2016), which postulates that formal institutions set the framework that influences entrepreneurship development. The independent actors and factors interacting in the entrepreneurship ecosystem determine the creation of new ventures (Vogel, 2013).

Chapter 5: Conclusion and Recommendations

5.1 Conclusion

The study investigated the impact of ICTs on promoting entrepreneurship in low and lower middle-income countries. The descriptive analysis of the study shows that new business formation has been growing gradually for the last decade in lower-middle income countries. The trend shows that entrepreneurship declined between 2007 and 2009 in all regions covered in study. This might be due to the global economic recession which surfaced in the late 2000s and early 2010s. Another feature of the data is that mobile and internet usage in low and lower-middle income countries has been growing in all regions for the last decade.

The regression results indicate that ICT generally fosters entrepreneurship in low and middle-income countries. Yet the effects of different forms of ICT differ by region. Accordingly, access to ICT goods, measured as share of imports, have significant and positive effect on new business formation in Africa. In Asia, however, it is access to internet, measured by number of fixed broadband subscriptions, which significantly increase new business formation. The results from both descriptive and regression analyses support the entrepreneurship theory of knowledge spillovers. This could be due to relatively more pronounced knowledge spill-over in Asia because of the existence of large modern industries in countries like Japan, Korea and China, while improving data management and communications using computer and cell phone, for example, is more important in Africa.

The results in general support the entrepreneurship theory of knowledge spillover, which postulates that knowledge production and spillover creates entrepreneurship opportunities, and that ICTs play important role in the dissemination of knowledge. Moreover, ICT could also promote entrepreneurship by enabling better work organization and information communication even in regions, such as Africa, where there is limited possibility for knowledge spillover.

The moderating effect of the institutional variables included in the study was also analysed. Accordingly, the effect of FBB on new business formation is enhanced by higher rate of transparency and accountability of the public sector; and by reduced number of days required to start business in the LLMI countries included in the sample. On the other hand, mobile penetration is found to have influence business formation positively and significantly when there is greater access to finance and enabling business regulatory frameworks. The effect of number of internet users in on new business formation is moderated by access to finance, condition of regulatory framework, and number of days required to start a business that the regression coefficient becomes significant only after the inclusion of at least one of them in the regression specifications.

To conclude, the study provides empirical evidence that ICTs could facilitate diffusion of knowledge and strengthening of social networks that, in turn, foster entrepreneurial development in low and lower-middle income countries. It further asserts that the link between ICT and entrepreneurship could be influenced by institutional moderators.

5.2. Limitation of the study

The study has used new business density as proxy of entrepreneurship. This measure does not take in to account the growth potential of the businesses. It was not possible to study these concepts because of data limitation. Therefore, the study does not show what determines the future survival and growth of established business entities in the countries covered by the study. In addition, the data used for the study have several missing values. This has reduced the number of observations in the regression estimation.

5.3. Recommendations

Based on the findings of the study, the following recommendations are proposed for policy makers interested researches in the study area.

For policy makers

The study provides insights for policy makers of low and lower-middle income countries that enhancing internet penetration, particularly in Asian countries, helps them foster new business formation. As result, these countries need to ensure that they have got conducive policies for the ICT sector development. Furthermore, increasing investment in the ICT sector could help them raise the rate of businesses incubation. In addition, the import of ICT goods has been found an important factor of entrepreneurial development particularly Africa. Therefore, it could be helpful for African countries to ensure that their trade policies are conducive for the import of ICT goods.

The study also found that the effect of ICT on entrepreneurship development is moderated by several institutional factors including quality of regulatory framework, degree of transparency and accountability of the public sector, cost of business start-up and access to finance. Therefore, it is crucial that low and lower-middle income countries ought to improve access to credit, and the quality of their institutions, such as rule of law, freedom of press, capacity and transparency and accountability of the public sector.

For future research

The study focuses on the effect of ICT on aggregate business formation. Yet, the effect of ICT for business formation could show considerable variation in different sectors. Therefore, further study on the sectoral effect of ICT could be informative. The effect of ICT could be more visible if future researches can include more diversified measures of entrepreneurship.

Future research on the moderating role of traditional institutions such as culture, and physical infrastructure may provide additional insights on how ICT affects entrepreneurship

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Annexures

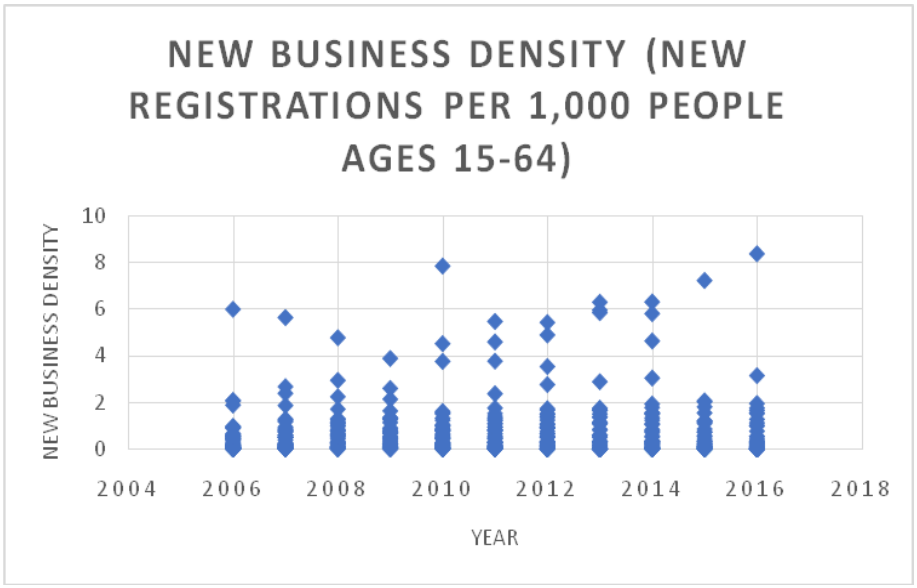
Annex 1

List of Low and Lower Middle-Income Countries covered in the Study

Africa	Asia	Latin America and the Caribbean
Burkina Faso	Afghanistan	Bolivia
Congo, Dem. Rep.	Bangladesh	El Salvador
Ethiopia	Bhutan	Haiti
Ghana	Georgia	
Kenya	India	
Lesotho	Indonesia	
Madagascar	Kyrgyz Republic	
Malawi	Lao PDR	
Morocco	Mongolia	
Niger	Myanmar	
Nigeria	Nepal	
Rwanda	Pakistan	
Sao Tome and Principe	Philippines	
Senegal	Sri Lanka	
Sierra Leone	Syrian Arab Republic	
South Sudan	Tajikistan	
Togo	Timor-Leste	
Tunisia	Uzbekistan	
Uganda	Vanuatu	
Zambia		

Annex 2

Average density of new business registration per 1000 person in low and lower middle-income countries (2006 to 2016)



Annexe 3: pooled OLS regression result

Dependent variable	New nosiness density
ICT goods imported	0.091*
	(2.57)
FBB	0.158*
	(2.45)
Internet users	-0.02
	(-1.4)
Mobile	0.003
	-0.57
Cost of business start-ups	-0.008**
	(4.62)
Time to start a business	-0.012**
	(4.65)
Transparency and accountability	-0.038
	-0.31
Business regulation	-0.318*
	(2.12)
Access to finance	0.007**
	(6.12)
_cons	2.092**
	(3.59)
R2	0.64
N	222