Information Technology for Development

ISSN: 0268-1102 (Print) 1554-0170 (Online) Journal homepage: https://www.tandfonline.com/loi/titd20

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To cite this article: Samwel Macharia Chege, Daoping Wang & Shaldon Leparan Suntu (2019): Impact of information technology innovation on firm performance in Kenya, Information Technology for Development, DOI: 10.1080/02681102.2019.1573717

To link to this article: https://doi.org/10.1080/02681102.2019.1573717

Published online: 04 Feb 2019.

INFORMATION TECHNOLOGY FOR DEVELOPMENT
https://doi.org/10.1080/02681102.2019.1573717

Routledge
Taylor & Francis Group

Impact of information technology innovation on firm performance in Kenya

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ABSTRACT

Information communication technology (ICT) is driving modern employment creation with networking sites enabling people to interact through innovation. However, ICT uptake and implementation differ due to moderating factors such as entrepreneur innovativeness, which enhances how technology innovation impacts organizational performance. This study examines the association between technology innovation and firm performance in Kenya by considering the impact of entrepreneur innovativeness on this association. A sample of 240 enterprises and structural equation modeling were used in the analysis. The findings indicate that technology innovation influences firm performance positively. The study recommends that entrepreneurs should develop innovative strategies to actualize firm performance. Government policy should aim at improving ICT infrastructure; promoting small and medium-sized enterprises' (SMEs') technological externalities within the industry, and establishing ICT resource centers to support SME performance. The study's findings enrich existing theories and contribute to business management practices in both developed and developing countries.

KEYWORDS

ICT innovation: SME; business environment: firm performance: developing country

1. Introduction

Globalization fast-tracks the development of new technology, such that, each day, there is a new discovery (Joensuu-Salo, Sorama, Viljamaa, & Varamäki, 2018; Oladimeji, Ebodaghe, & Shobayo, 2017). Changes occur rapidly, and many entrepreneurs are left wondering whether to update or replace their old strategies (Kaplan, 2014). Information communication technology (ICT) is a new avenue for modern employment creation, with networking sites enabling people to interact through innovations (Roztocki & Weistroffer Roland, 2011).

However, ICT uptake and application differ due to moderating factors such as entrepreneur innovativeness and business environment, which influence the relationship between information technology (IT) innovation and organizational performance (Alexandra & Kassim, 2013; Yunis, Tarhini, & Kassar, 2018). Innovation in ICTs brings opportunities and provides foundations for new business undertakings (Kossaï & Piget, 2014). Innovative ideas can include the use of IT to create new markets and gain a competitive advantage through greater interactivity, cheaper transactions, and direct communication with partners and clients (Hoque, Mohammad, Albar, & Bao, 2016; Zhu, Zou, & Zhang, 2018).

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Francis Andohbaidoo is the accepting Associate Editor for this article.

SMEs in developing countries face challenges in technology innovation due to their size and uncertain environments (Wamuyu, 2015). Changes in the business environment have led firms to increasingly rely on IT to achieve and retain competitiveness, improve productivity, and prosper in contemporary dynamic markets (Apulu, Latham, & Moreton, 2011; Yunis et al., 2018). These changes drive innovation-related activities, which are technology-based and are intended to improve performance (Igun, 2014). However, despite the wide adoption of ICT by organizations in various sectors, several survey reports have found that many enterprises fail to advance through the business lifecycle stages (Amankwah-Amoah, 2018).

Kenya's government has incorporated ICT and internet connectivity as an engine for socio-economic growth and development by establishing the e-Citizen web portal and customer service centers to streamline e-government services under one roof (Kevin, Sonny, Tigineh, & Sriram, 2017). According to the ICT Authority, the value of Kenya's ICT sector is about US$500 million and accounted for 2.9% of the nation's gross domestic product (GDP) in 2012. Kenya's national ICT policy aims at improving ICT in rural areas and attaining an 80% access rate through partnership and the implementation of a US$2.89 billion National Broadband Strategy (Kevin et al., 2017).

Despite this progress in the ICT sector, SMEs in developing countries experience critical difficulties such as retarded growth, decreasing trend in technological innovation, and a high failure rate (Bunyasi, Bwisa, & Namusonge, 2014). According to a Kenya Institute for Public Policy Research and Analysis (KIPPRA) survey report, indicate that SMEs have limited contribution to the GDP (KIPPRA, 2014). Although SMEs account for over 60% of the production and employment sector, their rate of failure ranges between 70% and 80% (Adeniran & Johnston, 2012). Research conducted by Liedholm (2002) involving about 28,000 SMEs in Africa and Latin America shows a sluggish growth rate among SMEs at the startup stage. According to Fajnzylber, Maloney, and Rojas (2006), only 12% of SMEs showed positive growth in a year, but bigger enterprises showed a greater propensity for outsourcing than increasing in Mexico. Many SMEs in developing countries lack the ability to innovate or seize available opportunities brought by new technology (KNBS, 2016; Mumbi, 2017).

Previous studies have shown that IT implementation among SMEs is slower than that of large enterprises (Ntwoku, Negash, & Meso, 2017). According to AlBar and Hoque (2017), major obstacles to ICT application in rural SMEs include inadequate top management support, resistance to change, lack of innovativeness, lack of skilled labor, and an increase in the digital divide between developing and developed countries (Apulu et al., 2011). A study conducted by Zahra (2011), revealed that the exterior environment impacts businesses' invention strategies and that prior studies concentrated on the impact of environmental uncertainty on the performance of SMEs (Li & Wong, 2003). The literature on the impact of IT innovation on SME performance in the context of developing countries is sporadic (Obasan, 2014).

This study seeks to close this research gap by assessing how information technology innovation influences firm performance in Kenya given the low level of technology innovation and the rate of business closure in developing countries. This study addresses the following questions: Does information technology innovation always lead to improved firm performance? What role do entrepreneurs play in information technology innovation to improve firm performance?

The rest of this paper is organized as follows. Section 2 presents a literature review. Section 3 presents the study's theoretical framework. Sections 4 and 5 present the research methodology and the results. Section 6 discusses the results and outlines the study's implications, conclusions, limitations, and suggestions for future research.

2. Related literature and hypothesis development

Information communication technology refers to the technology systems used to transmit, store, process, display, create, and automate information dissemination (Gunday, Ulusoy, Kilic, & Alpkan, 2011; Modimogale & Kroeze, 2011). These technologies include items such as television; fixed telephone lines; mobile phones; radio; satellite systems; video; computers; network software and

hardware; and the equipment and services related to these technologies, such as emails, video-conferencing, blogs, and social media (Ali, Jabeen, & Nikhitha, 2016). Technology innovation is the systematic application of all sources of organized knowledge, such as literature, science, and the arts, geared toward organizational performance (Luppicini, 2005).

ICT raises firms' productivity and market share and provides firms with many benefits, such as help in introducing new products and services, becoming more customer-oriented, responding better to market changes, and being able to innovate for better firm performance (Gërguri-Rashiti, Ramadani, Abazi-Alili, Dana, & Ratten, 2017). However, ICT cannot improve firm performance or sustain a competitive advantage if it is not implemented innovatively, or if organizational structures and work processes are not improved or changed (Brynjolfsson & Saunders, 2010). ICT innovation comprises all the processes aimed at creating a new technique, idea, or product for the ICT sector, defined by the social, political, or ecological context (Misuraca, Pasi, & Brancati, 2017).

Innovation improves a firm's value chain and introduces new products, services, solutions, and work procedures (Shaw, O'Loughlin, & McFadzean, 2005). Schumpeter (1942) viewed innovation in entrepreneurship as a significant component of the firm's life cycle. He defined the concept of 'disruptive innovation,' which entails the creative destruction that occurs when a firm optimizes profitability by establishing new products or services that disrupt the current market and cause a shift in resource use. Innovation, in Schumpeter's view, comprises the aspects of inventiveness; the introduction of new processes, products, or services; investment in research and development (R&D); and improvement in technologies.

Innovation plays an important role not only in business but also in a country's economic development and a firm's competitive advantage (Saunila, 2014; Serdyukov, 2017). Innovative entrepreneurs gain first-mover advantage by bringing about new ideas, processes, products, or services, or improving the utility of a product or service, thus increasing profitability (Franco & Mario, 2017). SMEs are progressively deliberated as the critical source of new product development and new technologies (Hilmersson, 2014).

Different countries define SMEs differently depending on their stage of economic growth (Berisha & Pula, 2015). The accepted principles for the definition of SMEs comprise staff numbers, investment level, and sales volume (European-Union, 2005). The European Commission defines SMEs as firms with 10 to 49 employees and medium-sized businesses as those with between 50 and 250 employees (Katua, 2014). In Kenya, the SMEs Act 2012 categories SMEs in terms of their sector, employee number, and investment value (Berisha & Pula, 2015). Scholars have defined rural SMEs as those enterprises working within the agricultural value chain (Eskesen, Agrawal, & Desai, 2014). These include individual farmers, producers, service providers, and intermediaries.

2.1 Theoretical model

Many researchers have developed models and theories to investigate the adoption of ICT at the firm level and to examine different aspects of ICT implementation (Chen & Kamal, 2016; Findik & Tansel, 2015; Haller & Siedschlag, 2014; Hartoyo & Daryanto, 2016). Some theoretical models focus only on external environmental factors, while others examine technological factors (Zahra, 2008, 2011). Several previous studies have centered on technology acceptance theories that highlight the use of IT at the individual level in developed countries (Momani & Jamous, 2017; Taherdoost, 2018). Innovation models such as the diffusion of innovation (DoI) by Rogers (1995) and the technology adoption model (TAM) by Davis (1989) have been widely used in information-related research and have become the dominant theories in studies of technology management (Zheng, 2015).

The basic aspects of these models cause procedural limitations when diverse flows of information change the innovation cycle (Agarwal & Prasad, 1998). In Roger's model, diffusion seems to be almost automatic and mechanical, and the model does not consider the social dynamics of how and why technology is adopted in the current information age (Jiménez & Zheng, 2017; Peres, Muller, & Mahajan, 2010). Many studies have found that both Roger's and Davis' models are limited in how

they predict and describe phenomena (Akrich, Callon, & Latour, 2002; Jiménez & Zheng, 2017; Rye, 2009). In addition, the models do not emphasize how contexts and structures shape innovation, and instead consider people as passive social groups that exist independent of the object (Akrich et al., 2002; Rye, 2009). The models also pay inadequate attention to entrepreneur innovation, which affects a firm's interaction with technology innovation (Zheng, 2015).

This study employs two main theoretical frameworks: The five-stage growth model (Churchill & Lewis, 1983) and the product-process model of innovation (Utterback & Afuah, 1995). The five-stage growth model postulated by Churchill and Lewis (1983) uses a model relevant to small and growing businesses that delineates five stages of firm development (Gupta, 2013).

The first stage is the firm existence stage; this is concerned with how the firm acquires customers and delivers products and services to them (Churchill & Lewis, 1983). Business start-ups have recently become a good way to advance technology because they are helped by continuous innovation and careful planning. Building a business from scratch can be a daunting and time-consuming task with many risks and a minimum guarantee of success (Rahman, Yaacob, & Radzi, 2016). Due to competition based on innovative ideas and new technologies, about 25% of startups have failed in their first year of operation (Bunyasi et al., 2014). However, innovation alone cannot contribute to success, as companies are no longer buying only goods and services, but also use technology to assist and develop these services through modern technological innovation. Therefore, innovation and entrepreneurship can improve performance during the firm existence phase of the company's survival (Gupta, 2013).

The second stage is survival; this is characterized by a workable business process with key questions focused on how the firm can break even and remain in business. Tidd and Bessant (2010), argue that technology is the key to the success of SMEs, as they use technology to innovate, which give them a competitive advantage in the marketplace. In other words, innovative SMEs show sustainable growth and performance compared to other SMEs that do not use technology (Rahman et al., 2016). The high failure rate of start-ups is steadily increasing and the survival of SMEs must be at the center of concern (Bunyasi et al., 2014). Technological innovation is used as a means of improving the survival rate (Tidd & Bessant, 2010). Entrepreneurs need to stimulate innovation because the success and survival of a business depend on its ability to innovate continuously (Varis & Littunen, 2010). Therefore, by improving the use of technological innovation, the survival of SMEs can be expanded to enable businesses to grow and develop.

The third stage is success; this requires that owners decide to either exploit the firm's progress and expand or keep the firm profitable and provide alternative business activities (Churchill & Lewis, 1983). The firm can stay at this stage indefinitely provided environmental changes do not destroy its market niche or ineffective management does not reduce its competitive abilities (Chattopadhyay & Bhawsar, 2017). Due to changes in business methods, the concept of "big eat small" is being replaced by "fast beats slow". The most successful companies will always find a way to take advantage of their competitors (Varis & Littunen, 2010). Technology is helping companies gain market share and new ideas for growing their business. In the success phase, technology has become an accelerator for business development through social networking, record automation and online marketing (Rahman et al., 2016). At this stage, SMEs need to prioritize their ability to assess technology needs that are linked to optimal efficiency and productivity (Rahman et al., 2016).

The fourth stage is take-off/growth; this is concerned with how to make the firm grow quickly and how to finance this growth (Favaretto & Meirelles, 2015). The most important task facing SMEs at the growth stage is to achieve growth and development, which not only increases business profits but also improves their ability to withstand risks and ensures a virtuous circle of commercial operations (Mothe & Thi, 2010). SMEs should focus on the formulation and implementation of technological innovation strategies, marketing strategies and cost control strategies (Pratali, 2003). For growing SMEs, the technology innovation strategy is particularly critical as the technology matures and is constantly updated at this stage (Favaretto & Meirelles, 2015).

The fifth stage is resource maturity, where the firm enjoys advantages of size, managerial talents, and monetary resources (Runyan, Huddleston, & Swinney, 2007). The main task of mature SMEs is to maintain and stabilize their market share, technological leadership, personnel structure, income and other benefits (Rahman et al., 2016). The technological innovation capacity of SMEs is to some extent the degree of economic production and the capacity for sustainable development (Pratali, 2003). The capacity for technological innovation is at the base of the innovation performance of a company at the maturity stage (Churchill & Lewis, 1983).

The five-stage growth model stages have the common features of size, diversity, and complexity (Churchill & Lewis, 1983). These depend on five management factors: effective organizational structure, management style, strategic plan, and the owner's role in the business (Churchill & Lewis, 1983; Levie & Lichtenstein, 2010). Firms with an innovative drive command the market if they maintain their entrepreneurial spirit, while firms that do not innovate may enter the sixth stage of ossification (Churchill & Lewis, 1983), characterized by a lack of innovative decision-making and the avoidance of risks (Gupta, 2013). The owner's ability to sell, produce, or invent is of highest importance (Pierre & Fernandez, 2018; Terziovski, 2010).

In this model, technological innovation is not only linked to the evolution of innovation, but also to the way in which it is diffused within the organization (Macvaugh & Schiavone, 2010). Technology is a powerful driver of innovation and reflects a constant trend of improvements to existing innovations (Chattopadhyay & Bhawsar, 2017). The five-stage growth model shows how a company's economic returns experience a steep exponential growth phase and a final decline, prompting companies to use technology to drive new innovations and improve their performance (Zheng, 2015). Each stage has different challenges, opportunities, resource needs, and management approaches (Churchill & Lewis, 1983), and SME development progresses from an entrepreneurial approach through stages of team building and innovativeness, leading to firm performance (O'Farrell & Hitchens, 1988).

ICT helps in the generation, integration, development, and enhancement of key resources at each stage of business development (Xiong & Qureshi, 2015). This conforms with the Schumpeterian view (1934) regarding the achievement of competitive advantage based on improving, shaping, or enhancing existing resources and competencies via innovative and complex processes (Gërguri-Rashiti et al., 2017), such as knowledge integration from various sources through continuous learning processes, risk management, and the seizing of new opportunities in each growth stage of the firm (Ng & Kee, 2012).

The product–process model of innovation postulated by Utterback and Afuah (1995) theorizes that the rate of product or process innovation is, and should be, a function of the stage of firm development represented by the product (Meissner & Kotsemir, 2016). The theory attempts to relate technology innovation to the three stages of firm development by identifying, and then separating process and product innovations (Gremyr, Witell, Löfberg, Edvardsson, & Fundin, 2014).

In the first stage, product changes are frequent because of nonstandardized production processes and competition based on product performance, allowing numerous product-related changes (Butler, 1988). Firms then move into the second stage (segmental stage) where there is less emphasis on product performance and more of a focus on the external variation between product competitors (Kraja & Osmani, 2015). The business environment in relation to competitors determines the innovation drive of the owner-manager (Amankwah-Amoah, 2018). During this stage, fewer product innovations occur but process innovations increase due to the introduction of specialized production equipment and inputs, which are volume-justified (Utterback & Afuah, 1995).

The third stage (systemic stage) is the final stage and marks the point where fewer process and product innovations occur due to sluggish growth associated with the firm's maturity level (Lester & Parnell, 2005). At this stage, the low-cost strategy may be most appropriate because production systems are no longer sufficiently flexible to tolerate product changes, and thus technology helps support price-based competition since innovation is characterized by continuous transformation (Yanes-est, Mar, & Ram, 2018).

The concept of product-process model is relevant to this study because in a competitive sense, the period during which a product retains a competitive advantage is directly related to its stage of development (Butler, 1988). For instance, the segmental stage covers the entire period from product inception to obsolescence (Utterback & Afuah, 1995). Therefore, the nature of the product/service should guide the producer's design on how the product or service would be actualized (Butler, 1988). The model elaborates how a product or service is produced or delivered to the client. It can be a combination of methods, capabilities, and technologies to produce, market, deliver and support a product or provide a service (Utterback & Afuah, 1995). Manufacturing organizations produce physical, tangible goods that can be stored in inventory before they are needed. By contrast, service organizations produce intangible products that cannot be produced ahead of time. In manufacturing organizations, most customers have no direct contact with the operation. However, in service organizations the customers are typically present during the creation of the service for instance in transport or hair and beauty salon business, customer's feedback can be used to improve the product-process innovation (Butler, 1988).

The two models apply well to this study, as IT innovation paves the way toward meeting strategic firm objectives, including but not confined to operational excellence and the introduction of new products and services (Jiménez & Zheng, 2017). Information technology innovations bring changes, and owner-managers should adopt those changes in the organization with an entrepreneurial spirit (Irungu, Mbugua, & Muia, 2015) and make use of these innovation opportunities to enhance the value of the organization and its competitiveness (Ahn, Minshall, & Mortara, 2015).

The models make it possible to visualize the conceptual model of this study. It includes five pertinent factors: IT innovation, entrepreneur innovativeness, business environment, organization structure, and firm performance. These are shown in Figure 1. The model provides an inclusive theoretical basis for analyzing how IT innovation is distributed and assimilated at the organizational level (Akinwale, Adepoju, & Olomu, 2017).

Further, the model suggests that innovation tendency is influenced by the capability of the entrepreneur to handle both formal and informal intra-organizational methods of workforce administration and communication (Seun, Kalsom, & Raheem, 2017). Entrepreneur characteristics such as the prudent use of resources and innovativeness play a significant role on firm performance (Laguir & Besten, 2016). Technology innovation implementation decisions sometimes depend on environmental characteristics such as competition, supplier pressure, customer demands and the entrepreneur's experience in the sector (Rahim & Zainuddin, 2016).

2.2 Importance of ICT and firm performance

According to the World Bank (2015), ICT incorporation in organizations has already had an impact on economic performance among firms in developing countries (Akinwale et al., 2017), where ICT contributes positively to firm growth and development. SMEs can use ICT to strengthen or replace existing information systems and networks and thereby open a new market for the business (Hartoyo & Daryanto, 2016). ICT promotes the dissemination of information and knowledge that facilitates development by bringing about social and economic changes (Osborn, Amy, & Ullah, 2015). Governments across the world advocate policies and programs that aim to bridge the digital divide by providing greater access to ICT in less-developed areas (Osborn et al., 2015). The 2030 Agenda for Sustainable Development recognizes the spread of ICT (Kevin et al., 2017) and global connections as a factor that quickens human resource development and thus narrows the digital divide (ITU, 2018).

Small and medium-sized enterprises can attain quick economic development while producing considerable opportunities for employment (Ndesaulwa & Kikula, 2016). Although Kenya has the largest ICT sector in East Africa (Kevin et al., 2017), Kenyan SMEs' contribution to the GDP accounted for only 3.8% in 2013 (Bunyasi et al., 2014), indicating dismal growth in the sub-sector. Information communication technology has become an intrinsic part of everyday life, and society cannot work without it (Roztocki & Weistroffer Roland, 2011). Many studies have tried to assess the economic impact of ICT on firm performance in the context of ICT for Development (ICT4D)

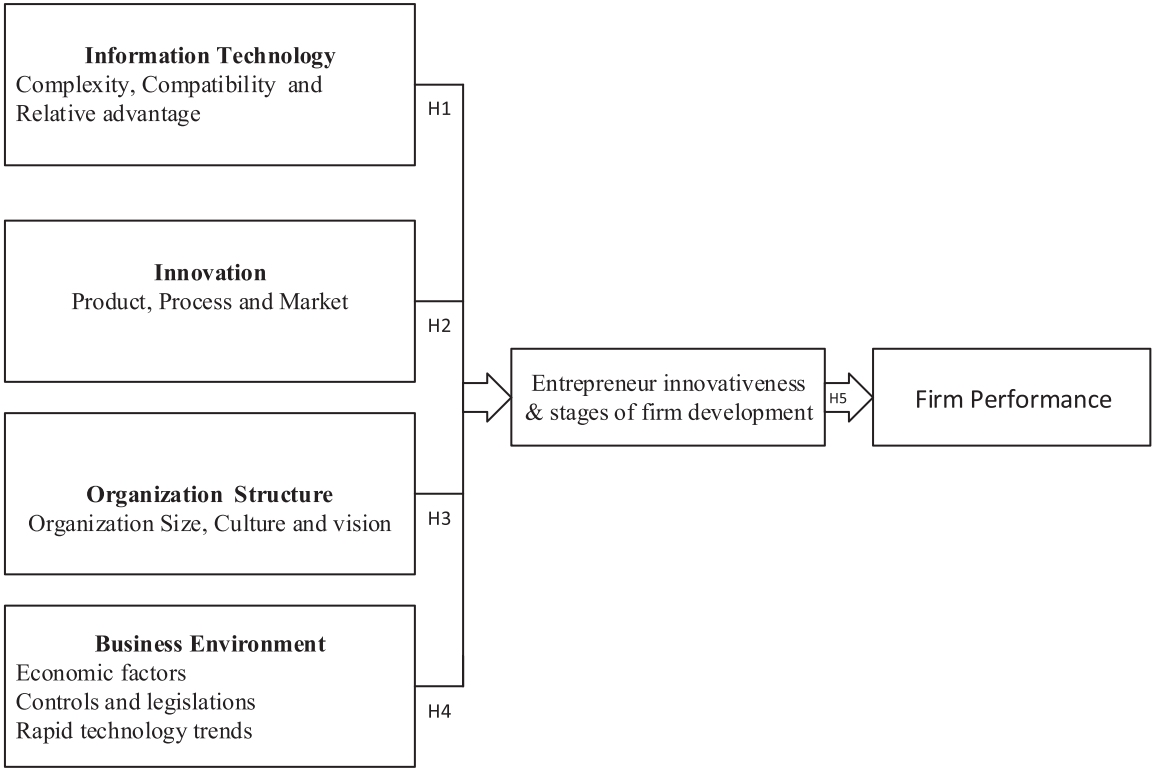

Figure 1. Study conceptual framework.

(Xiong & Qureshi, 2015). Scholars have raised concerns about the concept of ICT4D, specifically about whether it can contribute to the development and how the results of development can be analyzed (Xiong & Qureshi, 2015). In this study, the focus on ICT4D is on the connection between the study's variables, which concern how SMEs create employment opportunities and speed up economic and societal development (Rampersad & Troshani, 2018). In addition, the effects of globalization cut across multiple facets of people's lives, societies, and organizations; thus, ICT4D has relevance for business undertakings (Kleine, 2015), as shown in Figure 2. ICT4D has its roots in the economics of business organizations, with a focus on improving living standards (Gunday et al., 2011). Implementing ICT innovation initiatives depends on the organization's and the manager's capability to enhance firm profitability through effective strategies (Tarutė & Gatautis, 2014). The integration of business with technology in each stage of business development reduces operational costs and increases efficiency (Apulu & Latham, 2010).

2.3 Technology innovation and firm performance

Patterns of technology innovation for products and processes have been found to be the result of many different factors, including the need for improved firm performance (Mihalic & Bousinakis, 2013; Novac-ududec, Enache, & Sbughea, 2011). When attempting to examine the period and process of a technology's development, these approaches take into account a vast number of factors in all stages of firm development (Churchill & Lewis, 1983). Previous studies have reported the significant importance of timely access to reliable information in increasing firms' performance and have highlighted the role played by IT in this regard (Gërguri-Rashiti et al., 2017; Yunis et al., 2018). Studies have also pointed out the need for a further examination of ICT implementation by owner-managers in order to understand how IT is used to improve performance (Kossaï & Piget, 2014; Margarita, Fernando, Bayo-moriones, & Lera-lo, 2013).

The technological context influences decision making on innovation in terms of compatibility, relative advantage, complexity, observability, confidentiality, and trialability (Rogers, 2003). Of these attributes, only complexity, relative advantage, and compatibility relate to the concept of ICT innovation (Akinwale et al., 2017; Ntemana & Olatokun, 2012). Relative advantage refers to the

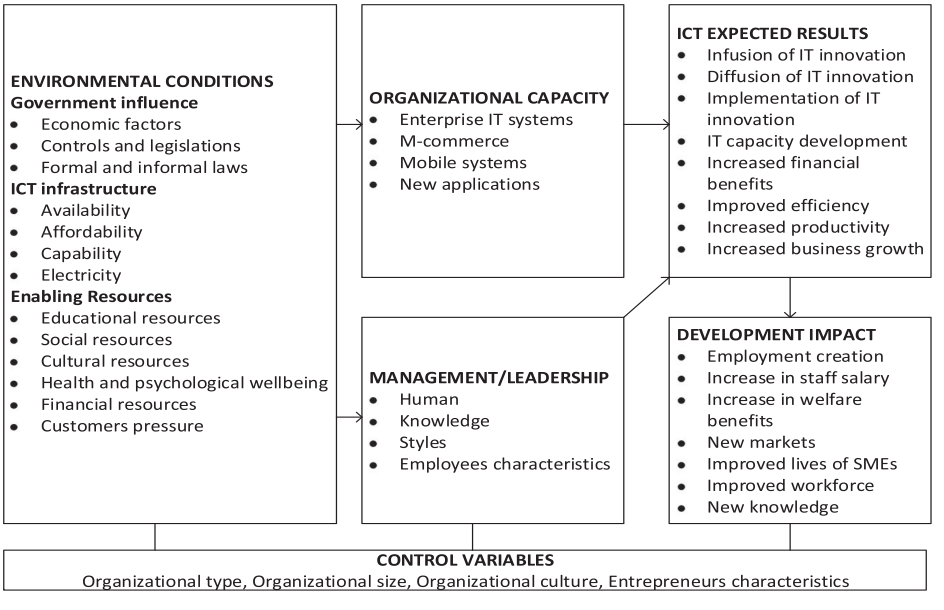

Figure 2. Importance of ICT4D.

extent to which SMEs perceive technology innovation as a better option than the idea it replaces (Rogers, 1995). It describes the value or loss that a firm may experience when it adopts or rejects a new technology (Akinwale et al., 2017). Technology compatibility refers to the extent to which technology innovation is seen to be consistent with the prevailing standards, previous experiences, and needs of new consumers or users (Rogers, 2003).

The compatibility of IT with current work practices enhances an SME's technology innovation (Ntwoku et al., 2017). Complexity is the extent to which SMEs perceive technology innovation as challenging to comprehend and use (Rogers, 2003). According to Roberts and Amit (2003), innovative enterprises have a competitive advantage that leads to high profits and business sustainability (Atuahene-Gima, 2004). The results of innovation appear in product, processes, markets, factors of production, and organizational structures (Roach, Ryman, & Makani, 2016).

The empirical literature defines innovation based on Schumpeter's description (Schumpeter, 1942): the introduction of new products, processes, and markets. According to Jong and Vermeulen (2006), innovation intensity is a process in which innovative inputs are transformed into innovative outputs through a process that involves human knowledge and labor to generate new or improved products, services, or work processes (Jong, 2000). According to Wu and Zhang (2013) IT innovation in agriculture is concerned with the use of any technology, invention or improvement made by farmers to cope with the complexity of local resource, ecological, economic and social conditions. For instance, the use of artificial insemination (AI) in case of livestock rearing or use of hybrid seed in case of crop production (Coudel, Devautour, Faure, Hubert, & Soulard, 2017; Wu & Zhang, 2013).

Innovation help in product value addition that may entail packaging or labeling a product for a special market, adding new features to an existing product or developing new ones from primary products. For instance making fruit juice or processing maize into flour (Irungu et al., 2015). The most common measures used in the literature on innovation include measures of the inputs into the innovation process (such as R&D expenditure) and direct measures of innovation output (such as new products or processes) (Akinwale et al., 2017). However, not all R&D expenditures result in innovation output since this measure reflects only the resources committed to producing innovation output, not those committed to the innovation process (Razavi, Nargesi, Hajihoseini, & Akbari, 2016).

As SMEs develops it moves through five growth stages, each with its own distinctive characteristics (Churchill & Lewis, 1983). IT innovation is a critical variable that not only helps to explain firm growth but also a major area that deserves managers' attention regarding their strategic decisions over the life cycle of their firms (Utterback & Afuah, 1995). This suggests that SMEs innovation strategy may vary over the firm life cycle, even though the likelihood might be different at each growth stage (Churchill & Lewis, 1983). Crossing each stage of growth require SMEs to acquire new technology and innovative strategies inside the organization (Chaston, 2010; Gupta, 2013). Linking the firm's growth stages with technological innovation and exploring whether innovation strategies vary over the firm's life-cycle stages is critical in SMEs performance (Utterback & Afuah, 1995).

Technology innovation pertains to both the evolution of innovations and the way it proliferates within the organization (Churchill & Lewis, 1983). Technology is a powerful driving force in innovative capacity and demonstrates a consistent trend toward new innovations as a result of improving upon current ones. The five-stage growth model shows how firms' economic returns go through a steep exponential growth phase and an eventual decline, which motivates businesses to leverage technology to produce new innovations that boost firm performance (Churchill & Lewis, 1983). Therefore, the identification of innovation strategies and the discussion of their development over time and across the firm's growth stages will allow a better understanding of multiple innovation strategies across growth trajectories. However, inadequate resources to acquire new technology maybe the reasons why SMEs are not able to move from one stage to another (Dunn & Cheatham, 1993). Based on the literature, this study proposes the following:

H_1: IT innovation has a positive influence on SME performance.

H_2: use of ICT has a positive influence on SME performance

2.4 Organizational structure and firm performance

According to Csaszar (2009), organizational structure guides firm performance, and a poorly designed structure stifles staff creativity and innovation (Lunenburg, 2012; Mintzberg, 1992). Organizational structures have a substantial impact on the firm's financial performance and the ability to manage employees (Setiawan, Putrawan, Murni, & Ghozali, 2016). The organizational structure defines how jobs and tasks are coordinated between individuals and teams within the firm (Trez & Luce, 2012).

The organizational context includes top management support, the organizational culture, and the personnel's knowledge. A firm's organizational context has an important impact on how it determines its ICT implementation and assimilation (Premkumar, 2003). Top management support, the staff's ICT skills, and the organizational orientation toward innovation promote the successful acceptance of an innovation (Wang & Shi, 2009). The manager's experience and development initiatives outline how various roles are delegated, coordinated, and controlled (Lunenburg, 2012). The organizational structure outlines how staff and supervisors relate to the organization in terms of decision making, communication channels, and workflow systems (Mintzberg, 1992; Peng, 2012).

According to Marija, Stevanović, and Belopavlović (2014), the SME management structure is highly centralized, with a wide range of controls, a low degree of specialization, and departmentalization. The Owner-manager makes all the important decisions and oversees all business processes (Hao, Kasper, & Muehlbacher, 2012). The main advantages of this simple organizational model are clear control systems and a high degree of flexibility (Trez & Luce, 2012). Researchers have argued that an organization's choice of structure will have an important impact on their subsequent levels of IT innovation and firm performance (Muduenyi, Oke, & Fadenyi, 2015).

Gustafsson, Franke, Johnson, and Lilliesköld (2008) identify four areas where ICT can complement and support the organization. The first two are vertical and horizontal communication between organizational units and members (Hao et al., 2012). The other two are the systems that control the processes – either partially through workflow procedures where a human performs the actual work but the process is coordinated by a machine or completely through automation where the human operators perform only supervisory tasks (Hao et al., 2012). In every stage of firm development, an effective organizational structure is required for continual firm improvement (Peng, 2012).

According to Churchill and Lewis (1983), in the start-up phase, small business owners focus on their customers and the opportunities to offer their products and services. The organizational structure is simple: the manager does everything and directly supervises his subordinates (Churchill & Lewis, 1983). Such a framework can predict key requirements at different times, such as the time commitment of the owner during the start-up, the need for delegation and the change in management roles as the SMEs grows (Churchill & Lewis, 1983). Experts explained that determining the company's growth trajectory in a predictable way from the company's existence, survival, success, take-off, maturity, and transformation requires the company's continued competitiveness from existence to maturity stage (Churchill & Lewis, 1983). The failure to establish a formal organizational structure with a professional workforce challenges the company's move from one stage to another (Peng, 2012). Based on the literature, the following is proposed:

H_3: organizational structure has a positive influence on SME performance

2.5 Entrepreneur innovativeness and firm performance

Entrepreneur innovativeness is the process of seeking new opportunities and products and the elimination of obsolete operations ahead of competitors (Wambugu & Gichira, 2015). It includes the manager's ICT skills and knowledge needed to generate new ideas that will promote business growth (Wamuyu, 2015). Entrepreneur innovativeness incorporates the manager's capacity to recognize and seize opportunities for promoting the innovative utilization of resources and improve firm performance (Yunis et al., 2018). Kuratko (2017) describes entrepreneur innovativeness as a

vision-directed process whereby an entrepreneur focuses on rejuvenating and shaping the organization's scope of operations through the exploitation of business opportunities (Hung & Chiang, 2010). These initiatives improve firm performance and competitive advantage (Shaw et al., 2005). Accordingly, technology innovations can contribute positively to organizational performance if the entrepreneur exploits available opportunities through entrepreneurial strategies, actions, and behaviors (Guo & Miller, 2010; Kyla, Puumalainen, & Saarenketo, 2005).

Some researchers have shown that SME managers are the key decision makers and that their decisions influence the firm's long-term activities (Kuratko, 2017). Managers' creativity influences ICT innovation decisions from initiation to implementation (Jiménez & Zheng, 2017). SMEs with innovative managers have a high likelihood of accepting technology innovation (Bruque & Moyano, 2007). An entrepreneur can gain a first-mover advantage by analyzing future changes in market demand, customers' expectations, and the environment (Spithoven, Clatysse, & Knockaert, 2011). Risk-taking is the act of undertaking any activity that involves uncertainty, as manifested in entrepreneurial behavior such as investing in a venture with a higher probability of failure but high returns if it succeeds (Allah & Nakhaie, 2011).

Taking a calculated risk in business is part of the entrepreneurial capability to discern future uncertainties before undertaking a risk (Brustbauer, 2016). Almoawi and Mahmood (2011) found that managers' inadequate ICT knowledge was the major obstacle to SMEs' ICT implementation. Chang (2006) found a positive relationship between the manager's technical knowledge and SME's acceptance of ICT. The efforts of rural SMEs to use technology to achieve desired results depend on the manager's initiative in learning and adopting ICT (Galloway, 2007).

According to Churchill and Lewis (1983), although their roles change at all stages of business growth, the importance of the owner-manager remains at all stages. Majumdar (2008), believes that business growth depends on the vision and position of the entrepreneur, and its parameters vary from one entrepreneur to another (Churchill & Lewis, 1983). The growth of a business depends on the speed with which experienced managers can plan and implement the project (Pitelis, 2010). The development of a company is limited by the extent of management resources, particularly the ability to coordinate and the ability to introduce new technological innovations into the business (Pitelis, 2010). Skills development, personal commitment, risk-taking, and clear vision are required in the first stages of firm growth (Adizes, 1979). Once the firm has reached maturity, leaders shift their focus on business sustainability, through appropriate planning, technological innovation, and the system to achieve the desired performance (Adizes, 1979; Churchill & Lewis, 1983). Based on the literature, the following is proposed:

H_4. Entrepreneur innovativeness has a positive influence on SME performance

2.6 Business environment and firm performance

The environment comprises the entirety of the physical and social factors that influence the decision-making process of an enterprise (Duncan, Spence, & Mummery, 2005). The surroundings within which a business operates can advance business development or limit business maneuvers due to changes in business environment (Dut, 2015). In the contemporary business environment, technology has affected and been integrated by almost all small and large organizations (Devaraj & Kohli, 2000).

Many firms face challenges while incorporating technology as an important component of their functions and processes due to gradual transformations in the environment (Zahra, 2011). Entrepreneurs can overcome these challenges through effective planning and process innovation (Neneh & Zyl, 2012). Scholars have found that the business environment has an important impact on firm performance (Ng & Kee, 2012).

According to Rahim and Zainuddin (2016), the business environment is characterized by rapid technological and market changes that pose a risk to product or service development processes. Environmental changes include continuous technology changes, market demands, and stiff

competition, which all affect business performance (Yanes-est et al., 2018; Zahra, 2011). Studies have developed three ecological perspectives (Akanni, 2015). The first perspective describes an organization's outside group as consisting of clientele, competitors, sellers, and government regulations (Sroufe, 2003). The second aspect centers on the characteristics of external features, such as intricacy, dynamism, and integration (Jong, Phan, & Ees, 2011). The external environmental aspects can moderate the marketplace orientations that influence firm performance (Ting, Wang, & Wang, 2012). The third perspective involves the supervisory perceptions of these environmental features (Raymond, 2012).

Interior and exterior environmental alignments have been recognized as having a moderating influence on business performance (Akanni, 2015; Lumpkin & Dess, 2001; Roberts, 2010). Top management should understand their effects and seize opportunities to protect their firm from being adversely impacted, and quantify both the external and internal factors that affect ICT innovation trends and firm performance (Chen, Honda, Hosoda, & Hayase, 2014). Rural SMEs are challenged by poor market access, lack of value-addition facilities, unskilled labor forces, and poor road networks (Njeru, 2016). According to Irungu et al. (2015), lack of proper information dissemination in rural areas is a main factor affecting SME growth.

The work environment of the company has diverse implications on its growth (Levie & Lichtenstein, 2010; Quinn & Cameron, 1983). According to Churchill and Lewis (1983), small businesses should maintain an agile culture at all growth stages by paying attention to changes in the environment, market changes, and incentives that reward growth and avoid ossification that occurs when innovation stagnates. Levie and Lichtenstein (2010), argues that organizations are not created like living organisms and that their growth can be created by changing internal and external environments. A business can survive and maintain its own changing environment by continuous adaptation of environmental changes for sustainable business growth. Leitch, Hill, and Neergaard (2010), maintains that there is a need to understand the company's stages of growth relative to the environment (Pitelis, 2010). Based on the literature, the following is proposed:

H_5: The business environment has a positive effect on SME performance

3. Methodology

3.1 Study sample

This study's primary units of analysis are the managers of SMEs in Tharaka-Nithi County, Kenya. The researcher selected this area for several reasons. First, it is one out of the 47 counties in Kenya with a robust 2015–2020 ICT roadmap despite being in a rural setting (Liboyi, 2015). Second, 98.2% of the county's households engage in crop farming (KNBS, 2016). Third, the county prioritized connecting its headquarters with a fiber optic backbone to boost internet connectivity in rural areas (Liboyi, 2015). To facilitate generalizability, the study used a random sampling of small-scale farmers and SMEs registered and licensed by the Youth Enterprise Development Fund (YEDF), cooperative societies, and the county government.

The size of the sample is an important factor in ensuring both its representativeness and its suitability for executing the appropriate statistical tools. Previous studies have recommended various sample sizes and advanced several theories for determining an appropriate sample size (Binu, Mayya, & Dhar, 2014; H. Guo, Pohl, & Gerokostopoulos, 2013). However, sample-size requirements may vary according to the statistical analysis, and a variety of opinions is observed in the literature, even when the same tools are applied. According to Israel, (2012), studies with a large population can use simplified formulae to achieve the desired sample size. A sample size comprising 200–500 respondents is sufficient for high-impact studies that use multiple linear regression or covariance analyses. The researcher applied a random sampling procedure to select a sample of 297 enterprises.

3.2 Measurements of variables

To measure the study variables, the researcher changed various variable constructs drawn from prior studies to fit the study context. The study modified variable constructs for the technology context (complexity relative advantage and compatibility) taken from Premkumar and Roberts (1999). Variables for technology innovation (product, process, and market innovations) were taken from Jong (2000) and Simiyu (2013). The study used different items to measure various types of innovation undertaken by small farmers. For example, respondents were asked whether they had introduced any new product or used hybrid seed variety, use of new methods/procedures, new inputs or machines, and availability of ICT marketing tools for the farm produce (Table 1).

Variables for organizational context were taken from Thong et al. (1996). Variables for owner-manager ICT knowledge and innovativeness were taken from Thong and Yap (1995). Environment factors were taken from Ramsey and Mccole (2005), Al-Qirim (2005), Rahayu and Day (2015), and Thong (1999). The measurement of SME performance was based on Fazli et al., 2013; Margarita et al. (2013), as shown in Table 3.

Most of the variables were scored on a five-point Likert scale (from 1 = strongly disagree to 5 = strongly agree), with high scores representing a higher ranking for the variables construct. The study measured the respondents' biodata such as age and gender using years or a dichotomous variable where 1 = male and 0 = female (Cooper & Schindler, 2003), as shown in Table 1.

3.3 Questionnaire design and data collection

The study uses a quantitative research design and a semi-structured questionnaire to gather the required data. The questionnaire was prepared based on the literature (Babin & Carr, 2010; Kothari, 2004; Mugenda & Mugenda, 1999; Yu, 2012). The researcher engaged the help of a university professor, three doctoral students, and three small-scale farmers to assess the structure and variable constructs in the questionnaire. Based on their feedback and guidance, the researcher made the necessary adjustments.

The researcher conducted a pilot study on 30 owner-managers who had sufficient knowledge and experience in the issues under investigation. Pre-testing enabled the researcher to determine the potential of the instrument to collect the required data as well as the instruments' consistency, reliability, and validity. In addition, a pilot study facilitated the review of the sequence, wording, simplicity, content, clarity, and layout of the study instrument (Akter, Ambra, & Ray, 2010). Computing Cronbach's alpha verified the internal consistency and reliability of the variables. According to Tavakol and Dennick (2011), an alpha value of at least 0.7 is adequate for any research. The Cronbach's alpha values were higher than 0.7; hence, the instruments were appropriate for the study.

The questionnaire had two sections. The first measured the respondents' biodata and firm background information (age, experience, education, firm age, industry or sector, legal registration status, firm size, and firm location). The second measured the independent variable constructs: technological context (compatibility, complexity, and relative advantage), technology innovation (product, process, and market innovations Coudel et al., 2017; Wu & Zhang, 2013), organizational structure, owner-manager innovativeness, and environmental factors.

To ensure a high response rate, the researcher used an integrated method of questionnaire distribution whereby two trained research assistants sent the respondents email, had face-to-face meetings, and sent a mobile message asking them to check their email and to confirm their availability. The research assistant explained the purpose of the study, gave assurances of anonymity for them and their organization, and explained how to fill out and return the questionnaire. The researcher distributed 297 questionnaires to SMEs in Tharaka-Nithi County, Kenya. The researcher collected 249 questionnaires, of which 240 were usable.

Table 1. Study variables and indicators.

No	Variable constructs and indicators (Measure)	Source
	A. **Technological Context Complexity**	(Premkumar & Roberts, 1999)
1	Is it easy to adopt new technology irrespective of new functionality	
2	Internet connectivity is available to the business if needed	
3	Technology applications are user-friendly	
	Compatibility	(Premkumar & Roberts, 1999)
1	New technology improves the existing business processes	
2	Some applications were replaced by a new system in the firm	
3	Availability of technology has increased business performance	
	Relative Advantage	(Premkumar & Roberts, 1999)
1	Technology is used to promotes business efficiency	
2	Use of technology enhance quick service to customers	
3	Use of technology enables the firm to get market information	
	B. Technology Innovation	(Jong, 2000;Okello & Ireri, 2017)
	Product innovation	
1	Introduction of a new product or hybrid variety	
2	Product value addition	
3	Product improvement /Genetic improvement	
	Process innovation	(Ganzer, Chais, & Olea, 2017; Jong, 2000)
1	Use of new methods and procedures	
2	Use of new inputs and machines in business	
	Market innovation	(Ganzer et al., 2017; Simiyu, 2013)
1	Focus on a new idea and use of online applications in sales	
2	Development of new market through ICT	
3	Availability of ICT marketing tools for farm produce	
	C. Organization structure	(Elbeltagi, Al Sharji, Hardekar, & Elsetouhi, 2013; Thong, Yap, & Raman, 1996)
1	Management support in of use of ICT through a shared vision	
2	Effective and flexible communication channels	
3	ICT equipment is easily available	
4	The organization is responsive to changes in technology	
5	Management is flexible in decision making	
6	There is a shared vision and staff unity	
	D. Entrepreneur innovativeness	(Agarwal & Prasad, 1998; Thong & Yap, 1995)
1	Competitive attitude and ability to use new technology	
2	Taking fist mover advantage in product value addition	
3	I don't fear risk-taking while implementing new technology	
4	Familiarity and experience in use ICT applications in business	
5	I have skills in technology trends helps in creating new product/service	
	E. Environmental Context	(Al-Qirim, 2005; Ramsey & Mccole, 2005; Thong, 1999)
1	Government ICT regulations and support initiatives	
2	Availability of ICT infrastructure and internet connectivity	
3	Organization ICT innovation initiatives and requirements	
4	Use of ICT has a competitive advantage over our rivals	
5	Use of ICT enables weather forecasting and market analysis	
6	Use of ICT enables access to local and international market	
	F. Firm performance	(Fazli, Sam, & Hoshino, 2013; Margarita et al., 2013)
1	Profitability	
2	Sales volumes	
3	Market expansion	
4	Employee number	

3.4 Respondents' biodata

The data in Table 2 show that 60% of the respondents were female while the rest were male, which reveals that female entrepreneurs have higher chances of doing business in the countryside. According to Gakobo (2013), most women in rural areas form more cohesive groups. The age bracket with

Table 2. The frequency analysis ($n = 240$).

Item	Classification	Frequency	Percentage %
Gender	Male	96	40
	Female	144	60
Age (years)	18–25 years	48	16.6
	26–30 years	60	25
	31–36 years	102	42.5
	Above 37 years	30	12.5
Business experience(years)	Less than 1 year	10	4.1
	1–2 years	26	10.8
	3–4 years	96	40
	5–6 years	108	45
Education level	Ph.D.	0	0
	Masters	2	0.8
	Bachelors	19	7.9
	Diploma	61	25.4
	Secondary certificate	119	49.5
	Primary certificate	37	15.4
Category of Legal Registration	Sole Proprietorship	171	71.2
	Partnership	39	16.2
	Groups/societies/Others	17	7
	Limited company	13	5.4
Industry category/sector	Agriculture	105	43.7
	Service	87	36.2
	Manufacturing	48	20
Firm size (employees)	1–5 employees	210	87.5
	6–10 employees	29	12
	11–15 employees	1	0.4
	over 15 employees	0	0
Geographical Location	Tharaka constituency	51	21.2
	Maara Constituency	73	30.4
	Chuka Igambang'ombe	116	48.3

the most respondents was the 25–34 year-old bracket (71%), while the above-35 bracket accounted for 13%. The results show that most of the sample was youthful, which is significant to national development (ILO, 2015).

Most of the respondents (50%) had secondary education, while 2% ($n = 4$) had gained a master degree and above; 8% had a degree, 25% had a diploma, and 15% had primary education. More than half of the respondents had only attained secondary education, a low rate. Previous studies also show that most small business owners have attained only secondary education (UNESCO, 2016). The respondents' level of education was important for the study because it influenced how the respondents interpreted the questionnaire. Most SMEs (88%) had between one and five employees; enterprises with six to 10 employees came next (12%). These results show that most of the sample firms were small enterprises with fewer than 10 employees. Most of the enterprises were in the manufacturing and agriculture sector (65%). Rural SMEs contribute to the informal employment that is significant to Kenya's economic growth (ILO, 2015).

4. Results

The study used IBM SPSS Amos software for data manipulation and statistical analysis (Carver & Nash, 2011; Meyers, Gamst, & Guarino, 2013). The study used exploratory analysis to identify the latent constructs represented in the original 38 measure items. The maximum likelihood method with Promax Kaiser normalization was used, as it provides a consistent approach to parameter estimation problems that can be developed for a large variety of estimation situation (Meyers et al., 2013). The variable constructs were abridged into a distinct factor using explanatory factor analysis (Katou & Budhwar, 2008).

First, a seven-factor solution was generated. The constructs that did not load to any of the factors at the suggested minimum level of 0.30 (Hair, Black, Babin, Anderson, & Tatham, 2010) were removed

from the model. Furthermore, the researcher refined the model by removing factor loadings of less than 0.30, as recommended by Hair, Black, Babin, and Anderson (2010). Finally, 29 items remained in the model after these steps. These items generated a five-factor solution with eigenvalues greater than one that explains 70.7% of the total variance of the variables. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (KMO = 0.929), approximate chi-square (624.345), and Bartlett test of sphericity ($p < 0.001$) established that the analysis was suitable.

To determine the reliability and validity of the variables, the study used Cronbach's alpha (α). The Cronbach Alpha values vary between 0 and 1; the closer the value is to 1, the greater the internal consistency of the items on the measuring scale. An alpha value above 0.70 is recommended. The results show an alpha of more than 0.6 across all study variable constructs. According to Alam (2011), an alpha value of at least 0.6 indicates appropriate reliability. The study tested for convergent validity, finding that all 29 of the study items' loadings were higher than 0.7, thus satisfying the established study scales (Su, Peng, Shen, & Xiao, 2013).

Furthermore, when the researcher tested the composite reliabilities (CR) using confirmatory factor analysis, the outcomes were also above 0.7, which is an acceptable benchmark (Fornell & Larcker, 1981). Moreover, the average variances extracted (AVE) for each variable construct exceeded 0.50, showing satisfactory reliability (Hair, Black, Babin, Anderson, & Tatham, 2010) as shown in Table 3. In addition, the study dimensions all produced good internal consistency, where the Cronbach's alpha values were higher than 0.70. The study used the tolerance and variance inflation factor (VIF) to evaluate the variables' collinearity; the results were within the commended maximum (Hair, Black, Babin, & Anderson, 2010; Pallant, 2007).

4.1 Structural model

The model fit indices showed that the measurement model was valid. Structural equation modeling (SEM) was performed by examining the fit indices and variance explained estimates. Table 4 shows the fit indices of the SEM and the recommended cut-off values used to assess the model's overall fit.

To reduce the sensitivity of the chi-square statistics, the chi-square value was divided by the degrees of freedom. The result of this division was 2.103, within the acceptable cut-off range. The comparative fit index (CFI = 0.958) and the normed fit index (NFI = 0.924) surpassed the acceptable minimum of 0.9. The goodness of fit (GFI = 0.913) was slightly higher than the minimum threshold of 0.9, which Etezadi-Amoli and Farhoomand (1996) argue is also acceptable. The root-mean-square error of approximation (RMSEA = 0.068) also exceeded the acceptance level of below 0.08, as shown in Table 5.

4.2 Test of hypotheses

Since the overall fit indices of the structural equation modeling indicates a good fit, the structural relations and their path coefficients were analyzed. Path coefficients and standard estimates enabled hypothesis testing, as shown in Table 6 and Figure 3.

The hypothesis testing showed that the technological context ($\beta = 0.487$, $p = 0.00$) had a positive effect on firm performance. Thus, the first hypothesis (H1) was accepted. Regarding the second hypothesis, it was found that technological innovation ($\beta = 0.245$, $p = 0.00$) had a positive impact on firm performance. Thus, the second hypothesis (H_2) was accepted. This shows that technological innovation has a significant influence on SME performance. Firm profitability may be influenced by stiff competition, customer requirements, market demand, and government legislation (Kuuya, 2015). Other aspects, such as distribution logistics and supplier pressure, can also affect SME performance. These outcomes indicate that IT innovation influences the capacity of entrepreneurs to attain higher firm productivity.

Regarding the third hypothesis, the results show that organizational structure ($\beta = 0.115$, $p = 0.098$) does not play a significant role in the relationship between IT innovation and firm performance. Thus,

Table 3. Factor loadings, Average Variance Extracted (AVE) and Composite Reliabilities (CR).

	Variable constructs Measures (Cronbach's alpha)	Factor loading	Eigenvalue	AVE	CR
	A. INFORMATION TECHNOLOGY ($\alpha = .896$)		12.816	0.558	0.894
1	Internet connectivity is available to the business if needed	.833			
2	Technology applications are user-friendly	.928			
3	New technology improves the existing business processes	.437			
4	Some applications were replaced by a new system in the firm	.816			
5	Technology is used to promotes business efficiency	.844			
6	Use of technology enhance quick service to customers	.696			
7	Use of technology enables the firm to get market information	.550			
	B. TECHNOLOGY INNOVATION ($\alpha = .937$)		5.382	0.657	0.937
1	Introduction of a new product or hybrid variety	.582			
2	Product value addition	.928			
3	Product improvement	.785			
4	Use of new methods and procedures	.777			
5	Use of new inputs and machines in business	.916			
6	Focus on a new idea and use of online applications in sales	.881			
7	Development of new market through ICT	.932			
8	Availability of ICT marketing tools for farm produce	.599			
	C. ORGANIZATION STRUCTURE ($\alpha = .838$)		1.398	0.582	0.817
1	Management support in of use of ICT through a shared vision	.855			
2	Effective and flexible communication channels	.542			
3	ICT equipment is easily available	.760			
5	Management is flexible in decision making	.501			
6	There is a shared vision and staff unity	.747			
	D. ENTREPRENEUR INNOVATIVENESS				
1	Competitive attitude and ability to use new technology	.445			
	E. BUSINESS ENVIRONMENTAL ($\alpha = .788$)		1.062	0.507	0.858
1	Government ICT regulations and support initiatives	.600			
2	Availability of ICT infrastructure and internet connectivity	.874			
3	Organization ICT innovation initiatives and requirements	.652			
4	Use of ICT has a competitive advantage over our rivals	.628			
5	ICT is used in weather forecasting and market analysis	.717			
6	Use of ICT enables access to local and international market	.765			
	F. FIRM PERFORMANCE		1.022	0.623	0.831
1	Profitability	.859			
2	Sales volumes	767			
4	Employee number	737			

the third hypothesis (H_3) is not supported. The results supported the fourth hypothesis – that entrepreneur innovativeness ($\beta = 0.523$, $p = 0.00$) has a positive impact on the relationship between IT innovation and firm performance. Thus, the fourth hypothesis (H_4) was accepted. The significant results on the relationship between entrepreneur innovativeness and SME performance could be attributed to various other factors, such as entrepreneurs' willing to take risk, experience, capability, customer demands, and an appropriate market (Zahra, 2011). Firm performance may be conditioned by other factors, such as competition, market dynamics, and changes in customer preferences (Seun et al., 2017). The ICT empowerment of owner-managers can boost SMEs' innovation levels (Hammawa & Hashim, 2015). An SME's decision to introduce a new product or machine depends on the owners-manager's knowledge, creativity, and innovativeness (Nguyen, Newby, & Macaulay, 2015). However, government support for ICT infrastructure is important for motivating owner-managers' innovative drive toward new technology (Ghobakhloo, Sai, Sabouri, & Zulkifli, 2012). Empirical

Table 4. Structural model fit indices.

INDEX	VALUE	CUT-OFF VALUE
CHI2/DF	2.103	<3
CFI	0.958	>0.9
NFI	0.924	>0.9
GFI	0.913	>0.9
RMSEA	0.068	<0.08

Table 5. Detailed model fit.

Model	NPAR	CMIN	DF	*P*	CMIN/DF	RMR	GFI	AGFI	PGFI	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI	RMSEA	LO 90	HI 90	PCLOSE
Default model	38	172.443	82	.000	2.103	.098	.913	.872	.624	.924	.903	.959	.947	.958	.068	.054	.082	.020
Saturated model	120	.000	0			.000	1.000			1.000		1.000		1.000				
Independence model	15	2276.656	105	.000	21.682	.557	.369	.278	.323	.000	.000	.000	.000	.000	.294	.284	.305	.000

Table 6. Analysis of study hypothesis.

Hypothesis	Independent Variables	Dependent Variables	Estimate	S.E	*t*-stat	*p*-value	Results
H_1	Technology Context	Firm performance	.487	.103	4.728	***	Accept
H_2	Technology Innovation	Firm performance	.245	.056	4.375	***	Accept
H_3	Organization structure	Firm performance	.115	.069	1.667	.098	Reject
H_4	Entrepreneur innovativeness	Firm performance	.523	.088	5.943	***	Accept
H_5	Business Environment	Firm performance	.017	.036	0.472	.640	Reject

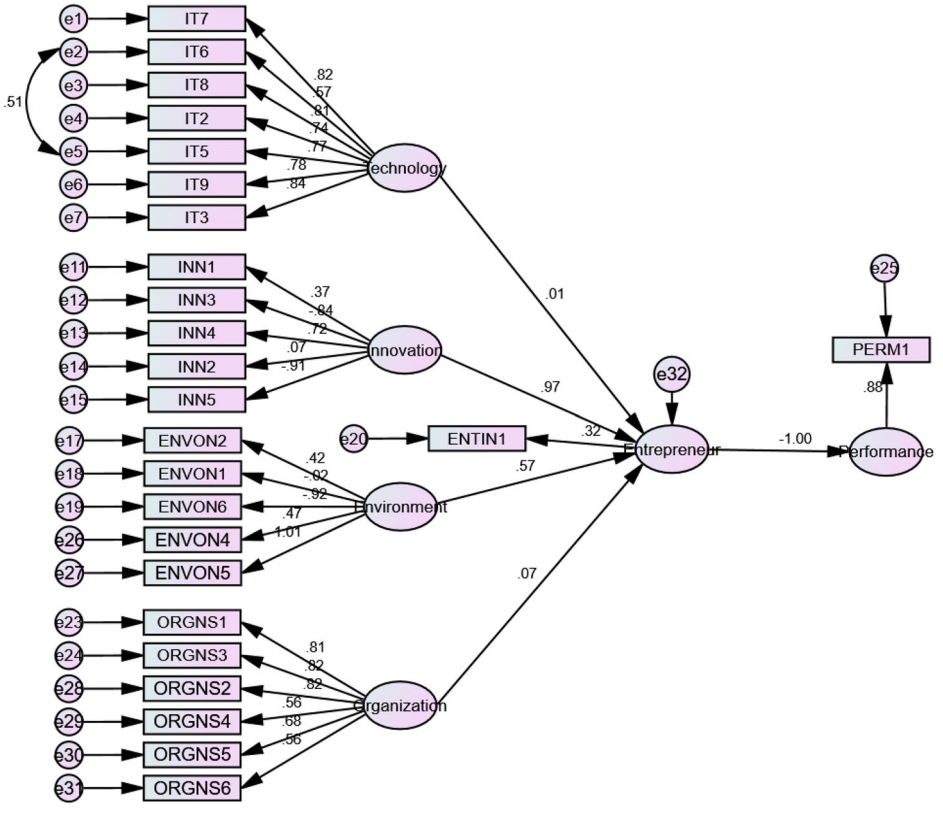

Figure 3. Structural model results.

studies suggest that experience and entrepreneur innovativeness are the cornerstones of a firm's ability to implement a new technology (Laguir & Besten, 2016).

According to the World Bank (2012), the use of ICT for agriculture in Africa depends on the owners' zeal to implement and adopt new technology. In the age of digital disruption, businesses can rise or fall based on their ability to spot and creatively respond to rapid technological change (Yunis et al., 2018). Entrepreneur's competitive attitude can influence how employees think about new technology (Nguyen et al., 2015). Some firms notice an emerging technology and take a "wait and see" attitude. Others see a new technology and take action and use new technology to create a competitive advantage (Majumdar, 2008). However, it is not new technology that gives a company a competitive advantage; it's the way the organization uses new technology that makes the difference (Laguir & Besten, 2016). Businesses need to use information technology innovatively in order to stay ahead of the curve (Brustbauer, 2016). New technologies can provide a genuine competitive edge, but the organization has to make the commitment to use technology to build new products and processes as well as making innovation part of their culture in order to realize the real business value (Pitelis, 2010).

Regarding the fifth hypothesis, the results indicate that the business environment ($\beta = 0.017$, $p = 0.640$) did not have a significant effect on the relationship between IT innovation and firm performance. Thus, the fifth hypothesis (H_5) was not accepted. Owner-managers' capacity to integrate technology innovation and the business environment can lead to firm profitability. These results are supported by a study conducted by Akanni (2015) that shows a strong relationship between the operating environment and firm performance.

5. Discussion

New technology always generates a chance for new business undertakings (Yunis et al., 2018). However, a slow acceptance of new technologies has forced business start-ups to close within a few years of operation (Bunyasi et al., 2014). The continuous, rapid release of new and upcoming technologies to the market means that ICT innovation can be either good or bad for business in relation to their operating environment (Peres et al., 2010). This study has assessed the impact of IT innovation on SME performance and has answered the study's research questions using integrated five-stage model of small business growth (Churchill & Lewis, 1983) and product–process innovation models (Utterback & Afuah, 1995).

The results of this study show that the performance of SMEs depends on their capability to manipulate commercial opportunities via rapid technology innovation which supports the findings of previous studies done by Akinwale et al. (2017) and Razavi et al. (2016). Regarding the first hypothesis, the results confirmed that ICT innovation has a direct influence on SME performance. These findings agree with Chung and Wang (2004). The results shown in Table 6 indicate that business performance improves when it follows different ICT innovation strategies in the operating environment. The findings show a significant relationship between technological innovation and SME performance, which support the first and second hypotheses, respectively. Thus, ICT plays a vital role in narrowing the gap between business organizations in developed and developing countries. This result is also consistent with research on technology innovation conducted by Mohr, Sengupta, and Slater (2010) and Al-Jabri and Sohail (2012), who found that perceived relative advantage motivates SMEs to implement ICT in their businesses and acts as a predictor of that process.

The main benefit of technological innovation in business performance is that it helps owner-manager's understand the market, customers, products and competitors (Yunis et al., 2018). Second, it reveals the interrelationship between technological dynamics, product quality and the level of innovation at all stages of business growth (Rahman et al., 2016). Third, it helps entrepreneurs take forward-looking perspectives, promote strategic planning and continually update existing technologies to improve business performance (Franco & Garcia, 2017). According to Pratali (2003), IT innovation addresses two fundamental goals of business competitiveness; improving product quality and the company's overall technical operations that guarantee sustainable firm performance.

Small and medium-sized enterprises in developing countries can use ICT to make more innovative decisions relating to their production and marketing strategies. Most of the institutions implementing ICT initiatives for SMEs in Africa have developed local IT such as M-farm, Drumnet, and Frontline short messages to boost agribusiness performance (Irungu et al., 2015; Okello & Ireri, 2017). However, a lack of ICT infrastructure and internet connectivity limits SMEs' ability to use these opportunities (Okello, Ofwona-Adera, & Mbatia, 2010). Wider access to information in a cost-effective manner would enable SMEs to obtain market information and weather forecasts, which would help them in their planning. Thus, businesses operating amid different technological infrastructures may have different technology acceptance orientations (Venkatesh & Davis, 2000).

The use of IT in business results in superior performance, and the perceived benefits associated with IT innovation stimulate SMEs' innovativeness (Kotler & Keller, 2012). According to Premkumar (2003), the implementation of technology innovation by SMEs depends on its compatibility with work practices, which can hamper its application in developing countries. The environmental factors that can increase business rivalry might be the basis of IT innovation strategies in the current transnational business model (Ting et al., 2012).

Regarding the third hypothesis, the results show that organizational structures have no significant influence on the relationship between IT innovation and firm performance. Information communication technology implementation in developing countries faces challenges such as weak organizations structures, a low level of ICT skills, and a lack of ICT infrastructure (Apulu et al., 2011). Research has shown that the effective adoption of ICT in an organization depends on the organization's structures and ICT channels, as well as government support (Kleine, 2015).

The significant results on the effect of entrepreneur innovativeness on the relationship between IT innovation and firm performance support the Five Stage Growth Model (Churchill & Lewis, 1983), which emphasizes innovation at each stage of firm development (Duane & Reilly, 2012). A manager's positive behavior coupled with experience has a significant impact on the firm's technology adoption (Wamuyu, 2015) and strengthens its confidence that IT will improve its business performance through increased market access and efficiency (Findik & Tansel, 2015). The results show that the choice to adopt technology is influenced by the entrepreneur's capability based on the relative advantage of IT innovation (Alyahya & Suhaimi, 2013).

Regular ICT training can address undeveloped entrepreneurial capabilities to make effective use of technology (Dibrell, Davis, & Craig, 2008). SMEs tend to have low managerial, environmental, structural, and low technology levels due to their limited resources and lack of exposure (Bunyasi et al., 2014; KNBS, 2016). Success depends on the entrepreneur's hard work and persistence (José, 2005). Training enhances the entrepreneur's ability to adopt the technology relevant to business growth (Matofari, 2015). These findings reveal the important role played by the entrepreneur's capability to screen the relevant environmental factors while introducing a new product, process, or market (Neneh & Zyl, 2012).

The entrepreneur's ability to undertake calculated risks and thorough environmental screening is necessary for addressing today's ever-evolving technology and customers preferences (AlBar & Hoque, 2017; Apulu et al., 2011). The insignificant results on the effect of the business environment on the relationship between IT innovation and SMEs performance could be attributable to the fact that entrepreneur innovativeness determines the level of IT innovation rather than the environment (Franco & Garcia, 2017). Thus, the entrepreneur influences the actual use of IT innovation in the firm (Kossaï & Piget, 2014). A government ICT regulatory framework is critical for ICT adoption, as it can facilitate or delay SMEs' ICT implementation (Franco & Mario, 2017). In addition, the results support the finding of Barnard, Kritzinger, and Krüger (2011) that a conducive business environment is associated with high performance.

This result implies that SMEs must pursue an IT mechanism in the operating environment (Zahra & Das, 1993), indicating that the pressure for technological innovation in relation to both environmental factors and performance might be risky (Brustbauer, 2016; Kraja & Osmani, 2015). Therefore, the impact of ICT on SME performance is influenced by the interplay of the innovation environment within which the business operates (Chattopadhyay & Bhawsar, 2017). The findings also affirm that entrepreneur capability influences the relationship between environmental factors and firm performance, which is supported by strategy scholars such as Chen et al. (2014) and Gupta (2007), whose findings recognized the link between performance and ICT.

5.1 Study implications

The study's theoretical implications advance the ICT4D research centered on SMEs in developing countries. In practical terms, this study found that, although ICT brings many benefits to SMEs through various applications, its implementation is a challenge that limits these benefits. Thus, government ICT policy and support programs should facilitate ICT innovation initiatives among SMEs to boost economic development and food security. The government should not only improve ICT access but also develop policies with incentives designed to develop the skills and capabilities of SMEs' owner-managers and employees. Adequate ICT skills and knowledge will enable SMEs to use the technology innovation and digital tools they need to gain access to global markets for

their products. Government policy should aim at improving ICT infrastructure; promoting SMEs' technological externalities within the industry; establishing ICT resource centers; and disseminating ICT innovation to promote SME performance. Although ICT infrastructure is a challenge in developing countries, previous studies recommend strengthening ICT through organizational initiatives such as training, devolved action plans, and benchmarking practices designed to familiarize employees with the latest technology.

Thus, government policies on SMEs in developing countries should address SMEs' performance and sustainability based on viable incentives for innovation activities. Relevant government agencies should make a concerted effort to promote SMEs by providing the requisite entrepreneurial and ICT training and by fostering business incubation, role modeling, and marketing as a strategy to improve SME performance. Educational practitioners should review the ICT curriculum in line with global trends to enable students to keep pace with changes in technology. Governments should facilitate an effective technology transfer to narrow the digital divide between industrialized and developing countries. This will enhance global collaboration enabled by ICT interconnectedness and motivate business re-engineering.

6. Conclusion and future research

While the results of this study deepen our understanding of the interdependence among the study variables, the study also has limitations that create avenues for future research. First, the study selected respondents based on a sampling technique that has disadvantages with respect to the generalizability of the results, though the technique was appropriate for the study owing to the nature of the data gathered from the SMEs sector. Furthermore, the study used semi-structured questionnaires as a data-collection instrument, which reduces construct validity (Avolio, Yammarino, & Bass, 1991). The questionnaires gathered information from managers and staff who worked for the firm, but IT innovation and firm performance change over time.

In addition, the study did not cover other interactive factors that relate to the employee/entrepreneur characteristics and attitudes that influence firm performance. Future research could use a longitudinal survey to capture the impacts of and relationships between IT innovation, entrepreneur innovativeness, and firm performance. Using this research design would produce valuable results. Similarly, undertaking a comparative study with SMEs in urban areas would offer more insight into comparisons between Kenyan SMEs operating in different locations but with common features. Furthermore, future research on the impact of technology transfer on SME performance in developing countries could be done to expand the scope of this study.

The main aim of this study was to analyze the impact of IT innovation on firm performance. Considering the competitive environment in which enterprises operate, it is imperative for entrepreneurs to develop innovative strategies that guarantee strong business performance while meeting their customers' expectations. The study's findings reveal that IT innovation influences SME performance and that the entrepreneur plays a critical role in the relationship between IT innovation and firm performance. Thus, SMEs can maintain a competitive advantage by utilizing IT innovation through the entrepreneur's energy and capabilities at all stages of firm development.

Disclosure statement

No potential conflict of interest was reported by the authors.

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