

The **KENYA INSTITUTE** for **PUBLIC**
POLICY RESEARCH and **ANALYSIS**

Digital Technology Utilization in Kenya's Formal and Informal Micro, Small and Medium Size Enterprises

Anne Gitonga

DP/338/2024

THE KENYA INSTITUTE FOR PUBLIC POLICY
RESEARCH AND ANALYSIS (KIPPRA)

Digital Technology Utilization in Kenya's Formal and Informal Micro, Small and Medium Size Enterprises

Anne Gitonga

Kenya Institute for Public Policy
Research and Analysis

*KIPPRA Discussion Paper No. 338
2024*

KIPPRA in Brief

The Kenya Institute for Public Policy Research and Analysis (KIPPRA) is an autonomous institute whose primary mission is to conduct public policy research leading to policy advice. KIPPRA's mission is to produce consistently high-quality analysis of key issues of public policy and to contribute to the achievement of national long-term development objectives by positively influencing the decision-making process. These goals are met through effective dissemination of recommendations resulting from analysis and by training policy analysts in the public sector. KIPPRA therefore produces a body of well-researched and documented information on public policy, and in the process assists in formulating long-term strategic perspectives. KIPPRA serves as a centralized source from which the Government and the private sector may obtain information and advice on public policy issues.

Published 2024

© Kenya Institute for Public Policy Research and Analysis

Bishops Garden Towers, Bishops Road

PO Box 56445-00200 Nairobi, Kenya

tel: +254 20 2719933/4; fax: +254 20 2719951

email: admin@kippra.or.ke

website: <http://www.kippra.org>

ISBN 978 9914 738 16 2

The Discussion Paper Series disseminates results and reflections from ongoing research activities of the Institute's programmes. The papers are internally refereed and are disseminated to inform and invoke debate on policy issues. Opinions expressed in the papers are entirely those of the authors and do not necessarily reflect the views of the Institute.

Abstract

Digital technology has the potential to enhance productivity of Micro, Small and Medium Size Enterprises (MSMEs) through enhanced market access and improved efficiency. The value added by the MSMEs' sector in Kenya is 33.8 per cent while it absorbs over 90 per cent of total labour force. Further, the informal sector, which accounts for 79 per cent for all MSMEs, contributes 10.4 per cent gross value added by MSMEs. A Tobit model was used to determine the utilization of digital technology in Kenya MSMEs using 2016 cross sectional MSMEs firm level data from the Kenya National Bureau of Statistics (KNBS). The level of informality was found to determine the use of digital technology, with informal sector MSMEs having low digital technology usage. In addition, there is a digital divide with low uptake of digital technology among women-owned firms. Further, the nature of worksites influences the use of digital technology with commercial or industrial sites and kiosks or jua kali sheds showing greater use of digital technology among informal MSMEs. Lastly, the usage of digital technology and innovation among MSMEs' are closely related. The study recommends continuous development of appropriate training on digital technology targeting informal MSMEs through MSEs associations; enhancement of the capacity and capability of women entrepreneurs to access and utilize digital technology through appropriate gender-sensitive policies and initiatives; design and implementation of appropriate ICT complementary worksites for informal MSMEs; and development and operationalization of a national innovation policy to promote the identification, documentation and promotion of innovations in Kenya. The operationalization of the national innovation database for digital technology is therefore critical.

Abbreviations and Acronyms

BETA	Bottom-Up Economic Transformation Agenda
BRS	Business Regulatory Services
CAIPs	County Aggregation and Industrial Parks
DTU	Digital Technology Use
ERS	Economic Recovery Strategy
GDP	Gross Domestic Product
ICT	Information Communication Technology
ILO	International Labour Organization
IT	Information Technology
KIRDI	Kenya Industrial Research and Development Institute
KNBS	Kenya National Bureau of Statistics
LASSO	Least Absolute Shrinkage and Selection Operator
LR	Likelihood Ratio
MSE	Micro and Small Enterprise
MSEA	Micro and Small Enterprise Authority
MSME	Micro, Small and Medium Size Enterprises
NASSEP	National Sample Survey and Evaluation Programme
NIIP	National Integrated Infrastructure Plan
ROSCA	Rotating Savings and Credit Association
SME	Small and Medium Enterprises
TAM	Technology Acceptance Model

Table of Contents

Abstract.....	iii
Abbreviations and Acronyms	iv
1 Introduction	1
2 Policy Review on MSMEs and Digital Technology	3
3 Literature Review	9
3.1 Theoretical Literature	9
3.2 Empirical Literature Review	10
3.3 Summary of Theoretical and Empirical Literature Review	12
4 Methodology and Analysis	14
4.1 Theoretical Framework.....	14
4.2 Empirical Specification	14
4.3 Data Source.....	15
5 Results and Discussion	19
5.1 Results	19
5.2 Discussion of Results.....	27
6 Conclusion and Recommendations	30
6.1 Conclusion.....	30
6.2 Recommendations for the Facilitation and Promotion of Digital Technology . among MSMEs in Kenya.....	30
References.....	33

List of Tables

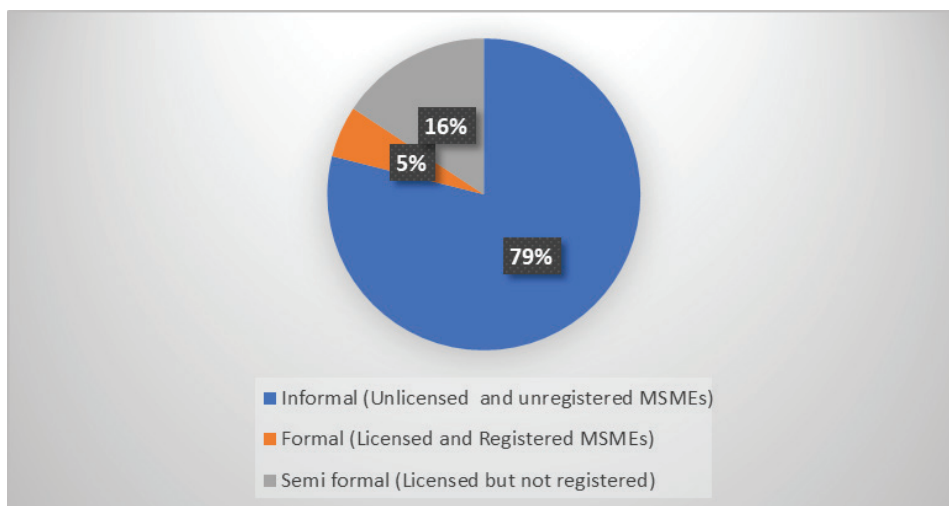
Table 2.1: Kenya policy framework on MSMEs and ICT	4
Table 4.1: Measurement of variables for analysis.....	16
Table 4.2: Descriptive statistics	17
Table 5.1 Factors that influence the of use to digital technology among MSMEs in Kenya.	19
Table 5.2: Factors that influence the of use of digital technology among formal sector (Model C)	22
Table 5.3: Factors that influence the of use of digital technology among informal sector (Model D).....	24
Table 5.4: Tobit regression findings of on sectors found to be statistically significant.	26

1. Introduction

Digital technology adoption is significantly and positively associated with firm productivity (European Investment Bank, 2020). Digital technology has the potential to address some of the challenges faced by informal and informal Micro, Small and Medium size enterprises (MSMEs) in Kenya by enhancing access to domestic and foreign markets. MSMEs in Kenya are faced with challenges that limit their productivity. This is evidenced by the low value added. To be specific, MSMEs in Kenya, comprising formal and informal enterprises, contribute to 33.8 per cent of the national output while Micro and Small Enterprises (MSEs) contribute to 24.7 per cent. The level of value addition for MSMEs who account for majority of the country's working population is therefore evidently low. This may be a result of low productivity and high levels of informality. The value added from the informal MSMEs accounts for only 10.4 per cent of MSME gross value added. This translates to 3.2 per cent gross value added for the whole economy. The informal sector enterprises are faced with insecurity of tenure, weak social protection and low ICT uptake. The Sessional Paper No. 4 of 2013 on Employment Policy and Strategy for Kenya further establishes that the informal sector is further characterized with low productivity.

MSMEs in Kenya are defined as enterprises with between 1 and 99 employees. These MSMEs in Kenya engage 14.9 million employees, accounting for over 90 per cent of Kenya's working population. In this study, informal MSMEs refer to businesses that operate with no business registration and no licence. These account for 79 per cent of MSMEs. There are another 16 per cent for MSMEs who, though not registered, have business licences. These are referred to as semi-formal. This reveals two levels of informality in Kenya.

Figure 1.1: Scope of informality among MSMEs in Kenya



Data source: KNBS (2016)

The informal sector is not limited to Kenya. In Sub-Saharan Africa, for instance, the informal sector contributes between 65 to 79 per cent of GDP and accounts for between 30 and 90 per cent of total non-agricultural employment and 61.2 per cent of global employment (IMF, 2017; ILO, 2018). The informal sector globally further accounts for 89.2 per cent of total employment (ILO, 2018). In Kenya, the informal sector accounts for about 18 per cent of the GDP and 83.6 per cent of the total employment, excluding those in rural small-scale agriculture and pastoralist activities (Government of Kenya, 2019). The proportion of informal sector employment to total employment in 1979 was 16 per cent, which increased to 41 per cent in 1991 and doubled in late 2000 to the current level of 83.3 per cent in 2023 (Figure 1.1). The rate of informality among MSMEs in Kenya has therefore been on the increase over the years.

Formal and informal MSMEs in Kenya account for over 90 per cent of the labour force. With the substantial number of informal MSMEs, ensuring MSMEs are competitive thus able to contribute to new jobs is of policy priority. This is especially important given that informal sector jobs are precarious characterized by job insecurity. Of policy importance is ensuring competitive industries with the ability of graduating from informal to formal vertically growing industries. The Government, in the Bottom-up Economic Agenda (BETA), acknowledges that there are several informal MSMEs who are under-utilized and thus generate low levels of income. These firms have the capacity of an enhanced contribution to GDP with improved productivity. ICT has the capability of expanding access to resources and promoting productivity of enterprises in the informal sector (Seetharaman, Cunha and Effah, 2019). ICT, therefore, has the potential to promote productivity among MSMEs who have low levels of productivity as evidenced by the low value addition. Understanding the factors that influence the adoption of digital technology can provide insights of digital divide among Kenyan MSMEs, therefore enhancing the understanding of the barriers to technology adoption and consequently identifying the opportunities for enhancing innovation and competitiveness among MSMEs.

The overall objective of this study is to determine the uptake of digital technology in Kenya MSMEs and further explore the factors that determine uptake among informal and formal MSMEs. Specifically, the objectives of the study seek to identify the factors that influence the use of digital technology among MSMEs; establish the factors that influence the use of digital technology among the formal sector; establish the factors that influence the use of digital technology among the informal sector, and thus assess the differences in digital technology utilization among formal and informal MSMEs in Kenya.

2. Policy Review on MSMEs and Digital Technology

Several policy documents dating back to the National Development Plans of the 1960s and 1970s highlight specific challenges facing MSMEs and propose interventions to address them. Policy review is critical to understand government interventions on MSMEs, addressing informality and digital technology and appreciating possible policy gaps. As established by Kotelnikov (2007), most government policies have focused on growth of SMEs, with limited attention on integrating ICT and SMEs' growth. The Kenya Vision 2030 identifies ICT as an enabler and the BETA identifies digital superhighway as part of the pillars for economic transformation. The digital superhighway is seen as an enabler for the transformation of MSMEs. Central to the BETA is the transformation of MSMEs through various policy interventions, including access to credit, industrial sites, value addition, innovation, and market access. The government recognizes that the labour force is largely under-utilized but with possibilities of enhanced productivity. Acknowledging ICT, including digital technology, plays a role in enhancing productivity. It is, therefore, important to explore Kenya's policy framework to establish where MSMEs and ICT converge while also identifying implementation challenges and possible gaps.

Table 2.1 below provides a synthesis of the policy framework of MSMEs and ICT in Kenya. It reveals some common themes in the policy framework aimed at supporting the business environment and support to local entrepreneurs.

Table 2.1: Kenya policy framework on MSMEs and ICT

Theme/policy issue	Policy Intervention	Policy Instrument	Summary of policy implementation
Recognition of the informal sector	Revision of trade and commercial licensing; encourage formal sector firms to sub-contract labour-intensive processes from informal sector firms	Sessional Paper No. 10 of 1973	Kenya policies from 1970s recognize the contribution and potential of the informal sector in ensuring income distribution given the sector's strong forward and backward linkages and ability to provide income and new jobs
	Removal of remaining barriers to informal sector activities	Sessional Paper No. 2 of 1985	
	Various interventions proposed include raising farm productivity and incomes to stimulate demand for goods and services provided by the informal sector; promotion of labour-intensive small scale activities; enhanced access to credit; enhanced access to market information and appropriate production methods. A special taskforce to review all policies to promote the informal sector to be established	Sessional Paper No. 1 of 1986	Low productivity, limited access to technology and low-quality jobs are, however, characteristic of the informal sector. Policy interventions have aimed at improving the business environment and addressing various business environment areas. The International Labour Organization (ILO), following the 104th Session in 2015 (No 204), adopted a recommendation for the transition from the informal to the formal economy through relevant assessments, studies and policy reforms. Member states are therefore called to undertake proper assessment of informality to inform policy formulation
	Review of policies and strategies aimed at removing constraints for small enterprises and informal enterprises and promotion of a favourable regulatory environment	Sessional Paper No. 2 of 1992	
	Promotion of entrepreneurial exchanges and youth mentoring programmes. Encourage culture shift from job seekers to job creators and self-employment and undertake measures to change attitudes and perceptions about the informal sector	Sessional Paper No. 4 of 2013	
	The promotion of skills and technology transfer to MSEs, the promotion of linkages for technology development and transfer to MSEs	Sessional Paper No. 5 of 2020	

Promotion of Business Linkages	Enhanced linkages with the formal sector through sub-contracting	Sessional Paper No. 10 of 1973	Informal sectors players were in the 1986, 1992, 1997 policies encouraged to form or join associations and/or cooperatives for sourcing of inputs and other support services. The MSE Act (No. 55 of 2012), establishes Register of MSE Associations for this purpose Though various policies call for the establishment of a subcontracting policy, this has yet to be actualized. Though there is increased integration of informal sector and the formal sector, there are still weak linkages among and between MSMEs and other stakeholders and limited policy guidance on the same
	The informal sector firms encouraged to form cooperatives for enhanced access to information, technology, and credit	Sessional Paper No. 1 of 1986	
	Recognizes the role of small enterprise associations in providing information, market access training and support services to members. Other business linkages proposed include inter-industrial linkages through sub-contracting mechanisms between large and small enterprises and buyer-seller forums	Sessional Paper No. 2 of 1992	
	Strengthen linkages between the informal sector and formal training institutions; strengthen business associations and Jua Kali associations or cooperatives to support operators in securing inputs and accessing markets	Sessional Paper No. 2 of 1997	
	Promotion of linkages between MSEs, and medium and large enterprises	Sessional Paper No. 4 of 2013	
Provision of Relevant Infrastructure	Promotion of investments in infrastructure	Sessional Paper No. 1 of 1986	Worksites, which is critical infrastructure for MSEs, have some inefficiencies with a number operating in semi-permanent worksites (KNBS, 2016) with inadequate supporting amenities including Internet, and appropriate technology (Njenga et al., 2022)
	Construction of worksites referred to as Nyayo sheds though a Jua Kali Fund	Sessional Paper No. 2 of 1992	
	Facilitate access to land and infrastructure	Sessional Paper No. 2 of 1997	
	Provision of infrastructure support such as entrepreneurial centres of excellence at constituency level; adoption of a cluster development strategy	Sessional Paper No. 4 of 2013	
	Enhanced access to decent and affordable infrastructure	Sessional Paper No. 5 of 2020	

Promotion of Women Entrepreneurs	Review of laws, regulations and policies that hinder women-owned enterprises	Sessional Paper No. 2 of 1992	Policies recognize women entrepreneurs as being more disadvantaged on matters relating to access to land, finance and education compared to men. The 1992 and 2005 Sessional papers further have gender-specific interventions enhancing access to technology and credit
	Promotion of gender equity through gender-responsive policies that increase access to finance; promote women's access to technology and technical skills and promote women entrepreneurship	Sessional Paper No. 2 of 2005	
	Enhanced digital skills for women in SMEs through capacity development	Kenya National Digital Masterplan (2022-2023)	
Business Registration and Licensing	The policy recognizes the centralization of registration of business names in Nairobi as a constraint for MSEs located outside Nairobi	Sessional Paper No. 2 of 1992	Despite the licensing reforms, business licensing is still considered a constraint as established in the 2016 MSME Survey Basic Report partially given the multiplicity of licensing authorities. The main challenge with business registration services was that it was centralized in Nairobi, introducing high transaction costs to MSMEs operating outside Nairobi seeking business registration
	Review of laws, regulations and policies that hinder women-owned enterprises		
	Review, consolidation and harmonization of trade licensing and review of relevant regulations	Sessional Paper no 2 of 2005	
	Promotion of formalization of MSEs and harmonization and streamlining of licensing and registration procedures; and the promotion of creative approaches for licensing and registration	Sessional Paper No. 5 of 2020	

ICT in enterprises	Enhance access to information and appropriate technology for small enterprises	Sessional Paper No. 2 of 1992	Policies call for the establishment of buyer-seller forums or marketplaces; e-commerce and e-trade platforms. These platforms are offered by the private sector. However, the policy framework for e-commerce has been largely absent. The government has further prioritized the digitization of government services, including business registration and licensing services through e-business and e-regulations platforms. MSMEs access Internet for various services, including e-government services such as filing taxes (iTax), assessing government information and services, undertaking business registration and business licensing (KNBS and CA, 2016). Trade facilitation is also electronic, though the Single Window, which was launched in May 2014 and established in the National Electronic Single Window System Act of 2022
	Enhance access to technology and information	Sessional Paper No. 2 of 1997	
	Establishment of a robust technology entrepreneurship ecosystem	2020 ICT Policy	
	The development a National Integrated Infrastructure plan facilitate rational, cost-effective, sustainable and easily maintained ICT infrastructure by multiple stakeholders in the design		
	Development and adoption of local e-commerce platforms		
	Enhance the Single window/ one-time submission system to allow traders to submit import, export and transit documentation and data electronically	National Trade Policy (2016)	

	Digitization of government services and investment in ICT infrastructure, including high-speed fiber optic infrastructure implemented alongside a cyber-security framework to ensure security everywhere	Digital Economy Blueprint (2019) and Kenya National Digital Masterplan (2022-2032)	
	Enhanced ICT support for enterprises through 24,000 hotspots in public spaces; establishment of 24,000 village digital hubs and regional smart hubs; 1450 Community Digital centres; integrated constituency-based digital marketplaces in 290 Constituencies; smart business centres; e-trade mechanism. Skills upgrading in digital skills	Kenya National Digital Masterplan (2022-2032)	
	Mainstream ICT in the education curriculum and promotion of digital skills through training	National E-Commerce Strategy 2023	

Sources: Sessional Paper No. 10 of 1965 on African Socialism and its Application to Planning in Kenya; Sessional Paper No. 10 of 1973 on Employment; Sessional Paper No. 2 of 1980 on Unemployment; Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth; Sessional Paper No. 2 of 1992 on Small Enterprise and Jua Kali Development in Kenya; Sessional Paper No. 2 of 1997 on Industrial Transformation to the year 2020; Sessional Paper No. 2 of 2005 on Development of Micro and Small Enterprises for Wealth and Employment Creation for Poverty Reduction; 2016 National Trade Policy; Sessional Paper No. 5 of 2020 on Kenya Micro and Small Enterprises Policy for Promoting MSEs for Employment Creation; National Information Communications and Technology Policy Guidelines of 2020 the Digital Economy Blueprint (2019) and Kenya National Digital Masterplan (2022-2032); National E-Commerce Strategy.

3. Literature Review

3.1 Theoretical Literature

3.1.1 Theories on Informal Economy

The concept of informal economy has been analysed through various theoretical frameworks. Central for this study is the Structuralist Theory and the Dualist Theory. The Structural Theory establishes the structural factors, including legal and regulatory structures, affect informality (De Soto, 1989) while dualists reveal the distinction of formal and informal sector (Dell'Anno, 2022). The 1972 International Labour Organization (ILO) report recognized the sector as an expanding sector, one that increased at a faster rate than the formal sector. The sector was further characterized with ease of entry and one that lacks links with the formal sector. The dualists view the informal sector as autonomous and not linked to the formal sector (Chen, 2012; Dell'Anno, 2022). Over the years, however, scholars have established that the informal has highly integrated with the rest of the economy and is often complementary (Tokman, 1978). The level of interdependency between the formal and informal sector in many economies is in fact strong and growing evidenced by various linkages in the marketing chain, supply chain and labour market (Losby, Else and Kingslow, 2002). This is the view of structuralists who view the informal sector as linked to the formal sector. Structuralists further posit that micro firms reduce input and labour costs through informality to increase competitiveness (Chen, 2012). Informality in a county is, however, often associated with the institutional environment weaknesses, which include excessive bureaucracy, high taxes, and regulation with ineffective enforcement. There is evidence that firms operating informally are small, unproductive and survivalists compared to formal firms that leverage on modern technology, and thus are more efficient. Informal sector enterprises are further found to have low value added per employee, which leads to low productivity and low-quality products (La Porta and Shleifer, 2008; 2014).

The ILO (1972) study, establish that informal sector enterprises are characterized by simple technologies or adapted technology. Tokman (1978) further recognize that the informal sector are often excluded from technological improvements. This is further exemplified in studies such as La Porta and Shleifer (2008), who found informal sector enterprises to operate outside of modern technology.

3.1.2 Theories on technology utilization

There are various theories that provide a framework for analysing technologies; technological change and technological adoption, thus utilization. Technology is in fact central to economic theory (Jensen, 2007). Endogenous growth model established technological change as endogenous and can therefore be achieved through knowledge accumulation and accumulation of human capital (Romer, 1990). It is therefore informed by economic decisions made by economic units. ICT is among the key technology adopted by enterprises endogenously. The decision to adopt ICT is informed by the enterprise's perception of the benefits

to the core business, the ICT capacity of employees, and the financial resources available. This is established in three key theories: Technology Acceptance Model (TAM), the Resource-based Theory, and Transaction Cost Theory.

The Technology Acceptance Model provides an explanation to technology usage based on Perceived Usefulness and Perceived Ease of Use. Perceived usefulness is described as the adoption of technology based on the extent; they believe it will enhance their job performance. Perceived Ease of Use, on the other hand, is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989: 320). The TAM further establishes that at external factors, such as training, therefore affects perceived usefulness and ease of use (Davis, 1989). Other factors include experience (Venkatesh and Bala, 2008) and organizational support and gender (Venkatesh, Thong and Xu, 2003; Venkatesh and Morris, 2000). Innovation characteristics also influence the acceptance of new technology (Lee, Kozar and Larsen, 2003).

The resource-based view (RBV) establishes that a firm's competitive advantage are resources and capabilities available to the firm. The resources include technology, skilled personnel, capital, among others (Wernerfelt, 1984). The resources available to a firm is informed partially by Transaction Cost Theory, which theorizes that a firm's decision to internalize activities is based on the transaction costs. If the price is low, purchase of the goods of the service is an option. Internalization of the transaction is within the firm's hierarchy informed by three dimensions; uncertainty, frequency and specific investments incurred (Williamson, 1979). This theory does, however, present some limitations given studies provide other factors including capacity and capability (Greve and Argote, 2015). Nonetheless, technology, in this case, ICT can lower transaction costs and information costs, thus is a consideration for firms.

The role of ICT in economic growth is summarized as follows: reducing transaction costs; enhancing connectivity; increasing efficiency and productivity; and increasing market access and market choice thus enabling market integration. ICT also enhances knowledge; access to information and access to social capital (Kramer, Jenkins and Katz, 2007; Kotelnikov, 2007; Bhattacharya, 2019). The competitive effect of ICT, therefore, can be summarized as follows: improving productivity; resource allocation and reducing transaction costs (Wolf, 2001). Firms, however, face capacity challenges that limit the absorption or acceptance of technology (Cohen and Levinthal, 1980; Davis, 1989).

3.2 Empirical Literature Review

The theories on informal economy and technology utilization reviewed above, reveals two aspects. First, is that firms are dual in nature; formal and informal. Second, ICT is an essential technology to firm productivity and efficiency. The capacity of a firm to absorb or use ICT is, however, dependant on firm level resources and capacity. The empirical studies below aim to explore the factors or resources that promote the adoption of ICT.

A study of 24 SMEs in Northern Ireland, for instance, reveal that characteristics and industry sector of the firm are contributory factors to ICT adoption by the firms (Shiels and McIvor, 2003). The firms, though defined as SMEs including micro firms, employing between 0 and 9, meso-size employing between 10 and 50 and medium employing over 50. Twenty-four (24) companies were selected for the study who were assessed in terms of the level of ICT integration (technical, operational, inter-organizational and strategic integration) and level of sophistication in terms of ICT use. The study reveals that the industrial sector is among the factors with disparities in ICT usage. The industry sector includes retail, construction, wholesale and distribution sectors. Firms in construction and distribution sectors were established to have both the high levels of and low levels of ICT adoption and sophistication while retail and wholesale sector firms were clustered largely at the median point. Other characteristics of the firm that determine the level of sophistication in terms of ICT use include size of the firm, and ownership structure and availability of relevant resources. The disparities in terms of sophistication in ICT use is also observed in the study by Biswas and Baptista (2012) in the European Union (EU). Within Africa, Vaumi, Leudjou and Faha (2021) establish that ICT is a significant input factor for informal SMEs and formal SMEs. Further, ICT contributes to improved revenue generation and increases labour productivity. The study using data from 6,300 enterprises with less than 50 employees carried in the 19 Sub-Saharan African (SSA) countries developed an ICT access and ICT usage index. The study thereby establishes that though formal SMEs possess more ICT equipment than informal ones; the ICT usage intensity is higher for informal enterprises. The findings also reveal firm characteristics and industry sector contribute to the adoption of ICTs by SMEs. The 13 countries of the study include Botswana, Cameroon, Ethiopia, Ghana, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and Zimbabwe (Esselaar, Stork, Ndiwalana and Deen-Swarray, 2007).

In a study conducted on firm level data from 19 Sub-Saharan Africa (SSA) countries on adoption and use of ICT reveals firm income, wage, size of the firm and share of exports are significant determinants of ICT adoption. The study used a Tobit regression model to analyze the determinants of the adoption of ICT-capital. The 19 SSA countries were Burkina Faso, Burundi, Cameroon, Cape Verde, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, Tanzania, Uganda and Zambia (Vaumi, Leudjou and Faha, 2021).

Using a binary choice logit model, Duran and Castillo (2021) sought to analyze the factors that influence the decision to adopt ICT in small businesses in Colombia revealed that formality is a significant factor. The other factors that influence the choice of use of ICT by small businesses in Colombia include personal factors of the business owner, the age and gender. The study established that being male decreases the probability of ICT adoption by 4.9 per cent. Being a male owner therefore reduces the probability of ICT adoption. The study establishes a negative relationship between the age of the owner and adoption of ICT, revealing that the older business owners have a lower probability of ICT adoption. On a firm level, the age of the business, the number of employees and membership to associations

and cooperatives increase the probability to technology adoption. Small businesses that operate in commerce and industry have a higher probability of adoption of ICT compared to those in the agriculture sector (Duran and Castillo, 2021).

A study conducted in Nigeria establishes that use of digital technology is associated with higher labour productivity for informal enterprises. The study employed IV LASSO regression techniques using a sample of informal non-farm enterprises that are not registered with any government agency in Nigeria. The LASSO technique was used to deal with unconfoundedness in the selection of observables and unobservables. The LASSO regression is a regulation technique used for models with high levels of multicollinearity. The study reveals that digital technology usage is associated with higher labour productivity, which is measured as output per worker. The productivity benefit is higher for larger informal enterprises. The study provided some policy insights on the effects of over-regulation of digital technology to access and use of the same by informal enterprises (Danquah and Owusu, 2021). The low productivity is also established in various countries, Kenya included, as established in a study by La Porta and Andrei (2008), which reveals that informal firms are small and unproductive. The study covered 13 countries, including Bangladesh, Brazil, Cambodia, Cape Verde, Guatemala, India, Indonesia, Kenya, Niger, Pakistan, Senegal, Tanzania, and Uganda using the World Bank Enterprise Surveys and informal surveys. In Kenya, Opiyo and K'Akumu (2006) establish that use of digital technology can enhance improvement and economic inclusion of the informal sector in Kariokor market cluster. Specifically, the study found that 38 per cent would benefit from ICT for market information; 22 per cent would use ICT for marketing the business; and 17 per cent would use it to identify the sources of cheaper input. The study further establishes that the industrial cluster can enhance access to ICT. Availability of complementary infrastructure was also found to be important. The study's analytical approach included questionnaires targeting 30 respondents, which was complemented by interviews and direct observation conducted in 2003. A study examining the technological capability of enterprises in the informal sector reveals low adoption because of low skills and education, lack of resources and over-dependence on the formal sector (Wanjau, 1998). ICT has a role in promoting innovation among formal and informal MSMEs in Kenya. A study by Gitonga and Moyi (2019) establish that ICT such as mobile phones, mobile money, websites, computers, tablets, and video cameras are positively associated with product and marketing innovation in Kenya.

3.3 Summary of Theoretical and Empirical Literature Review

Theory, specifically, structural theory, reveals that informality is a result of structural barriers, which include registration and licensing of businesses. It also reveals that formal and informal sectors are distinct. As relates to use of technology, studies reveal the informal sector is characterized by limited use of technology. The informal sector is also associated with low productivity. Exposing the dual nature of formal and informal firms. Theory also reveals uptake of technology is premised on Perceived Usefulness and Perceived Ease of Use as established in

the Technology Acceptance Model. The TAM therefore presents variables such as gender, organizational support, innovation, and the sector which informed the study's analytical framework. Empirical studies explore the use of technology in this dual system of formal and informal firms. The studies reveal that though ICT benefits both formal and informal MSMEs, the uptake of ICT among informal MSMEs may be low and therefore less impactful. The literature review further reveals there are firm characteristics such as age and size of firm and individual characteristics such as gender of businesses owner have an influence on the decision to adopt ICT. The gender aspect was, however, only established in one of the studies reviewed; that of small enterprises in Colombia. In Kenya, MSMEs experience unique gender dynamics, whereby though majority (59%) of MSMEs are female, female enterprises are largely informal. This study leveraging on the literature reviewed explores firm characteristics especially complementary infrastructure as established by Opiyo and K'Akumu (2006) and individual characteristics such as gender that inform uptake of digital technology in Kenya. There are limited studies conducted in Kenya that consider ICT complementary infrastructure (worksites); the role of networks (business linkages) and gender for adoption of digital technology.

4. Methodology

4.1 Theoretical Framework

This study leveraged on the theory of Technology Acceptance Model to explain the digital technology acceptance and utilization among MSMEs. TAM explains how users accept technology based on perceived usefulness and perceived ease of use. Perspective usefulness or acceptance is as established in the theoretical literature review is informed by social influences such as gender of user and organizational factor such as organizational size. The acceptance of technology is also influenced by additional factors including experience, organizational support and innovation characteristic of the firm. These form critical elements that inform the analytical framework. The study leverages on variables proxying social influences, organizational support, other organizational factors to gauge perceived usefulness and ease of use of technology, thus establishing the determinants of digital technology use of the firm. To assess the factors influencing technology acceptance among MSMEs in Kenya, therefore, this study considered gender of MSME owner, organizational size and experience, proxied by size and age of the firm respectively, and organizational support, proxied by business linkages and innovation characteristics, proxied by innovation activity. TAM has been used to establish acceptance of technologies in different sectors. This reveals that the acceptance of technology is influenced by the sector. The additional organizational and individual influences, and thus this analysis includes the level of formality and nature of worksite.

4.2 Empirical Specification

Digital technology in this study refers to digital or computerized technology such as computers, the Internet, and mobile phones. This is informed by the definition of digital economy in Digital Economy Blueprint as “the entirety of sectors that operate using digitally enabled communications and networks leveraging Internet, mobile and other technologies.”

To explain digital technology utilization therefore, digital technology was the dependent variable constructed using the three forms of digital technology, which are mobile phones; computers and Internet (Table 4.1). However, given there are several MSMEs that do not use digital technology, this is reflected in the data, which reveals several ‘zeros’, the constructed digital technology variable was thereby censored. The Tobit model was therefore applied in this study since it is the most appropriate model for a censored outcome given the data is left-censored at zero (Wooldridge, 2010). The model was originally proposed by James Tobin (1958) to model non-negative continuous variables where several observations have “zero” value. The Tobit model is therefore effective in handling the dependent variables that are censored. In this case, the censoring was at zero, given there were many observations with zero values.

Informed by theoretical and empirical literature reviewed therefore, the study estimated the following model to identify the factors influencing the use of digital

technology among MSMEs in Kenya.

$$DTU_i = \beta_0 + \beta_1 \text{formalityLevel} + \beta_2 \text{gender} + \beta_3 \text{Age} + \beta_4 \text{Sector} + \beta_5 \text{size} + \beta_6 \text{newproduct} + \beta_7 \text{newprocess} + \beta_8 \text{worksites} + \beta_9 \text{business linkage} + i \quad (1)$$

The dependent variable, Digital Technology Use (DTU), has values between 0 and 3, representing the different levels of use of digital technology among MSMEs in Kenya (Table 4.1).

The variables considered in the empirical model include organizational influences, such as age, size and sector of firm; organizational support, which is the linkages; ICT complementary infrastructure, which is nature of the worksite; innovation influences and individual influences such as gender of business owner.

In order to establish the factors that influence the use of digital technology among the formal and informal sector in Kenya. Equation (1) was adopted slightly as follows:

$$DTU_{if} = \beta_0 + \beta_1 \text{gender} + \beta_2 \text{Age} + \beta_3 \text{Sector} + \beta_4 \text{size} + \beta_5 \text{newproduct} + \beta_6 \text{newprocess} + \beta_7 \text{worksites} + \beta_8 \text{business linkage} + i \quad (2)$$

Where DTU_{if} refers to digital technology use among firm i in level of formality f .

4.3 Data Source

The study used the Kenya National Bureau of Statistics (KNBS) MSME 2016 survey dataset, which combined responses from licensed firms using establishment-based sampling frame and unlicensed established using household-based master sampling frame. The establishment sampling frame was drawn from county governments business licensing register databases from all the 47 county governments. This sampling frame was drawn from the fifth National Sample Survey and Evaluation Programme (NASSEP V) maintained by the Kenya National and Bureau of Statistics (KNBS). The dataset is a comprehensive dataset with 21,863 observations representing licensed and unlicensed establishments obtained from KNBS. This data was collected by KNBS at firm level and household level in December 2015. The final dataset which is available at KNBS therefore provides information on formal, informal and licenses micro small and medium sized establishment. The survey established with appropriate weights applied, that there were about 1.56 million licensed MSMEs as identified from the establishment sample and 5.85 million unlicensed businesses identified from the household sample. The MSME data did not have information on the level of education of owner in the dataset. This therefore was not analyzed. As established by (Koto, 2015), however, this would lead to a potential endogeneity issue as a determining factor in the decision to operate in the informal sector. This combined MSME dataset is used to establish the factors that influence the use of digital technology among MSMEs while a separate dataset drawn from this for formal and informal MSMEs was used to establish the factors that influence use of digital technology in formal and informal MSMEs, respectively.

4.3.1 Variable specification and measurement

The measurement of variables used are presented in Table 4.1 below.

Table 4.1: Measurement of variables for analysis

Variable	Measurement
Dependent Variable	
Digital Technology Use	Variables with values of 0 to 3, to indicate the digital technology use. The data is censored in both sides; the lower limit of 0 for firms not using any digital technology and upper limit 3 for firms using all three forms of digital technology. The three forms of digital technology are mobile phones; computers and Internet
Independent Variables	
Level of Formality	Constructed categorial variable: 1 if licensed but not registered with the registrar of companies; 2 if licensed and registered with registrar of companies (formal), and 3 if have no license and no business registration (informal)
Ownership	Constructed categorial variable: 1 if male ownership, 2 if female ownership and 3 if ownership is male/female partnership
Age of Firm	Continuous variable: the number of years the firm has been in operation from inception of the establishment to the current period. Age is transformed into logarithm to attain normality to deal with high levels of skewness
Sector	Constructed categorial variable as follows; 1= Agriculture, forestry and fishing; 2= Mining and quarrying; 3= Manufacturing; 4= Electricity, gas, steam and air conditioning supply; 5= Water supply; sewerage, waste management and remediation activities; 6= Construction; 7= Wholesale and retail trade; repair of motor vehicles and motorcycles; 8= Transportation and storage; 9= Accommodation and food service activities; 10= Information and communication; 11= Financial and insurance activities; 12= Real estate activities; 13= Professional, scientific and technical activities; 14= Administrative and support service activities; 15= Education; 16= Human health and social work activities; 17= Arts, entertainment and recreation; 18= Other service activities

Broad Sector Category	Constructed categorial variable as follows: 1=Agriculture, forestry and fishing; 2=Manufacturing; 3= Wholesale and retail trade; repair of motor vehicles and motorcycles; 4=Other services
Firm Size	Continuous variable; the total number of employees
New Product	Constructed categorial variable: 1 if the respondent indicated that they had either introduced a new product or significantly improved the product between 2013 and 2015 and 0 otherwise
New Process	Constructed categorial variable: 1 if the respondent indicated that they had either introduced a new process or significantly improved the process between 2013 and 2015 and 0 otherwise
Worksite	Constructed categorial variable as follows: 1 = an open market; 2 = Commercial / industrial site/ building; 3 = kiosk/exhibition/jua kali shed; 4=a mobile business and 5 = residential business
Business Linkage	Constructed categorial variable: 1 if MSME is a member of an MSE/jua kali association, 2 if in other business linkage which include chamber of commerce, merry-go-round, ROSCAs. 0 if otherwise

4.3.2 Descriptive statistics

The descriptive statistics are presented in Table 4.2 below.

Table 4.2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Digital technology use	21,863	0.648	0.838	1	4
Level of formality	21,695	1.369	0.622	1	3
Owner gender	21,863	1.639	0.738	1	3
Age of firm	21,811	7.924	7.894	0 (under 1 year)	96
Broad sector category	21,863	3.195	0.668	1	4
Sector	21,863	8.433	4.25	1	19
Firm size (Number of employees)	21,863	3.836	7.370	1	99
New product	21,584	0.084	0.277	0	1
New process	21,583	0.033	0.178	0	1

Worksite	21,863	2.371	1.02	1	5
Business linkage	21,631	0.619	0.871	0	2

Data Source: Combined MSME survey (2016)

On a national perspective, when the weight is applied, the findings reveal licensed MSMEs are 1.5 million accounting for 21.1 per cent of enterprises while unlicensed MSMEs are 5.85 million in total. The findings of the survey further reveal some gender dynamics, which vary based on the license status of the firm. Male owned MSMEs, for instance, account for 47.7 per cent of licensed MSMEs and 31.7 per cent of unlicensed MSMEs. Female-owned MSMEs account for 32.1 per cent of licensed establishments and 61.0 per cent of unlicensed MSMEs. MSMEs are heterogenous, operating in 19 different sectors and with varying firm size employing between 1 and 99. Majority, however, employ 9 employees or less. In terms of innovation, 8.4 per cent undertake product innovation while 3.3 per cent undertake product innovation.

5. Results and Discussion

5.1 Results

5.1.1 Factors influencing the of use to digital technology among MSMEs in Kenya

The study reveals the factors that influence the use to digital technology among MSMEs in Kenya as firm formality; gender of business owner, age of firm, size of firm; sector of firm; nature of worksite; innovation activity and business linkages. Utilization of digital technology is positively influenced by the size; innovation activity (both product and process); business linkages such as MSE associations. Conversely, firms owned by women, older firms and firms operating in kiosks/exhibitions/jua kali sheds are less likely to use digital technology. These results are presented in Table 5.1 below.

Table 5.1: Factors that influence the of use to digital technology among MSMEs in Kenya

Model A (broad sector effects)			Model B (disaggregated sector effects)		
Variable description	Variable	Results	Variable description	Variable	Results
Level of formality (base: semi-formal (licensed only))	Formal	0.91*** (0.03)	Level of formality (base: semi-formal (licensed only))	Formal	0.766*** (0.029)
	Informal	-0.579*** (0.059)		Informal	-0.553*** (0.049)
Owner gender (base: male)	Female	-0.238*** (0.028)	Owner gender (base: male)	Female	-0.184*** (0.027)
	Male-female joint owners	0.161*** (0.028)		Male-female joint owners	0.13*** (0.028)
Age of firm	Age(log)	-0.032** (0.013)	Age of firm	Age(log)	-0.026** (0.013)
Firm size	Total number of employees	0.043*** (0.002)	Firm size	Total number of employees	0.042*** (0.002)
Worksites (Base: open market)	Commercial / industrial site/building	0.067 (0.057)	Worksites (Base: open market)	Commercial / industrial site/building	0.055 (0.055)
	Kiosk/exhibition/jua kali shed	-0.272*** (0.073)		Kiosk/exhibition/jua kali shed	-0.255*** (0.071)

	Mobile business (no physical premise)	-0.102 (0.143)	Mobile business (no physical premise)		-0.205 (0.139)
	Residential	0.071 (0.065)	Residential		0.06 (0.063)
Product Innovation (Base: No product innovation)	New product	0.648*** (0.045)	Product Innovation (Base: No product innovation)	New product	0.502*** (0.037)
Process innovation (Base: No process innovation)	New process	0.213** (0.070)	Process innovation (Base: No process innovation)	New process	0.170** (0.058)
Business linage (Base: No linkages)	MSE association	0.284*** (0.039)	Business linage (Base: No linkages)	MSE association	0.29*** (0.038)
	Other business linkage	0.046** (0.028)	Other business linkage		0.061** (0.027)
Broad Sector (base: Agriculture, forestry, and fishing)	Manufacturing	0.041 (0.199)	Sector (base: Agriculture, forestry, and fishing)	Manufacturing	0.032 (0.192)
	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.353* (0.197)	Wholesale and retail trade; repair of motor vehicles and motorcycles		0.347* (0.189)
	Other services	0.716*** (0.197)	Mining and quarrying		0.479 (0.345)
			Electricity, gas, steam, and air conditioning supply		2.345*** (0.510)
			Water supply; sewerage, waste management and remediation activities		0.548 (0.421)
			Construction		1.042*** (0.226)

			Transportation and storage		1.022*** (0.214)
			Accommodation and food service activities		0.216 (0.165)
			Information and communication		2.011*** (0.198)
			Financial and insurance activities		1.171*** (0.196)
			Real estate activities		1.626*** (0.281)
			Professional, scientific, and technical activities		1.698*** (0.23)
			Administrative and support service activities		2.29*** (0.211)
			Education		0.916*** (0.197)
			Human health and social work activities		1.282*** (0.211)
			Arts, entertainment, and recreation		0.231 (0.213)
			Other service activities		0.285 (0.194)
Observations		20,587	Observations		20,587
Uncensored		8,540	Uncensored		8,540
Left – censored		10,797	Left – censored		10,797
Right – censored		1,250	Right – censored		1,250
LR chi ² (31)		4038.56	LR chi ² (31)		4912.85
Prob>chi ²		0.0000	Prob>chi ²		0.0000
Pseudo R ²		0.0780	Pseudo R ²		0.0949

Source: Author's estimations using MSME survey combined dataset

Notes: Standard errors reported in parenthesis. *, ** and *** denote significant at 10%, 5% and 1% levels, respectively

5.1.2 Factors influencing the of use of digital technology among formal sector in Kenya

The factors that influence the use of digital technology among formal and informal MSMEs are similar, as presented in Table 5.2 and 5.3 below. For formal MSMEs, utilization of digital technology is also influenced by size of firm, product innovation activity and MSE business linkages and is also negatively associated with female owned firms. Unlike the MSMEs, however, age of the firm, nature of the worksite is not a determining factor.

The results, therefore, reveal that individual characteristic such as gender of owner and firm characteristics such as age, sector of the firm and other organizational support or ICT complementary factors, such as nature of worksite, innovation, and membership in MSE association as determinants of digital technology use among MSMEs, whether formal or informal.

Table 5.2: Factors that influence the of use of digital technology amongst formal sector (Model C)

Variable description	Variable	Results
Owner gender (Base: male)	Female	-0.277*** (0.082)
	Male-female joint owners	0.538*** (0.078)
Age of firm	Age(log)	0.036 (0.34)
Firm size	Total number of employees	0.060*** (0.003)
Worksites (Base: open market)	Commercial /industrial site/building	0.262 (0.195)
	Kiosk/exhibition/jua kali shed	-0.06 0.258)
	Mobile business (no physical premise)	0.004 (0.496)
	Residential	0.113 (0.219)
Product innovation (Base: No product innovation)	New product	0.85*** (0.104)
Process innovation (Base: No process innovation)	New process	0.244 (0.153)

Business linkage (Base: No business linkage)	MSE association	0.339*** (0.100)
	Other business linkage	0.05 (0.079)
Sector (Base: Agriculture, forestry, and fishing)	Manufacturing	-0.196 (0.87)
	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.272 (0.865)
	Mining and quarrying	1.487 (1.347)
	Electricity, gas, steam, and air conditioning supply	2.156 (1.487)
	Water supply; sewerage, waste management and remediation activities	-0.076 (1.055)
	Construction	0.952 (0.885)
	Transportation and storage	1.264 (0.881)
	Accommodation and food service activities	0.187 (0.867)
	Information and communication	2.306** (0.598)
	Financial and insurance activities	1.35 (0.87)
	Real estate activities	2.201** (0.926)
	Professional, scientific, and technical activities	1.809** (0.897)
	Administrative and support service activities	2.187** (0.884)
	Education	0.684 (0.865)
	Human health and social work activities	1.521* (0.88)
	Arts, entertainment, and recreation	-118 (0.908)
	Other service activities	-0.199 (0.88)
Observations		4,351
Uncensored		1,998
Left – censored		1,425
Right – censored		928

LR chi2(27)	1234.40
Prob>chi ²	0.0000
Pseudo R ²	0.0928

Notes: Standard errors reported in parenthesis. *, ** and *** denote significant at 10%, 5% and 1% levels, respectively.

Source: Author's estimations using MSME survey combined dataset–formal MSMEs

5.1.3 Factors that influence the of use of digital technology among informal sector in Kenya

Though the analysis for informal MSMEs presents very similar findings of formal MSMEs, the main major difference is the nature of worksite and industrial sector. The factors that influence the use of digital technology among informal MSMEs include gender of owner, size of firm, innovation activity and nature of worksites. Unlike formal MSMEs, informal MSMEs operating in commercial buildings and in kiosk/exhibition/jua kali shed are associated with use of digital technology compared to those on open markets. The variable on nature of worksites was not statistically significant for formal MSMEs. Further difference is that the sectors which use digital technology is wider for informal sector compared to formal MSMEs, which is presented in section 5.4 below.

Table 5.3: Factors that influence the of use of digital technology among informal sector (Model D)

Variable description	Variable	Results
Owner gender (Base: male)	Female	-0.424*** (0.125)
	Male-female joint owners	0.297 (0.195)
Age of firm	Age(log)	0.028 (0.053)
Firm size	Total number of employees	0.047*** (0.009)
Worksites (Base: open market)	Commercial /industrial site/building	0.387** (0.153)
	Kiosk/exhibition/jua kali shed	0.386* (0.205)
	Mobile business (no physical premise)	0.111 (0.211)

	Residential	0.194 (0.166)
Product Innovation (Base: No product innovation)	New product	1.127*** (0.104)
Process innovation (Base: No process innovation)	New process	0.449 (0.426)
Business linkage (Base: No business linkage)	MSE association	0.484** (0.208)
	Other business linkage	0.390*** (0.126)
Sector (Base: Agriculture, forestry, and fishing)	Manufacturing	0.478 (0.315)
	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.461* (0.277)
	Mining and quarrying	0.558 (0.877)
	Electricity, gas, steam, and air conditioning supply	2.156 (1.487)
	Water supply; sewerage, waste management and remediation activities	2.23** (1.053)
	Construction	3.79*** (0.968)
	Transportation and storage	0.543 (0.398)
	Accommodation and food service activities	0.582* (0.322)
	Information and communication	3.882*** (0.903)
	Financial and insurance activities	2.617*** (0.547)
	Real estate activities	1.263* (0.661)
	Professional, scientific, and technical activities	3.668** (0.951)

	Administrative and support service activities	1.876*** (0.838)
	Education	1.726*** (0.424)
	Human health and social work activities	2.181*** (0.476)
	Arts, entertainment, and recreation	-0.28 (0.575)
	Other service activities	0.142 (0.365)
Observations		1,582
Uncensored		397
Left – censored		1,140
Right – censored		46
LR chi ² (27)		313.56
Prob>chi ²		0.0000
Pseudo R ²		0.1083

Notes: Standard errors reported in parenthesis. *, ** and *** denote significant at 10%, 5% and 1% levels, respectively.

Source: Authors' estimations using MSME survey combined dataset informal MSMEs

Table 5.4: Tobit regression findings of on sectors found to be statistically significant

Formal MSMEs	Informal MSMEs
ICT	ICT
Real Estate	Real Estate
Professional, Scientific, and Technical Activities	Professional, Scientific, and Technical Activities
Administrative and Support Service	Administrative and Support Service
Human Health and Social Work	Human Health and Social Work
	Financial and Insurance
	Education
	Wholesale and Retail Trade
	Water Supply; Sewerage, Waste Management and Remediation Activities
	Construction

	Accommodation and Food Service Activities
--	---

Source: Authors' estimations Factors that influence the of use of digital technology amongst informal sectors

5.2 Discussion of Results

5.2.1 Factors that influence the of use to digital technology among MSMEs in Kenya

Level of formality: MSMEs operating formally are associated with a 0.766 increase in the digital technology use score compared those that are semi formal (only licensed). Conversely, MSMEs operating informally are associated with a 0.553 decrease in the use of digital technology. The difference between formal and informal MSMEs will be explored further in section 5.2.2.

Gender of business owner: Female-owned businesses are less likely to use digital technology compared to firms with male-female joint ownership. This finding again brings out the importance of gender-sensitive policies that apply to MSMEs whether formal or informal. Enhancing digital skills and inclusion women in business and other special interest groups as priority as established in the Kenya Digital master plan.

Age of the business: The coefficient of age is statistically significant for MSMEs but when disaggregated to formal and informal, this variable is no longer significant (Table 5.2 and Table 5.3). This means as the firm age increases, the likelihood of using digital technology increases. This is an interesting finding. It is likely that the firm adopts more advanced technology as it matures.

Size of the business: The larger the firm, the higher the probability of using digital technology. This is likely due to the increase in capacity and resources as established in the resource-based theory. A one-unit increase in the number of employees in MSMEs is associated with a 0.043 increase in digital technology use.

Worksites: MSMEs operating in kiosk/exhibition/jua kali shed is associated with a 0.255 decrease in the use digital technology compared to MSMEs operating in open markets. This is likely because this type of worksite often lacks ICT complementary infrastructure such as electricity.

Firm level Innovation: The study reveals a strong relationship between innovation and digital technology. MSMEs that undertake product innovation are associated with 0.50 increase in use in digital technologies while MSMEs that undertake process innovation are associated with a 0.17 increase in use of digital technology.

Business linkages: Being in a business association or other business linkages such as merry-go-round or ROSCAs is associated in an increase in use digital technology. For MSE business association, the increase is 0.29 while other business linkages is 0.061. These business linkages provide MSMEs with financial

resources, capacity building and information with higher impacts with business linkages through business associations.

Sector: MSMEs in Kenya are highly heterogeneous, with those in the services sector are adopters of digital technologies. When the sectors are disaggregated further, the findings reveal that the sectors that use digital technologies when compared to agriculture as follows: construction; wholesale and retail trade; repair of motor vehicles and motorcycles; transport and storage; information and communication (ICT); finance and insurance activities, real estate activities; professional services; administrative and support services; education and human health and social work. The use of digital technology in the trade sector is essential to ensure effective implementation of a single window system to facilitate electronic transactions in trade.

The sectors that do not appear to be adopters of digital technology among MSMEs are manufacturing and food and accommodation. Yet, both are priority sectors: the manufacturing sector, which has been a focus area in terms of policy as established in the Kenya Vision 2023 and BETA, is not among the sectors that have a likelihood to adopting digital technology. Accommodation and food service activities are not among digital technology adopters, yet they constitute a good proportion of MSMEs in Kenya.

5.2.2 Assessing the Differences in Digital Technology Utilization Among Formal and Informal MSMEs in Kenya

Level of formality: The study reveals that while there are some distinct differences between formal and informal MSMEs, there are some similarities. For instance, on the similarities, whether formal or informal, female-owned MSMEs have a negative probability of using digital technology. The study also established that larger firms, firms with business linkages and firms that undertake product innovation whether formal or informal, the higher the probability of using digital technology. The magnitude for formal MSMEs, however, differ for these variables from informal as presented in Table 5.2 and 5.3. The key differences relate to the sectors and nature of worksites. The sectors that use digital technology among informal MSMEs are significantly more compared to informal MSMEs (Table 5.4) and the nature of worksite is a determinant for informal but not formal. These are detailed below.

Gender of business owner: Female-owned MSMEs that are formal are associated with a 0.277 decrease in the digital technology use compared to men-owned MSMEs that are formal. Female-owned MSMEs that operate informally are associated with a 0.424 decrease in digital technology use compared to men-owned MSMEs that also operate informally.

Size of firm: For formal MSMEs, a one-unit increase in the number of employees is associated with a 0.060 increase in the digital technology use, holding all other variables constant. For informal MSMEs, a unit increase is associated with a 0.028 increase in the use of digital technology.

Firm level innovation: Formal MSMEs that undertake product innovation are associated with a 0.85 increase in digital technology use. Informal MSMEs, interestingly, have a larger impact of 1.127 increase in use of digital technology.

MSE association: A unit increase in MSE association membership among formal MSMEs is associated with an increased update of digital technology by 0.339 points. For informal MSMEs, this is associated with an increase of 0.484 points. Other business linkages yield an increase in the use of digital technology at a slightly lower magnitude of 0.39 points for informal MSMEs but insignificant for formal.

Worksites: The nature of worksite is a determinant of utilization of digital technology among informal MSMEs. Informal MSMEs operating from commercial /industrial sites / buildings and those operating from kiosk/exhibition/jua kali sheds use digital technology. For formal MSMEs, however, the nature of worksite is not a determinant of digital technology use. Appropriate ICT complementary worksites is therefore central to digital technology use among informal MSMEs.

Sector of firm: The use of digital technologies varies based on the sector and level of informality; there is a wider range of service sectors that use digital technology among the informal sector compared to the formal sector. Revealing a higher digital technology usage among the various informal enterprises sectors compared to formal enterprises. The study Esselaar, Stork, Ndiwalana and Deen-Swarray (2007) had a similar finding, whereby the ICT usage intensity was higher for informal enterprises compared to formal enterprises. It is likely these informal enterprises leverage more on digital technology to market their services compared to formal. In both formal and informal MSMEs, however, manufacturing sector is not an adopter of digital technology.

6. Conclusion and Recommendations

6.1 Conclusion

The overall objective of this study was to identify the factors that influence the use to digital technology among MSMEs in Kenya. The study establishes level of formality; worksites, business linkages, innovation activity and gender as important essential for promoting use of digital technology therefore policy priorities.

6.2 Recommendations for the Facilitation and Promotion of Digital Technology Among MSMEs in Kenya

Continuous promotion of digital economy pillars: The government, as established in BETA, has placed digital economy as among the priority pillars. Implementation of the ICT policy, Digital Economy Blueprint and the National Digital Masterplan is therefore key in enhancing the digital economy within the digital infrastructure; digital government services and products; digital skills and digital innovation, entrepreneurship, and digital business pillars. As relates to support to MSMEs, therefore, the installation of hotspots in business centres, and establishment of ICT complementary infrastructure envisioned in the policy framework in the form of village digital hubs and Community Digital Centres will be of importance. As established in this study, the nature of worksites is a determinant of the use of digital technology. The installation of hotspots within other MSME infrastructure, such as commercial sites, industrial parks, kiosks and jua kali sheds will therefore be beneficial. The national policy instruments further call for the promotion of e-commerce and integrated constituency-based digital marketplaces. This calls for provision of relevant training or skills upgrading on digital skills.

Poor digital skills are also established as a constraint in the 2023 Kenya National E-Commerce Strategy: Ensuring digital economic awareness including cyber security and data governance is, therefore, essential through Government capacity-building programmes that target MSMEs or representative MSE associations to transfer to MSMEs. Training and capacity needs assessment on digital skills and capacity is therefore of priority. Further consideration of the design in a flexible training and capacity building approaches is essential to allow MSMEs, especially sole proprietors, to undertake business operations.

Appropriate ICT complimentary worksite infrastructure: In the development of a National Integrated Infrastructure Plan (NIIP) and other ICT business support proposed in government policy, careful consideration be given to MSMEs experiencing a digital divide. The NIIP will therefore be critical infrastructure informing the development and design of industrial sites or infrastructure such as County Aggregation and Industrial Parks (CAIPs), MSME parks, technology parks and incubations hubs. This, therefore, calls for the establishment and operationalization of a digital technology sensitive national

integrated infrastructure plan to guide all worksite and industrial developments targeting MSMEs in the country.

Support MSME associations: Associations are important social capital for businesses in Kenya. Continued policy support for associations is thereby critical. Strong and resourceful associations provide members with various benefits while promoting technology and skills transfer, especially digital skills. The skills transfer is achieved through various mechanisms, including sub-contracting which can be facilitated by MSMEs. MSME associations can also provide guidance on business formalization. The MSE registrar is therefore an important institution that can strengthen MSE associations to be more efficient and beneficial to members. For the Registrar of MSEs to be effective, however, there is need for enhanced awareness to MSEs to form or join associations and for associations to register with the MSE Registrar. Of policy priority, therefore, is to establish, through the MSE Registrar, is government-funded or organized trainings to MSE association leadership for transmission to the members. Secondly, is the promotion of business linkages and enhancement of digital skills by Micro and Small Enterprise Authority (MSEA) and through workshops and seminars aimed at enhancing digital skills and promoting business linkages. Third, is the development and operationalization of a national sub-contracting policy. Continued policy interventions to promote business associations and other business linkages is also important.

Promotion of women entrepreneurs and of gender-sensitive policies and interventions: Policy interventions that are tailored to enhance the capacity and capability of women entrepreneurs to access and use digital technology is necessary. This can be achieved through specialized programmes to support women owned MSMEs. Particularly those operating informally. Training and capacity needs assessment is therefore a priority.

Sector support: Some of the industrial sectors that are not statistically significant when it comes to use of digital technology are key policy priority sectors as established in the country's industrial policies. The manufacturing sector for instance is targeted to contribute 15 per cent to GDP. The sector has over the years stagnated at 10 per cent GDP or below. The other sector is food and accommodation, which is essential in promoting Kenya's tourism sector. If the industry is not inclined to use digital technology, then the marketing will not be ineffective. Government initiatives to promote the use of digital technology within manufacturing, trade and tourism sector will therefore enhance the country's economic development. This calls for a sector-based needs assessment of the digital technology and capacity skills for the sectors by relevant authorities, which include MSEA with the aim of promoting industry specific skills to relevant technology.

Innovation: Innovation has been identified in Kenya's Vision 2030 as an enabler. The study establishes significant association between innovation and digital technology. Of policy priority, therefore, is the development and operationalization of a national innovation policy, which is currently not yet established. Digital technology and therefore digital entrepreneurship would therefore be central to innovation policy. A mandate of the policy, therefore, is to facilitate for the

development and adoption of new MSME relevant digital technology through mechanisms such as regulatory sandboxes and institutionalize government initiatives such as Huduma WhiteBox and promotion of intellectual property awareness and uptake. The identification, documentation and promotion of innovations is also a policy priority that would promote digital entrepreneurship. This can be active through the operationalization of the Innovation Database in Kenya established in the Science, Technology, and Innovation Act No. 28 of 2013 as a mandate of Kenya National Innovation Agency (KENIA). The database maintained by KeNIA would enhance access to innovation and technology developed and/or available within the country.

Promote e-commerce and digital market platforms to enhance market access: Promotion of buyer-seller platforms or e-commerce platforms has been identified as policy priority. This calls for the establishment an effective framework to inform implementation of the Kenya National E-commerce Strategy. This includes review of regulation and standards around courier systems, review of consumer protection provisions and data protection as relates to e-commerce and fast-tracking the operationalization of the draft National Addressing System Policy and Bill for identification of location addresses with ease.

Addressing informality through the promote of transition to formal economy: The review policies and practices that affect MSMEs is central to ensuring a conducive business environment for MSMEs. Continuous review of the business environment is essential for the government to monitor trends as relates to business registration and licenses. This calls for a coordinated and integrated policy implementation approach, given MSMEs are highly heterogenous. MSEA, therefore, plays a critical role in undertaking such assessments and in ensuring coordination of policy implementation. Government initiatives such as Huduma Centres, which improve access to business registration services through decentralization is beneficial and therefore scaled up. This can be complemented with additional business entry reforms, including e-government services as envisaged in the national ICT policies.

A digital one-stop-shop for government common services is a priority of the government. A single digital reference point for all business registration and licensing services has the potential to reduce transaction costs and enhance efficiency. Of urgency, therefore, is the implementation of the digital one-stop-shop with emphasis on provision of comprehensive licensing, noting the multiagency licensing approach in Kenya.

References

- Aker, J. and Mbiti, I. (2010), "Mobile phones and economic development in Kenya". *The Journal of Economic Perspectives*, 24(3): 207-232.
- Ashrafi, R. and Murtaza, M. (2008), "Use and impact of ICT on SMEs in Oman". *The Electronic Journal Information Systems Evaluation*, 11(3): 125-138.
- Aunger, R. (2010), "Types of technology". *Technological Forecasting and Social Change*, 77(5): 762-782.
- Bhattacharya, R. (2019), "ICT solutions for the informal sector in developing economies: What can one expect?" *The Electronic Journal of Information Systems in Developing Countries*.
- Bigsten, A.K. (2004), "What to do with the informal sector?" *Development Policy Review*, 22: 701-715.
- Biswas, P. and Baptista, A. (2012), "Growth of ICT capital and deceleration of labour productivity in the EU countries: The missing links". *Computer and Information Science*, 5(5): 55-68.
- Bloom, N., Draca, M., Kretschmer, T. and Sadun, R. (2010), *The economic impact of ICT*. Centre for Economic Performance, Enterprise LSE Ltd.
- Castells, M. and Portes, A. (1989), "World underneath: The origins, dynamics and effects of the informal economy". In A. Portes, M. Castells and L. (eds). Benton, *The informal economy: Studies in advanced and less developed countries*, 11-33). Baltimore: Johns Hopkins University Press.
- Chen, M. (2012), The informal economy: Definitions, theories and policies. Women in Informal Employment Globalizing and Organizing (WIEGO).
- Chen, M.A. (2012), The informal economy: Definitions, theories and policies. WIEGO.
- Cohen, W. and Levinthal, D. (1980), "Innovation and learning: The two faces of RandD". *The Economic Journal*, 99: 569-596.
- Cong, R. (2000), "Marginal effects of the tobit model". *Stata Technical Bulletin*, 56: 27-34.
- Danquah, M. and Owusu, S. (2021), Digital technology and productivity of informal enterprises: Empirical evidence from Nigeria. WIDER Working Paper 2021/114.
- Davis, F. (1989), "Perceived usefulness, perceived ease of use and user acceptance of information technology". *MIS Quarterly*, 319-340.
- De Soto, H. (1989), *The other path: The invisible revolution in the Third World*. New York: Harper and Row.
- De Soto, H. (2000), *The mystery of capital: Why capitalism triumphs in the West and fails everywhere*. Else. Basic Books.

- Deen-Swarray, M., Moyo, M. and Stork, C. (2013), "ICT access and usage among informal businesses in Africa". *Info*, 15(5).
- Deen-Swarray, M., Ndiwalana, A. and Stork, C. (2013), Bridging the financial gap and unlocking the potential of informal businesses through mobile money in four East African countries. ERPN: Social Enterprise.
- Dell'Anno, R. (2022), "Theories and definitions of the informal economy: A survey". *Journal of Economic Surveys*, 36: 1610-1643.
- Duran, J. and Castillo, R. (2021), Factors related to information and communication technologies. Adoption in Small Businesses in Colombia.
- Esselaar, S., Stork, C., Ndiwalana, A. and Deen-Swarray, M. (2007), "ICT usage and its impact on profitability of SMEs in 13 African countries". *Information Technologies and International Development Journal*, 4(1): 87-100.
- European Investment Bank (2020), Digital technologies and firm performance: Evidence from Europe. European Investment Bank (EIB) Economics Department.
- Fafchamps, M. (1994), "Industrial structure and micro enterprises in Africa". *The Journal of Developing Areas*, 29: 1-30.
- Fu, X., Mohnen, P. and Zanella, G. (2018), "Innovation, informality, and firms' growth in low-income countries". *Technological Forecasting and Social Change*, 131: 315-325.
- Gitonga, A. (2008), *Factors affecting growth of micro and small enterprises in Kenya*. Nairobi: Kenya Institute for Public Policy Research and Analysis (KIPPRA).
- Gitonga, A. and Moyi, E. (2019), *The role of information communication technologies in innovation in Kenya's micro, small and medium establishments*. Nairobi: Kenya Institute for Public Policy Research and Analysis (KIPPRA).
- Gitonga, A. and Musamali, R. (2021), *Enhancing entrepreneurship in Kenya*. Nairobi: The Kenya Institute for Public Policy Research and Analysis (KIPPRA).
- Government of Kenya (1965), Sessional Paper No. 10 of 1965 African Socialism and its Application to Planning in Kenya.
- Government of Kenya (1985), Sessional Paper No. 02 of 1985 on Unemployment. Ministry of Labour.
- Government of Kenya (1986), Sessional Paper No. 01 of 1986 on Economic Management for Renewed Growth.
- Government of Kenya (1992), Sessional Paper No. 2 of 1992, Small Enterprise and Jua Kali Development in Kenya. Ministry of Labour and Human Resource Development.

- Government of Kenya (1997), Sessional Paper No. 2 of 1997 on Industrial Transformation into the Year 2020. Nairobi: Government Printer.
- Government of Kenya (2003), Economic Recovery Strategy for Wealth and Employment Creation 2003-2007. Nairobi: Ministry of Planning and National Development.
- Government of Kenya (2005), Sessional Paper on Development of Micro and Small Enterprises for Wealth and Employment Creation for Poverty Reduction. Nairobi: Ministry of Labour and Human Resource Development.
- Government of Kenya (2020), Sessional Paper No. 05 of 2020 on Kenya Micro and Small Enterprises Policy for Promoting Micro and Small Enterprises (MSEs) for Wealth and Employment Creation. Nairobi: Ministry of Industrialization, Trade and Enterprise Development.
- Greve, H. and Argote, L. (2015), "Behavioral theories of organization". In Elsevier, and J. Wright (Ed.), *International Encyclopedia of the Social and Behavioral Sciences* (Second Edition), 481-486.
- Hart, K. (1973), "Informal income opportunities and urban employment in Ghana". *The Journal of Modern African Studies*, 11(1): 62-89.
- Hart, K. (1973), "Informal income: Opportunities and urban employment in Ghana". *Journal of Modern African Studies*, 61-89.
- ILO and UN (1972), *Employment, incomes and equality: A strategy for increasing productive employment in Kenya: Report of an inter-agency team*. Geneva: International Labour Organization.
- ILO (2018), *Women and men in the informal economy: A statistical picture*. Geneva: International Labour Organization (ILO).
- ILO (2021), Conceptual framework for statistics on informal economy. Department of Statistics, Working Group for the Revision of the standards for statistics on informality. Draft under construction for discussion at the third meeting of the Working Group. International Labour Organization (ILO).
- IMF (2017), Regional economic outlook. Sub-Saharan Africa. Washington, DC: International Monetary Fund (IMF).
- Jensen, R. (2007), "The digital divide: Information (Technology), market performance, and welfare in the South Indian fisheries sector". *The Quarterly Journal of Economics*, 122(3): 879-924.
- Kenya Vision 2030 Delivery Secretariat (2021), Kenya Vision 2030 Flagship Projects Process Report (2008-2017).
- KIPPRA (2013), Kenya Economic Report 2013: Creating an enabling environment for stimulating investment for competitive and sustainable counties. Nairobi: Kenya Institute for Public Policy Research and Analysis (KIPPRA).

- Klapper, L. and Love, I. (2011), "The impact of business environment reforms on new firm registration". *SSRN Electronic Journal*. 10.2139/ssrn.1786802. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1786802.
- KNBS and CA. (2016), Enterprise ICT Survey 2016. Nairobi: Kenya National Bureau of Statistics (KNBS) and Communications Authority of Kenya (CA).
- KNBS (2016), Micro, Small and Medium Establishments; Basic Report. Nairobi: Kenya National Bureau of Statistics (KNBS).
- KNBS (2020), Informal Sectors Skills and Occupations Survey (ISSOS) - Basic Report. Nairobi: Kenya National Bureau of Statistics (KNBS).
- Kotelnikov, V. (2007), Small and medium enterprises and ICT. United Nations Development Programme – Asia-Pacific Development Information Programme (UNDP-APDIP).
- Koto, P. (2015), "An empirical analysis of the informal sector in Ghana". *Journal of Developing Areas*, 93-108.
- Kramer, W., Jenkins, B. and Katz, R. (2007), The role of the information and communications technology sector in expanding economic opportunity. Kennedy School of Government, Harvard.
- La Porta, R. and Shleifer, A. (2008), The unofficial economy and economic development (Vol. Brookings Papers on Economic Activity).
- La Porta, R. and Andrei, S. (2008), The unofficial economy and economic development. Brookings Papers on Economic Activity.
- La Porta, R. and Shleifer, A. (2014), "Informality and development". *Journal of Economic Perspective*, 28(3): 109-126.
- Lee, Y., Kozar, K. and Larsen, K. (2003), "The technology acceptance model: Past, present, and future". *Communications of the Association for Information Systems*, 12(1): 50.
- Losby, J., Else, J. and Kingslow, M. (2002), Informal Economy Literature Review. SED Consulting and Research and the Aspen Institute.
- Massaquoi, J. (1992), "Informal sector technology: A review of policy issues". In J. Massaquoi (eds), *Technological capability in the informal sector in Sierra Leone*, 1-24. Freetown: University of Sierra Leone.
- Michels, M. and Musshoff, O. (2022), "A tobit regression model for the timing of smartphone adoption in agriculture". *Heliyon*, 8(11).
- Njenga, G., Nguli, J., Ngugi, R., Musamali, R., Lutta, P. and Naeku, C. (2022), Research ecosystem strengthening through the development of a framework for County Business Environment for Micro and Small Enterprises in Kenya.

-
- OECD (2004), *ICT, E-business and small and medium enterprises*. Paris: OECD Publishing.
- Opiyo, R. and K'Akumu, O. (2006), "ICT application in the informal sector: The case of the Kariokor market MSE cluster in Nairobi". *Urban Forum*, 17(3): 241-261.
- Perry, G., Maloney, W., Arias, O., Fajnzylber, P., Mason, A. and Saavedra-Chanduvi, J. (2007), *Informality: Exit and exclusion*. Washington, DC: World Bank.
- Romer, P. M. (1990), "Endogenous technological change". *The Journal of Political*, 98(5): 71-102.
- Schwab, K. (2016), The Fourth Industrial Revolution: What it means, how to respond. World Economic Forum.
- Seetharaman, P., Cunha, M. and Effah, J. (2019), "IT for the informal sector in developing countries: A broader perspective". *Electronic Journal of Information Systems in Developing Countries*, 85(3).
- Shiels, H. and McIvor, R. (2003), "Understanding the implications of ICT adoption: Insights from SMEs". *Logistics Information Management*, 16(5): 312-326.
- Solow, R.M. (1956), "A contribution to the theory of economic growth". *Quarterly Journal of Economics*, 70(1): 65-94.
- Tarutè, A. and Gatautis, R. (2014), "ICT impact on SMEs performance". *Procedia - Social and Behavioral Sciences*, 110: 1218-1225.
- Tobin, J. (1958), "Estimation of relationships for limited dependent variables". *Econometrica*, 26: 24-36.
- Tokman, V.E. (1978), "An exploration into the nature of informal-formal sector relationships". *World Development*, 6(9-10): 1065-1075.
- Vaumi, A. T., Leudjou, R. and Faha, P.C. (2021), "Adoption and impact of ICT on labour productivity in Africa: Evidence from cross-country firm-level data. Nairobi: African Economic Research Consortium.
- Venkatesh, V. and Bala, H. (2008), "Technology acceptance model 3 and a research agenda on interventions". *Decisions Science*, 39(2): 273-315.
- Venkatesh, V. and Morris, M. (2000), "Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behaviour". *MIS Quarterly*, 24(1): 115-139.
- Venkatesh, V., Thong, J. and Xu, X. (2003), "User acceptance of information technology: Toward a unified view". *MIS Quarterly*, 27(3): 425-478.
- Wanjau, W. (1998), "Technological capability of the micro-enterprises in Kenya's informal sector". *Technovation*, 19(2): 117-126.

- Wernerfelt, B. (1984), "A resource-based view of the firm". *Strategic Management Journal*, Vol. 5, No. 2: 171-80.
- Williamson, O. (1979), "Transaction-cost economics: The governance of contractual relations". *Journal of Law and Economics*, 22(2): 233-61.
- Wolf, S. (2001), Determinants and impact of ICT use for African SMEs: Implications for rural South Africa. Bonn: Centre for Development Research (ZEF Bonn).
- World Bank (2023). Data Bank: World Development Indicators. Retrieved from World Bank Open Data: <https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=KE>.
- Yi, M., Fiedler, K. and Park, J. (2006), "Understanding the role of individual innovativeness in the acceptance of IT-based innovativeness: Comparative analyses of models and measures". *Decision Sciences*, 37(3).

ISBN 978 9914 738 16 2

**Kenya Institute for Public Policy Research and Analysis
Bishops Garden Towers, Bishops Road
PO Box 56445, Nairobi, Kenya
tel: +254 20 2719933/4, 2714714/5, 2721654, 2721110
fax: +254 20 2719951
email: admin@kippra.or.ke
website: <http://www.kippra.org>**