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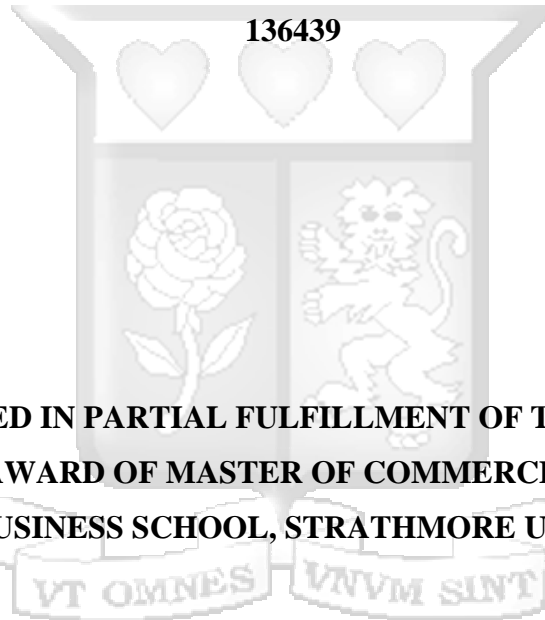
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**THE EFFECT OF DIGITALIZATION ON THE OPERATIONAL EFFICIENCY  
OF TELECOMMUNICATION FIRMS IN KENYA**

**PERIS WANDETO**

**136439**



**THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE AWARD OF MASTER OF COMMERCE DEGREE AT  
STRATHMORE BUSINESS SCHOOL, STRATHMORE UNIVERSITY, KENYA**

**JUNE 2023**

## DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

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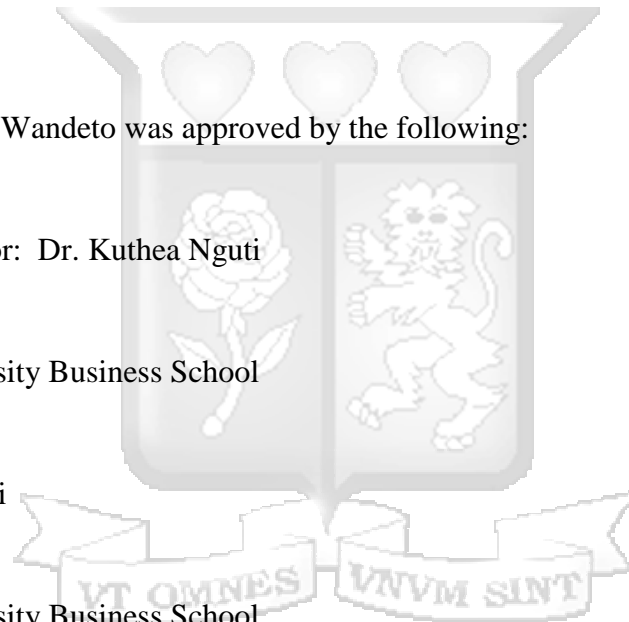
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## **DEDICATION**

I dedicate this work to my son, Jabari Mwangi, to serve as an inspiration and encouragement for him to set a higher goal in his educational pursuit.

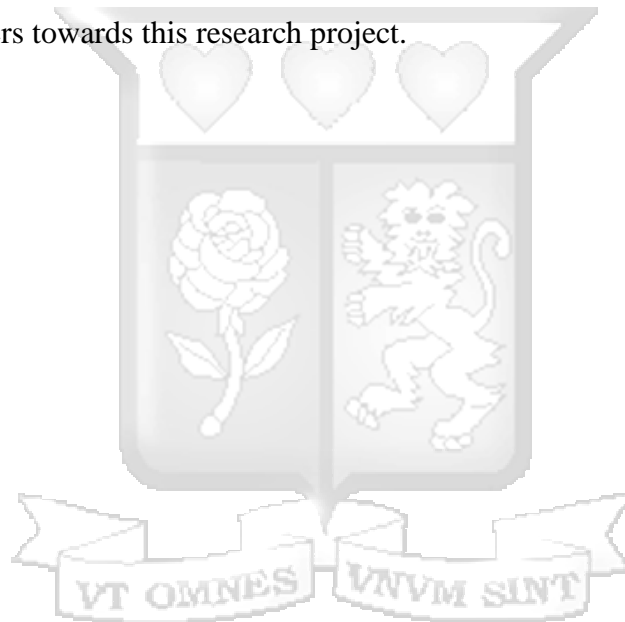


## **ACKNOWLEDGMENT**

First and foremost, I want to thank the almighty God for enabling me reach this far through the gift of life, good health, and wisdom throughout the thesis process. I wish to acknowledge individuals whose efforts in different forms have contributed to the current shape of this research proposal.

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Finally, I wish to thank my family, friends, and colleagues for their assistance, critique, patience, and prayers towards this research project.



## **ABSTRACT**

Kenya's telecommunication sector has grown tremendously in recent years, and this has been attributed to growth in the digital economy, mobile uptake, and internet penetration. Despite this growth, little scholarly work has been conducted to examine the effect of digitalization on the operational efficiency of telecommunication firms in Kenya. In particular, the study examined the effect of digital literacy on the operational efficiency of telecommunication firms in Kenya, established the effect of organizational digital capability on the operational efficiency of telecommunication firms in Kenya, and found out the effect of digital investment on the operational efficiency of telecommunication firms in Kenya. The study focused on the leading mobile telecommunication companies, and mobile service providers in Kenya with the three main telecommunication firms: Safaricom Ltd, Airtel Networks Kenya Ltd, and Telkom Kenya Ltd serving as data sources. In the examination of the effect of digitalization on operational efficiency among firms in telecommunication, this study used Diffusion of Innovation Theory, Resource-based Theory and Queueing Theory. This study used a descriptive research design and all 280 employees serving in different employment cadres at Safaricom Ltd, Airtel Networks Ltd, and Telkom Ltd constituted the target population. In identifying target departments, the study used a purposive sampling technique and stratified sampling was used to select a sample of 165 employees working in the five sections/departments. Data collection was conducted using a questionnaire. The study analyzed the data collected using descriptive analysis and regression analysis. A quantitative approach was used for data analysis. The findings showed that the independent variables (Digital literacy, Digital capability, and Digital investment) explain 57.6% of the variability of the dependent variable (operational efficiency). The study findings show that there are telecommunication firms that have not fully committed adequate financial resources for digitalization and digital literacy can help employees achieve their goals more quickly. ANOVA results tested whether overall regression model was a good fit for the data. The results show that the independent variables statistically predict dependent variable  $p=001$  ( $<0.05$ ) and hence the model is good fit for the data. The results show that digital capabilities positively influence operational efficiency mainly through technological capabilities. Therefore, firms seeking to accelerate their digital journey need to achieve time and cost efficiency in their regular business operations so that they are a step closer to their transformation goals. The study concluded that telecommunications firms that are undergoing digital transformation and have completed digital transformation need to pay attention to and cultivate digital capability.

**Key Words:** Digitalization, operational efficiency, telecommunication, digital literacy, digital capability, digital investment

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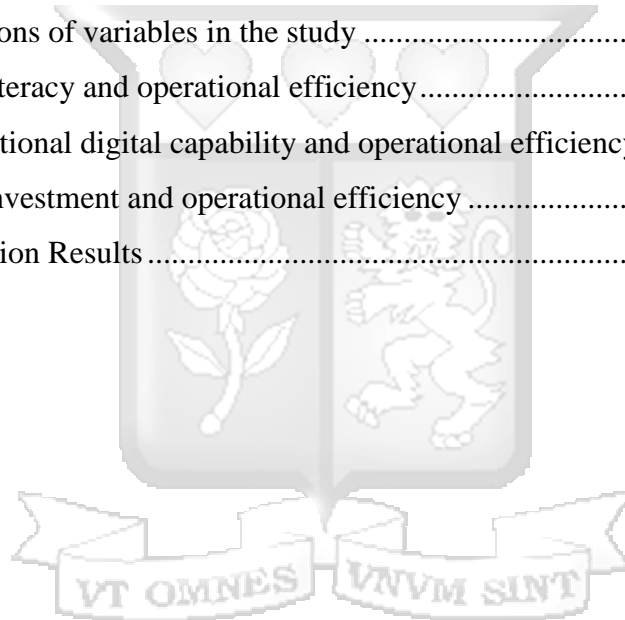
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## **LIST OF ABBREVIATIONS AND ACRONYMS**

<b>DT:</b>	Digital Transformation
<b>ERP:</b>	Enterprise Resource Planning
<b>ICT:</b>	Information Communication and Technology
<b>IT:</b>	Information Technology
<b>LTD:</b>	Limited
<b>SMEs:</b>	Small and Medium Enterprises



# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Digitalization has been identified as the most significant technological trend that is changing both, society, and business (Parviainen, Tihinen, Kaariainen, & Teppola, 2017). Nowadays, firms are constantly under pressure to use digital technologies and to adapt their business models to this new reality. Although going digital evokes many benefits, it also requires investments and associated costs (Ahmad, & Murray, 2019). Digital technologies have changed the way businesses engage in the market in terms of what they sell as value propositions, how they sell them their value demonstrations (Gandhi, Thota, Kuchembuck, & Swartz, 2018; Syam & Sharma, 2018).

While the topic of digitalization is currently prominent in the minds of many practitioners and academics, digitization and the digitalization of business are not new topics of interest. Demands for simplification and transparency in process information management and rationalizing, optimizing a very fragmented and splintered process are key drivers for digitalization. It is important to note that maintaining existing digital infrastructures and implementing new digital business models require investments on a very large scale (Schwertner, 2017). This leads to the question, how is digitalization described its impact on operational efficiency and what digital technologies telecommunication firms should invest in.

“While digitalization puts emphasizes on digital technologies, the term digitalization has been coined to describe the manifold sociotechnical phenomena and processes of adopting and using these technologies in broader individual, organizational, and societal contexts” (Legner et al., 2017, pp. 301-302). Digitalization is an emerging, open and dynamic concept that has not been fully defined; it is an ongoing process that should be approached with sensitivity and openness to what it might encompass; a means rather than an end (Hagberg, Sundstrom & Egels-Zandén, 2016). Digitalization is taking analog information and encoding it into zeros and ones for computers to store, process and transmit it. According to Gray, and Rumpe (2015) digitalization is using digital technologies to change the way business is conducted and provide new revenue and produce new opportunities.

### **1.1.1 Digitalization**

Digitalization is defined as a world where everything is associated through information technologies (Stroterman and Fors, 2004). According to another definition, digitalization is described as the development of a new business model or the use of digital technologies to create a new resource and value by changing an existing business model. For example, converting a handwritten text into a digital format is described as digitalization. (Bloomberg, 2018).

Digitalization can help empower, recognize, and coach employees more impassively and thereby increase the trustworthiness of the leader concerning the expression of objectives and intentions. This leadership practice that can be tied back to Avolio, Kahai, and Dodge (2000) seems to be a process in progress. Avolio, Kahai, and Dodge (2000) suggest that digitalization has a major impact on the perception of a leader's behavior (such as inspirational, caring, credible, honest, goal-oriented, or stable emphasizes). Being interconnected through digital means provides an open and transparent communication channel where the leader can demonstrate integrity, accountability, and justice. With increased transparency, removal of hierarchies about, behavior and humanizing effect of digitalization, leaders are obliged to be honest about their work and private lives and become accountable to the employees.

Digitalization has become an increasingly popular topic for research, more so in the areas of information systems, strategy and marketing and its role in revolutionizing the business sector. One notable observation is the growing use of business intelligence (BI) for better management and decision-making processes in the business sector. For instance, Gartner (2009) reports that business intelligence was at the top of the priority agendas in firms, also BI skills are highly pursued (Brandel, 2009). The influential work of Frey and Osborne (2017) on the impacts of digitalization on professions focuses on the risk that professions, will be fully automated in the foreseeable future. The study offers a perspective on the impacts that digitalization will have when it comes to organizational structure and labor engagement. The study also identified computation bottlenecks, that is, capabilities that occupations possess and that cannot be replaced by machines soon. They find that the professional category that managers belong to is at a low risk of computerization because these occupations require capabilities such as creativity and social intelligence. Digitalization has been identified as the most significant technological trend that is changing

both society, and business.

Organizations are going through a process of change so that they can use the technological opportunities required by the age. The concept of digital transformation is expressed as the structuring of technology production and management process in the organization, especially with different degrees of digital technologies, including business models (Kraus, Schiavone, Pluzhnikova, Invernizzi, 2021).

Digital transformation is a term used primarily to describe the transformation from partly digitized to fully digitized business and society models (Hess, Matt, Benlian, & Wiesböck, 2016). As such, business models are completely based on ‘digital levers’ that are dependent on mechanisms unobtainable without the internet. The concept of ‘digital transformation’ therefore primarily deals with the managerial- technical viewpoint of business model transformation” (Riedl et al., 2017, p.481). From an IT perspective, digital transformation denotes the body of changes that occur to automate tasks (Legner et al., 2017). Digital transformation is a process that endeavors to improve an organization’s operations by triggering significant changes to its properties through a combination of information, computing, communication, and connected technologies (Val, 2019). Some of the organizational aspects affected by digital transformation include acquisition of digital resources, designing digital growth strategies and internal organizational structure. From this viewpoint, digital transformation refers to the innovative use of various advanced digital technologies to create value on a larger scale for internal and external stakeholders (Gong & Ribiere, 2021).

According to Chromjakova (2018) an important part of the high productivity and impactiveness in organizations today is confronted with growing automation and digitization of production processes which is strongly connected with the ability of employees to be prepared to communicate with the newest digitized production technologies. The skills and abilities of employees to influence radically the productivity, performance, and value add of production flows is referred to as digital literacy. Digital literacy is defined as the competencies required for one to participate in a knowledge society using digital devices such as smartphones, tablets, laptops, and desktop PCs (Walton, 2016). Digital literacy enables businesspeople to supply digital artifacts as well as connect their ventures to digital platforms (Nambisan, 2017). Building on the three distinct elements of

digital technologies as defined by von Briel, Recker, and Davidsson, (2018) digital literacy according to the present study is in the context of telecommunication firms entails the ability to actively use digital artifacts (digital component, application, or media content that is part of a new product (or service) and offers a specific functionality or value to the end user, digital platforms (a shared, common set of services and architecture that serves to host complementary offerings, including digital artifacts and digital infrastructure.

It is also argued that digital skills and competence are important resources required for the innovation process (Renko, Carsrud, & Brännback, 2009). As described by Moorman and Slotegraaf (1999) digital capability as a firm's technological ability to formulate and develop new products and related processes. In the context of digital products, digital literacy could be described as "a firm's skill, talent, and expertise to manage digital technologies for new product development". Carcary, Doherty, and Conway, (2016) suggest that successful digital transformation requires an organization to develop several capabilities in many different areas and these capabilities may differ depending on the specific sector and the specific needs of the organization. Levallet and Chan (2018) identified two key digital capabilities: a well-developed information management capability and a flexible IT infrastructure but did not link them to innovation. Having discussed key variables that are important in any organization's efficiency, the study in the next section highlights the concept of operational efficiency and how it is affected by digitalization.

Telecommunication firms are aspiring to become digital lifestyle service providers by using their networks to play the key enabling role for this journey. They are increasingly gaining the consumer's wallet share by venturing into unconventional sectors for a telecom operator. According to Awadhi, Obeidat, and Alshurideh (2021) leading telecommunication firms tend to be large companies with extensive customer bases and therefore they have access to huge amounts of data. This presents a massive opportunity for firms in this sector to tap into the market for data insights. Indeed, the company need good-quality, big datasets to understand consumer behavior, identify trends, and predict future developments. What experts in the company demand forms a natural confluence with the data that telecoms can supply and hence a relationship is ready for the taking.

Additionally, a reputation for good customer service is something that generally eludes the telecoms industry. Instead of wasting time listening to 'hold' music on the phone, customers

want a fast and effective experience. In a study of customers in the telecommunication, 46% identified real-time assistance as a priority when choosing a provider (Dhir, Rajan, Ongsakul, Owusu, R& Ahmed, 2021). According to Kenney et al. (2019) argue that digitalization can create economic value through innovation and enables enhanced reverse logistics; and capturing product data used to generate operational efficiencies and maximize revenue opportunities

### **1.1.2 Operational efficiency**

Operational efficiency is primarily a metric that measures the efficiency of profit earned as a function of operating costs (Saghafian, Hopp, Van Oyen, Desmond, & Kronick, 2014). Indeed, the greater the operational efficiency, the more profitable a firm or investment is because the entity can generate greater income or returns for the same or lower cost than an alternative. Operational efficiency in the manufacturing sector continues to be a prominent issue among academics and industry players, but very little attention is paid to the service industry. An efficient telecommunication sector is an important solution to resolving the problems of unemployment and sustainable economic growth (Asaleye et al., 2018).

Drucker (1963) defines efficiency as “doing things right”. Several studies have emphasized the importance of operational efficiency as a factor of how to get things done. Eskandari (2007) opined that a company’s overall business process efficiency and performance are closely related. To survive and prosper, firms must produce their output from input efficiently. Gill et al (2014) observe that a firm’s performance can be measured by its financial and operational performance. However, an increasing debate has been placed on the concept of operational efficiency concerning increasing competition, business processes, and the emergence of new technological innovations (Bhagavathy, 2009). The improvement of operational efficiency has a direct impact on a firm’s profit margins and cost-efficiency. While previous studies have investigated the operational efficiency of telecommunication firms, in areas such as service delivery (Masson, Jain, Ganesh, & George, 2016; Hu et al, 2019), most of these early studies focused on global telecommunication firms (Lu & Hung, 2008). The observation is that operational performance of telecommunication firms changes when there is inefficiency on the part of technology.

To enhance operational efficiency and benefits, redesigning business processes is deemed to be beneficial as seen in the banking sector, with technological tools such as enterprise

resource planning (ERP) used to streamline business operations proving to be inevitable (Cenamor, Sjodin, & Parida, 2017). Studies have shown that ERP allows firms to sustain operational efficiencies in the long run as well as to attain both financial and non-financial benefits (Rosin, Proksch, Stubner, & Pinkwart, 2020). It has been argued that organizational change is constantly occurring in the form of new technology and new market conditions (Asaley et al., 2018). This therefore creates new problems that require organizations to be open and flexible to adapt to their environment.

It is vital to recognize that ensuring the principles targeted by operational efficiency are closely related to the establishment of organizational order. The networks required for this communication are provided by the innovations brought by digitalization. With changing technological infrastructure, operational efficiency is one of the key drivers for telecommunication companies. According to Ericsson's "Telecom IT for the digital economy" report; "efficiency will continue to be an important business driver. In the short to medium term, recent technological advances in the virtualization and automation domains will serve as low-hanging fruit providing enhanced internal operational efficiency" (Bjorkdahl, 2020). Therefore, it becomes critical to examine the link between digitalization and operational efficiency.

Most global organizations find it difficult to achieve operational efficiency without compromising on quality and customer experience. According to Luz Martín-Peña, Díaz-Garrido, and Sánchez-Lopez (2018) organizations seeking to accelerate their digital journey need to achieve time and cost-efficiency in their regular business operations so that they are a step closer to their transformation goals. The diverse digital transformation solutions and tools available to end-users mean organizations must make unique cases for how they intend to apply these solutions to improve operational efficiency, but a few important categorizations can be applied to develop functional strategies.

A significant number of organizations are using the internet to conduct their business activities. This adoption of digital technologies alters the way firms operate and interact with their environment. According to Del Giudice (2017), digitalization causes the emergence of new business models and may change the relationship between firms and their customers. Moreover, digitalization allows customers to have direct interaction with employees in the firm allowing exchange of information between them and this certainly

forces firms to always pay close attention to the digital reputation (Papa, Santoro, Tirabeni & Monge, 2018).

Most firms that invest in digital technologies tend to improve customer engagement which in turn improves their operational efficiency. Digitalization also offers productivity improvements, cost reductions, and innovations that influence performance within organizations (Hess et al., 2016). Several researchers from different disciplines have contributed to the evaluation of digitalization and its opportunities and challenges (Burton-Jones et al., 2020; Hai et al., 2021). In the current study, the researcher focuses on telecommunications in Kenya to understand how digitalization affects its operational efficiency.

### **1.1.3 Telecommunication in Kenya**

While the global market for telecommunication firms is expected to grow at an exponential rate, there have been increasing calls to continuously invest in new technologies to remain competitive (Kalam, 2020). To understand the Kenyan telecommunication market, this study examined effect of digitalization on operational efficiency. It becomes important to note that telecommunications firms in Kenya share information over long distances through technology. According to the Kenya Information and Communication Act (1998), Kenya Communication Amendment Act (2009) and Kenya Communication Regulation (2001) Telecom firms in Kenya are defined under Network Facilities Provider (NFP). This covers mobile network operators, internet service providers, application service providers and content service providers for purposes of providing communication services.

The Communications Authority of Kenya (CA) is responsible for the development and implementation of policies and strategies with respect to telecommunications services in Kenya. The Authority licenses telecommunications operators, service providers and monitors their performance on a continuous basis to ensure that they discharge the obligations as stipulated in their licenses. It also ensures adherence to laws concerning communication. Telecommunication is a key factor for the economic development of the country.

Today, Kenya hosts a changing ecosystem where numerous software applications, services, and even social habits emerged from the country's aptitude, and appetite, for mobile

transaction platforms. The era of industrialization and the information age has seen the telecommunication industry expand into diversified functions to support the growth of technological advancement for better services demanded by any nation (Sultana, Irum, Ahmed, & Mehmood, 2012).

This is the case for the telecommunication industry in the country, over time firms have ventured outside the scope of merely being enablers to being the drivers of change around technological adoption. Hence the importance of this industry to any country cannot be overemphasized. Telecommunication operators in both fast-growing and mature markets are under high pressure in today's business climate (Shahzad, Yaqub, Di Vaio, & Hassan, 2021). These changes create opportunities while making the industry more competitive.

Kenya's telecommunication sector market continues to grow at a considerable rate at a time the world is experiencing high connectivity, steep competition and rapid development in the mobile market. Currently there are four leading mobile operators in Kenya namely Safaricom Ltd (66%), Airtel Networks Kenya Ltd (26%), Telkom Kenya Ltd (7%) and Finserve Africa Ltd (2%) (Communication Authority, 2022). Regarding mobile subscription and profitability Safaricom Ltd is in the top position among the four operators. This study mainly focused on the top three mobile network operators namely Safaricom, Airtel and Telkom who are responsible for providing all the services related to telecommunications i.e voice, data, and SMS. The continued growth of the industry and its vital importance to Kenya's economic landscape necessitates to understand how efficient the industry's business operations are and how technological evolution through digitalization is impacting operational efficiency.

## **1.2 Problem Definition**

Kenya's telecommunication sector has grown tremendously since 2018 with latest data showing operators in Kenya making KES 291 billion in 2019, an increase of 7.5% from 2018 (KNBS, 2020). This has been primarily attributed to growth in the digital economy, mobile uptake, and internet penetration. Additionally, the government of Kenya has identified the telecommunication industry as an important sector that supports rapid economic growth and therefore this sector depends on technological advancements that are expected to transform firms in the telecommunication sector (Chesula & Kiriinya, 2018). The existing body of work has looked at the influence of competitiveness on performance

of telecommunication firms (Kyengo, Ombui & Iravo, 2016; Muthama, 2016; Ma, 2019). A more closely related study was conducted in Nairobi, Kenya by Nyakiongora (2018) who examined operational efficiency of telecommunication firms but from value chain management practice perspective.

Telecommunication firms like all firms in the age of industry 4.0 have sought business opportunities for profitability and growth through the digitization of business processes. However, the present researchers have not looked at operational efficiency but more at on corporate governance (Manita et al, 2020), and organizational performance (Chen, Jaw, & Wu, 2016; Zhai, Yang (Chan, 2021). Efficient integration can only be achieved through digital processes and collaborative tools (White, 2012). With this being the case, the importance of digitalization has increased. Research emphasizes that digitalization should be included in the existing business perspectives, as this topic addresses much more than just technological shifts (Bouncken et al., 2021). Generally, studies have examined the relationship between digital technologies and firm performance, and it is observed that the research does not offer clear evidence about the benefits of digitalization on operational efficiency (Kohtamaki et al., 2020). Some studies report a weak or nonexistent role (Lee et al., 2022; Liang et al., 2010).

There has been clear evidence of studies conducted on digitalization in Kenya, but the study observes knowledge gap on the effects of digitalization on operational efficiency. Prior studies had reported different outcomes in relation to the general organizational performance of telecommunication firms. Therefore, to bridge this research gap, this study examines the effects of digitalization on operational efficiency of telecommunication firms in Kenya.

### **1.3 Research Objectives**

#### **1.3.1 General Objective**

The main objective was to examine the effect of digitalization on the operational efficiency of telecommunication firms in Kenya.

#### **1.3.2 Specific Objectives**

- i. To examine the effect of digital literacy on the operational efficiency of telecommunication firms in Kenya.
- ii. To establish the effect of organizational digital capability on the operational

- efficiency of telecommunication firms in Kenya.
- iii. To find out the effect of digital investment on the operational efficiency of telecommunication firms in Kenya.

#### **1.4 Research Questions**

- i. To what extent does digital literacy affect the operational efficiency of telecommunication firms in Kenya?
- ii. How does organizational digital capability affect operational efficiency of telecommunication firms Kenya?
- iii. To what extent does digital investment affect operational efficiency of telecommunication firms in Kenya?

#### **1.5 Scope of the Study**

The study focused on the leading mobile telecommunication companies, mobile service providers in Kenya with the three main telecommunication firms: Safaricom Ltd, Airtel Networks Kenya Ltd, and Telkom Kenya Ltd serving as data sources. The study concentrated on digitalization and operational efficiency of the firms in the last five years. The firms have been chosen because cumulatively they control 99% of the voice, data and messaging market share as per the Communications Authority statistics (CA, 2021). This study used three theories (Diffusion of Innovation, Resource-based view Theory and Queueing Theory) in explaining the effect of digitalization on operational efficiency among firms in the telecommunication. Moreover, descriptive research design will be adopted by this study and the study covers a period of five years (2016 – 2021).

#### **1.6 Significance of the Study**

The main objective of this study was to examine whether there exists evidence on the effect of digitalization on the operational efficiency of telecommunication firms in Kenya. In addition, the study sought to fill the existing knowledge gap around the interconnectedness of digitalization and operational efficiency.

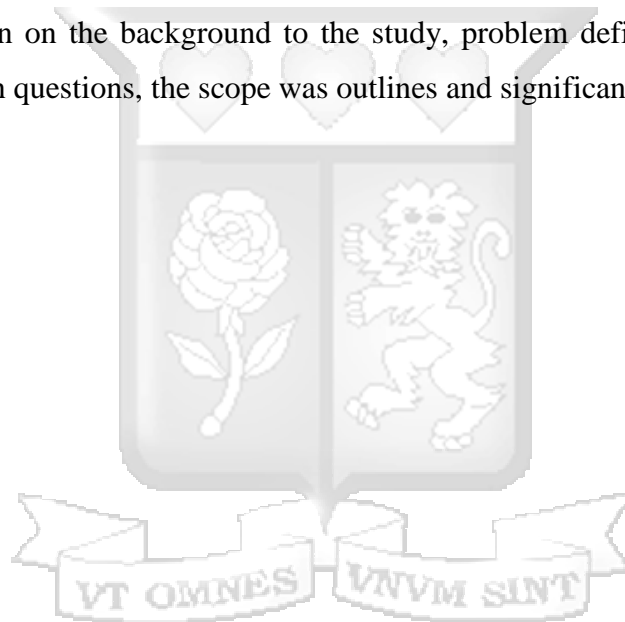
Stakeholders including the government and policy makers may use the information to identify the shortcomings within the sector and possible frameworks to deal with such shortcomings. The research findings shall also aid in the formulation of strategies that will see firms in the telecommunication sector leverage in IT to improve their business

operations. More so, the service providers need to appreciate the perceived weaknesses in the telecommunication sector and how it affects service delivery.

The researcher may need the study findings to stimulate further research in this area and as such form a basis of good background for further research. The study will thus contribute to the existing body of knowledge in the area of digital transformation and business operations in Kenya. Further, the study will enhance knowledge on linkages between digitalization and its impact on operational efficiency in Kenya.

### **1.7 Chapter Summary**

This chapter served as an introduction to the topic under study. In particular, the chapter provided discussion on the background to the study, problem definition, stated research objectives, research questions, the scope was outlines and significance of the study.



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents a review of previous studies related to digitalization and operational efficiency. Specifically, the chapter discusses the theoretical review, empirical review guided by the specific objectives, research gap and summary of literature. This section also discusses the theory on which the research is based.

#### **2.2 Theoretical Review**

To examine the effect of digitalization on operational efficiency among telecommunication firms in Kenya the study used the Diffusion of Innovation Theory, Resource Based Theory and Queuing Theory.

##### **2.2.1 Diffusion of Innovation theory**

In explaining how digitalization can affect operational efficiency, this study used diffusion of innovation theory developed by E.M Rogers in 1962 (Garcia-Aviles, 2020). Diffusion of Innovations theory consists of four main elements. Rogers defines the components of the theory as: “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995, p. 10). The basic tenet of the theory is that disseminations of information can lead to higher operational efficiency. Therefore, a member of any group can be assessed by how soon and how often they adopt newer ideas. The theory seeks to explain how over time an idea or product gains spread through a particular population. It is anticipated by adopting innovation it brings desirable consequences for the company. The diffusion of innovation theory helps understand the underlying process in which organizations follow in the adoption or non-adoption of digital technologies.

Lyytinen and Damsgaard (2001) conducted a critical study that focused on analysing aspects such as the nature of IT, the concept of diffusion arena, the analysis of pull and push forces within DoI research, the view of adopters as rational decision makers, and the presumption that innovating social system has no history, and no feedback. Their findings indicated that IT components should be understood as networked, malleable, and learning intensive artefacts, which are socially constructed. Moreover, the diffusion arenas were volatile, subject to political control and overlapped with several institutional regimes with different

interest and concerns. They concluded that the dynamics of constituting diffusion arenas deeply shape the direction and pace of diffusion process and recommended that diffusion researchers should trade generalizability against accuracy and simplicity in their theoretical accounts of IT diffusion, arguing that knowing better and deeper is more important than knowing broader. Lyytinen and Damsgaard (2001) concur that the diffusion of innovations theory draws upon other theories of organizational behaviour adopted from microeconomics, sociology, and communication theory.

While the theory helps us understand this area, several factors affect it, for example, knowledge of new technology is very important for one to use the technology and there is a likelihood that people may reject the innovation since they lack knowledge about it. Professionals in a number of disciplines including business management or marketing, have used this theory to increase the adoption of innovative products and practices. Clarke (1999) observes that this theory has potential application to information technology ideas, artefacts, and techniques, and has been used as the theoretical basis for a number of research projects on information systems. The end result of the diffusion is that people, as part of a social system, adopt a new idea, behavior, or product. Adoption means that the firm does something differently than what they had previously such using new systems to enhance operational performance. The key to adoption is that the person must perceive the idea, behavior, or product as new or innovative.

A consideration of the objectives of the study suggested a theoretical framework that has components of technological innovation, adoption, diffusion, and communication. Several theories were carefully examined in an attempt to find a theory that encompassed all the components. It has been used as the theoretical basis for a number of information systems projects (Minishi-Majanja & Kiplang'at, 2005; Scott, Plotnikoff, Karunamuni, Bize & Rodgers, 2008). Additionally, the theory has been widely applied to investigate diffusion of innovations in telecommunication sector (Tscherning, & Damsgaard, 2008). Therefore, the theory's application to information technology and telecommunication makes it appropriate as theoretical framework for this study because adoption of ICTs requires heavy investment, which may interpret to mean taking high risks.

Surry (1997) observes that this theory has been widely applied to instructional technology but points out that it is often criticized for being change-agent oriented because it emphasises

the change agent's role. According to the theory, there are individuals who are predisposed to being innovative, and these will adopt an innovation earlier than those who are less predisposed (Rogers, 1995). A support network of change agents would be created, or innovation attributes would be used in the creation of message content, or peer-to-peer communication would be encouraged, or message content would be tailored to a type of individual's readiness to change, or implementation support would be provided.

### **2.2.2 Resource-based view theory**

The resource-based view (RBV) was developed by Jay B. Barney in 1991 and argues that a firm's sustained competitive advantage is based on its valuable, rare, inimitable, and lack of substitutable resources (Hagen, et al, 2022). The capability of firms to create or acquire these resources affects their performance and competitiveness over their competitors. Valuable resources help a firm exploit opportunity and/or avoid threats in the environment and enable it to develop and/or implement strategies to improve its efficiency and effectiveness (Dubey, et al, 2019).

Resources and capabilities are considered valuable if they allow an organisation to both exploit opportunities and counter threats. Therefore, these resources should enable the organization to meet the factors critical to success in their business environment. Research has suggested that there is the potential for productivity improvements in the value chain when organizations are willing to make relation-specific investments and combine resources in unique ways (Dyer, 1996). Organizations that make relation-specific investments are able to combine resources in unique ways to generate relational rents and gain competitive advantage over organizations that are unable to do this. In an increasingly digital business environment, digital capability has re-emerged as an important mechanism through which Organizations can create pervasive digital connections among activities and entities within the value chain. Therefore, an organization's digital capability enables them to take advantage of emerging digital technologies and respond to the changing market demands.

According to Freeman, Dmytriyev, and Phillips, (2021) this theory has been extensively used within the ICT and IS literature to explain how firms are able to gain competitive advantage and superior performance. At the core of the theory is that superior firm performance is attributable to resources and skills that are firm-specific, rare, and difficult to imitate by rival firms (Taher, 2012). As a result, firms can achieve competitive advantage

by acquiring or developing organizational capabilities that are rare, non-substitutable, and not subject to imitation (Ibid). Furthermore, the theory assumes that skills, capabilities, and other resources that organizations possess differ among organizations and such resources are the primary determinants of firm performance. Therefore, firms that are able to identify the characteristics of resources or capabilities that are not subject to imitation by competitors will attain sustainable competitive advantage (Freeman, Dmytriyev, & Phillips, 2021). Indeed, scholars have noted the importance of technological capability as a key organizational capability and consistent with the view of RBV, found that an technological capability that shares the characteristics of rarity, non-substitutability and non-replicability can foster superior firm performance (Chen et al., 2014).

This theory has been used in the study to help explain how telecommunication firms can utilize digitalization to enhance services. According to Xu et al. (2014) advocated the need for firms to exploit not only their internal resource capabilities, but also the external resources via tighter integration with suppliers and customers to gain maximum competitive advantage given today's highly interconnected business environment. Therefore, Barratt and Oke (2007) demonstrated how collaborative activities may facilitate visibility and information flow between two partners. Such visibility could be acquired through the attempt of focal organization to gain most up-to-date information regarding customer preferences for production planning and forecasting purposes (Vanpoucke et al., 2017).

### **2.2.3 Queuing theory**

Queuing theory first introduced in the early 20th century by Danish mathematician and engineer Agner Krarup Erlang. Queueing theory techniques enable us to measure operational efficiency of the studied queueing system, as well as the level-of-service offered to the clients. By changing the number of servers in the queueing system we study the sensitivity of the service facility useless time, the sensitivity of the queue length and the average waiting time, as the number of servers increases. Queues can be applied at different levels in telecommunication systems; they can be adopted to study the waiting time experienced by a given request instanced to a processor or the time spent by a message or a packet waiting to be transmitted on a given link or through a whole network. In particular, every protocol in every node of a telecommunication network can be modelled through an

appropriate queuing process.

Queuing theory as an operations management technique is commonly used to determine and streamline staffing needs, scheduling, and inventory in order to improve overall customer service. It is often used by Six Sigma practitioners to improve processes. This theory was used to analyze a variety of possible emergency responses to an airborne bioterrorism attack in a public place and the model pointed to specific actions that could be taken to reduce the wait time for emergency care, thus decreasing the potential number of deaths (Wein, Craft, & Kaplan, 2003).

### **2.3 Empirical Review**

Although it is critical to figure out the operational efficiency outcomes of digitalization, little academic work on this topic has been done (Rosin, Proksch, Stubner, & Pinkwart, 2020). One possible explanation is that varying consequences of digitalization have distracted scholars. The process-related intermediate results (such as user base growth and customer satisfaction) gain much attention. For example, when examining the effect of digitalization on the Spanish automobile manufacturing industry, Llopis-Albert, Rubio, and Valero (2021) focused on the satisfaction of stakeholders. Although process-related metrics are crucial, the goal of digitalization should be better economic outcomes, such as operating costs or net profit margins. Digitalization is measured in terms of digital connectivity, uses of the internet, e-business, e-commerce, and e-government. According to a study by Linde, Sjodin, Parida, and Gebauer (2020) most companies spend more than USD 1 million per year on digitalization projects, not including the hidden costs. This paper makes a thorough analysis of the benefits and costs of digitalization, and then explores its impact on firm performance. firm performance into the operating performance and the financial performance.

In another study, Liu, Han, Li, Gupta, and Sivarajah (2022) examined how leveraging customer engagement can improve the operational efficiency of social commerce startups. The authors used data set collected from 71 weeks in a social commerce start-up in China. They found that social media data increases demand forecasting accuracy and reduces operational costs in inventory management. Elsewhere, Chauhan, Akhtar, and Gupta (2022) conducted a study to show digital banking's influence on customers' evaluation of service experience. They found that the use of "gamification" in technology-driven banking

services enhances customer engagement. Moreover, Kim, Ko, Kim, and Jiang (2021) in their study report that digital service innovation helps improve customer engagement, which also leads to customer equity.

Lin and Lv (2019) used case studies to show that because digital technology presents all aspects of enterprise production, sales, and consumption in the digital form, transparent information results in personalized, customized, and experiential service consumption. A study by Golzer and Fritzsche (2017) showed that digital technology can be used precisely in business processes. Because the intelligent decision-making system and control system improve the operation and management efficiency of enterprises, their production performance is improved. Li's (2020) research revealed that digital technology can actively drive the intelligent transformation of enterprise products and services and the creation of new marketing operations, which, consequently, can help improve enterprise market share and performance. Vial (2019) revealed that digital technology can actively promote organizational change in enterprises and enhance enterprise operation performance through value creation. A study by Srinivasan and Venkatraman (2018) showed that enterprises connect producers, service providers, traders, and consumers through digital platforms, creating a new community market and promoting the digital transformation of the enterprise business model. Kong et al. (2018) studied the effect of Google's withdrawal from the Chinese search service market on the innovation of Chinese companies that rely on foreign technology; they discovered that the availability of information is a decisive factor for corporate innovation.

### **2.3.1 Digital Literacy and the Operational Efficiency of Firms**

Digital literacy means having the skills to thrive in a society where communication and access to information are increasingly done via digital technologies, such as online platforms and mobile devices. In her seminal work, Bruce (1999) presented different faces of information literacy, which emphasized the capacity to utilize information to engage with professional responsibilities in diverse ways rather than specific skills. Bruce (1999) also proposed information literacy as a characteristic of a learning organization, and therefore, underlined the importance of organizational support to develop employees' information literacy. In line with Bruce's work, Lloyd's recent research has also conceptualized information literacy as more than an individual's information handling skills. According to Lloyd and Williamson (2008), information literacy is experienced differently in work settings. Information skills learned during school or university education may not be

transferable to the work context (Forster, 2017).

The performance of work activities requires employees to engage with information in diverse ways, which means the employees' capability to understand the setting and its commonly accepted practices must be developed and nourished (Lloyd, 2017). According to Somerville and Bruce (2017), information literacy is a component of an organization's informed learning system, which allows individuals to use the information to learn within the workplace ecosystem. Such a learning system can work only if employees can know their information environment, social practices, and goals (Lupton, 2008).

The findings of a study by Kulathunga, Ye, Sharma, and Weerathunga, (2020) and Mabula, and Ping, (2018) show that technological literacy has a positive impact on the performance of SMEs. In addition, Omiunu's research (2019) shows the effect of ICT literacy on SME performance. When someone has ICT literacy, he or she can develop various related skills in optimizing the use of ICT including skills in understanding, using, modifying, and creating SME content and services. The results of this study are expected to provide information to SMEs, the government, and universities regarding the importance of ICT adoption and literacy on SMEs' performance.

Bawden (2008) recognized that the traditional concept is an essential aspect of the broad notion of digital literacy that is still valid, but it is generally defined which put specific emphasis on technological aspects and skills that are restrictive and arguably influenced by the technologies of that time. Glister (1997) explicitly stated that digital literacy is about mastering ideas (critical thinking), not keystrokes (using a computer), which distinguishes his viewpoint from the traditional concept that focuses on technical skills to a much broader prospect. Bawden (2008) strongly acclaimed Glister's viewpoint of digital literacy and determined it to be a broadly defined concept that prioritizes not only the technical skills but also cognitive and critical thinking skills, which are essential in the digital age. However, Glister's view remained as a concept and eventually failed to provide a comprehensive notion of digital literacy that outlines the complete set of skills, competencies, and attitudes that are required in today's digital information age (Bawden, 2008).

The notion of digital literacy has undergone quite a dramatic change. In the past, most frameworks focused on the technical aspects of operating in digital environments,

developing skills and abilities to use a specific set of tools or applications (Ferrari, 2012). The concept has since gradually become embedded into a much broader domain that goes beyond the narrow view of the technical aspects and focuses onto the context of cognitive and socio-emotional aspects of work using digital technologies (Eshet-Alkalai, 2004; Eshet-Alkalai & Chajut, 2009). Due to the various notions and viewpoints of the digital literacy concept, there is inconsistency in understanding the term that has been creating confusion. Lankshear and Knobel (2008) stressed that the term digital literacy is rather a broad concept, which should encompass several different concepts related to digital literacy and can be significantly seen through diverse scenarios. Thus, the term 'digital literacy' should be referred in its plurality form as 'digital literacies,' which would benefit in understanding the term much clearly.

Lankshear & Knobel (2008) formulated digital literacy as a social practice that 'involves the use of digital technologies for encoding and accessing texts by which we generate, communicate and negotiate meanings in socially recognizable ways.' It is clear from this that a digitally literate person has an ability to participate in a socially organized practice that involves meaning making through digital technologies and media (Rantala, 2010). In addition, Ferrari (2012) supported this view by stating that the literacy need of today's society includes decoding and encoding digital texts. Lankshear & Knobel (2008) produced evidence by conducting studies on a variety of social practices on the Internet and concluded that people's relationship with media in the digital age is tied to social and cultural contexts. Therefore, it has become essential to understand literacy going beyond the individual skill-based literacy, and approach it as a constellation of social practices.

Eshet-Alkalai (2004) emphasized that digital literacy is the survival skill in the digital age that constitutes a system of skills and strategies applied by the users to improve performance and solve problems within the digital environments. The author observed that digital literacy involves more than just the technical ability to use software or operate a digital device. It includes a slightly wide range of complex cognitive, sociological, and emotional skills that users need to employ in digital information environments for being functional (Eshet-Alkalai, & Chajut, 2009).

### **2.3.2 Digital Capability and the Operational Efficiency of Firms**

Digital capabilities can be described as a rich set of behaviors, attitudes and practices. They

are transferable skills that enable the users to participate confidently and responsibly in the digital sphere while technologies change over time and across spheres. Although the literature on organizational digital capability that links to innovation in an emerging digital technology context is still scarce, the positive effect of technological capability on innovation has received widespread support (Zawislak & Alves, 2013; Zhou & Wu, 2010). As a technological capability in the digital context, digital capability is an important requirement to achieve digital innovation because the success of digital product development is highly dependent on how well a firm could manage digital technologies. Every step involved in digital innovation from acquiring the digital technology, and developing new digital solutions needs an optimal level of capabilities by talented professionals.

In digital technology context, some mixed findings could be observed. Westerman et al. (2011) found that profitability and revenue generation are higher for firms with above average digital innovation values. Similarly, Weill and Woerner (2015) report an increase in revenue growth and profit margins for companies that are embracing digital technology and operating within the digital ecosystem. Therefore, research findings of digital innovation–performance link are contradictory and probably, context-dependent. On the other hand, Chae, Koh, and Prybutok, (2014) found no relationship between IT capability and organizational performance. Their study called for future researchers to identify and incorporate other variables that potentially affect the relationship between IT capability and business performance. In response to this call, we contend that innovation could be the factor that may affect the relationship between a firm’s digital capability and business performance because the link between digital capability and organizational performance has not been established yet, particularly in the context of IT firms.

Besides the importance of orientation toward digital technology adoption, a firm also needs to have the capability to manage and make the best use of digital technology in the innovation process because capability expedites innovation process by integrating and mobilizing both human and technological strengths and resources. A study by Liu et al. (2011) states that managing digital transformation can be challenging, but preparedness for resources and digital capability are necessary.

Teece (2013) contends that the dynamic capability approach provides organizations with a

coherent framework for developing and managing capabilities in a way that will build competitive advantage. Indeed, digital innovation and digital capability are necessary to integrate digital technologies with the digital talent of professionals. Drawing on dynamic capability theory, digital capability could be considered dynamic capability, described as an organization's ability to create new products and processes, and respond to changing market circumstances (Khin, & Ho, 2018). Moreover, digital capability complements the digital orientation of a firm because only the firms with skill to manage new technologies will adopt the technologies and are able to commit toward converting the technologies into new products. In addition, digitally capable firms also need to have commitment and readiness toward embracing new technology to develop new products that bring competitive advantage. Hence, we contend that digital capability and digital orientation are compatible and complement each other in achieving product innovation because innovation is proven to be triggered by technology orientation and enabled by technological capability (Renko et al., 2009).

Khin, and Ho, (2018) investigated the relationship between digital technology, digital capability, and organizational performance. They used data from 105 small to medium-sized IT firms in Malaysia and utilized structural equation model (SEM) analysis from partial least square (PLS) approach. They found that digital capability has a positive impact on digital innovation and that digital innovation mediates the effect of technology orientation and digital capability on financial and non-financial performance. What this means for firms in telecommunication industry is that they should take the opportunity of emerging digital technologies and digitalization trend by being committed toward embracing new digital technologies and upgrading their digital capabilities to become innovation leaders and to boost firms' performance. Every organization that has an Internet connection has an inherent digital capability. There is however a huge variation in the ways that organizations use this capability. Organizations that understand this opportunity and learn to measure and improve their own digital capability are likely to find themselves in a better position to compete in the digital economy. However, many organizations need help to gain a more comprehensive understanding at decision-making level of what digital capability is and how it can add value to their business. A dedicated process for measuring an organization's digital capability is therefore essential.

Ramantoko, Fatimah, Platini, and Kinasih (2018) , measured digital capability maturity of

Small-Medium Kampong-Digital Companies in Indonesia and they used quantitative research and exploratory research design. Their study shows overall digital capability maturity index for Kampong Digital Suci, Rahayu, and Binong are 2.62, 3, and 2.36 from the maximum scale of 4 respectively. This suggests that the constructed model of measurement may be overwhelming for the type of companies under investigation.

Research by Henfridsson et al. (2014) highlights how the unique properties of digital technology enable new types of innovation processes that are distinctively different from the analog innovation processes of the industrial era. However, their study focuses on digital technology of digitalized physical products, but not the mainstream IT products. Merely scant literature is available on conceptualizations of digital innovation, its driving factors and outcomes. A qualitative study of respondents from eight sectors in Germany by Eidhoff et al. (2016) indicate that the most critical factors for a company's decision to pursue digital product innovation can be found in the technological and environmental dimensions. In view of limited literature on digital innovation, there is a need for empirical evidence of driving factors in digital innovation in the IT industry context.

### **2.3.3 Digital Investment and the Operational Efficiency of Firms**

Digital investment is a measure of a firm's strategic technology investments for exploring how emerging digital technologies could potentially differentiate the business transactions and operations (Nwankpa, & Datta, 2017). Similarly, the World Economic Forum (2019) defines digital investment as investment in digital technologies such as robotics, the internet of things, big data analytics, artificial intelligence, and social media applications. A firm's digital investment relative to the digital investment of its industry peers determines the digital strategic posture and digital strategy of the firm (Mithas, Tafti & Mitchell, 2013).

With the pace of change accelerating, firms are faced with the obvious choice of embracing digital technologies while remaining agile and open to experiments and innovation. Anecdotal evidence suggests that digital investment can offer new ways for companies to grow and be more competitive. Investments in digital technologies can reshape existing customers' value proposition and business operations resulting in greater integration and collaboration among a firm's value chain partners (Westerman, Bonnet, & McAfee, 2014). In their study, Westerman, Bonnet, & McAfee found that managers in all industries are using digital advances such as analytics, mobility, social media and smart embedded devices

as well as improving their use of traditional technologies such as ERP to change customer relationships, internal processes and value.

Xu, Zhong, and Cao (2022) examined whether digital investment affects carbon efficiency in China. They found that ICT capital improves the local carbon emission efficiency, and it has spatial spillovers to the surrounding areas and has the most prominent impact on the carbon emission efficiency of the central region. Furthermore, the findings show that ICT capital improves carbon emission efficiency by promoting technological innovation, alleviating industrial structure distortions, enhancing resource allocation efficiency, and accelerating human capital accumulation. The implications of the study findings are that it has important policy guiding significance for the region to stimulate the potential of ICT capital and facilitate the transformation of performance in most firms. Elsewhere, Riera, and Iijima (2018) carried out a study to examine whether investment in digital technologies yield digital business value in Japan. Using dataset from Small and Medium Enterprises awarded by The Ministry of Economy, Trade and Industry “METI”, found that firms with higher knowledge creation capabilities gained higher benefits from investment in digital technologies as the investment increased and vice versa.

Investments in digital technologies increase the complexity, turbulence, and dynamism in the competitive landscape (Nan, & Tanriverdi, 2017). Prior studies show that embedding digital investments into an organization’s core operations and business processes presents major challenges even for firms that have a strong track record of prior transformation and implementation. Although both researchers and practitioners argue that investments in digital technologies should be a strategic imperative for companies seeking to remain competitive, research on how firms can enable or shape these investments and the underlying apparatus through which digital investment can drive IT innovation remains unresolved and equivocal. Directly to this point, companies such as Amazon have transformed the entire business landscape and industry by introducing innovative digitally enabled processes and business models, while firms such as General Electric have emerged as a cautionary tale of digital investment.

Examination of the factors driving digital investment and the conditions through which IT innovation is attained remains an important phenomenon of interest for various reasons. First, recent years have seen organizations across industries engage in record investments

in digital technologies in a bid to gain a competitive advantage and improve performance. Nevertheless, anecdotal evidence reveals that after investing in these digital technologies many firms continue to struggle to realize the innovative outcomes these digital investments were expected to deliver (Davenport, & Westerman, 2018). Indeed, extant literature has not thoroughly scrutinized digital investment and the organizational conditions that foster digital investment initiatives (Vial, 2019; Yoo, Boland, Lyytinen, & Majchrzak, 2012). As a result, there is a need to empirically investigate the direct relationship between digital investment and operational efficiency of firms.

Sriram and Stump (2004) found evidence of the improved effect of quality programs after IT investments. Chan, Churchill, and Chiu, (2017) state that digitalization can act as an enabler of organizational memory in databases, increasing companies' learning capabilities. Another good example is the use of business intelligence (BI) programs, which store and process information for managers to improve their decisions in terms of both speed and accuracy. A study by Leidner and Elam (1995) suggests that the use of BIs is positively related to the problem-solving speed of managers. Real et al. (2006) find support for their hypothesis, stating that "Information technology has a positive influence on organizational learning as a knowledge creation process" – albeit that they do not differentiate in their research how IT helps this process. However, Johannessen et al. (2001) warns that investing in information technologies easily leads to focus on explicit knowledge and demotion of tacit knowledge, as tacit knowledge is not easily transferred to digital form. This could hinder the competitiveness of the organization, so an emphasis on tacit knowledge while adding digital assets is suggested.

Most global organizations find it difficult to achieve operational efficiency without compromising on quality and customer experience. According to Luz Martín-Peña, Díaz-Garrido and Sanchez-Lopez (2018) organizations seeking to accelerate their digital journey need to achieve time and cost efficiency in their regular business operations so that they are a step closer to their transformation goals.

The diverse digital transformation solutions and tools available to end-users mean organizations must make unique cases for how they intend to apply these solutions to improve operational efficiency, but a few important categorizations can be applied to

develop functional strategies.

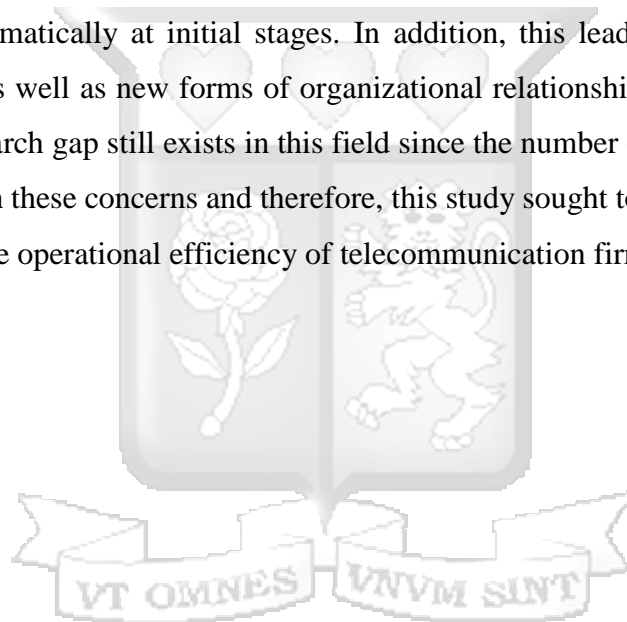
A significant number of organizations are using the internet to conduct their business activities, this adoption of digital technologies alters the way firms operate and interact with their environment. According to Del Giudice (2017), digitalization causes the emergence of new business models and may change the relationship between firms and their customers. Moreover, digitalization allows customers to have direct interaction with employees in the firm allowing exchange of information between them and this certainly forces firms to always pay close attention to the digital reputation (Papa, Santoro, Tirabeni & Monge, 2018). Most firms which invest in digital technologies tend to improve customer engagement which in turn improves their operational efficiency. Digitalization also offers productivity improvements, cost reductions and innovations which influence performance within organizations (Hess et al., 2016). Several researchers from different disciplines have contributed to the evaluation of digital transformation and its opportunities and challenges (Burton-Jones et al., 2020; Hai et al., 2021).

#### **2.4 Research Gap**

This study examines the effect of digitalization on operational efficiency. Several authors posit that advancing digitalization incentives can enhance service quality and foster development of more cost-efficient firm's operations. They argue that firms are increasingly adapting digital a system to support services. Moreover, they measured the effect of digitalization in terms of service quality, revenue growth or profit margin. However, although the authors have sufficient evidence of positive effect of digitalization on organizational performance, there is no support of operational efficiency. The lack of evidence to establish a positive relationship between digitalization and operational efficiency is due to the limitations of the studies to explain their mechanisms. Some authors reported that firms began to optimize and improve their processes' efficiency through digital tools to ensure business continuity giving rise to digital capabilities, but the current study found no consensus in literature on the relationship between digital capabilities and firm performance.

Further literature indicate that digitalization has changed the way businesses are conducted mainly through applications such as the internet and nowadays, organizations are constantly under pressure to use digital technologies and adapt their business models to this new reality.

However, although going digital evokes many benefits, it also requires investments and associated costs. Considering the notable progress of digital technologies, the question is how digitalization is being employed by practitioners and to what extent this progress is being followed by scholars and academics. Therefore, a research gap remains on how many telecommunications firms especially in Kenya can leverage digitalization to enhance operational efficiency. Given the increasing interest of scholars and practitioners in the topic of digitalization and the scant attention paid to the contribution of digitalization to firms, this study examines the effect of digitalization on operational efficiency. From literature reviewed, there is limited scholarly work done on digitalization especially among telecommunication firms in Kenya. Available studies have shown that digitalization has put pressure on the organization to reflect on their current strategy and explore new business opportunities systematically at initial stages. In addition, this leads to new product and service offerings as well as new forms of organizational relationships with customers and employees. A research gap still exists in this field since the number of empirical insights is limited related with these concerns and therefore, this study sought to examine the effect of digitalization on the operational efficiency of telecommunication firms in Kenya.



**Table 2.1 Summary of Knowledge Gaps**

<b>Study</b>	<b>Focus of Study</b>	<b>Findings</b>	<b>Research Gap</b>	<b>Focus of Current Study</b>
Rosin, Proksch, Stubner, & Pinkwart, 2020	Digital new ventures: Assessing the benefits of digitalization in entrepreneurship	Digitalization in new ventures leads to indirect savings through increased operational efficiency. It also leads to considerably greater market flexibility	Focus of the study was on entrepreneurship	The study will focus on telecommunication companies
Llopis-Albert, Rubio, and Valero (2021)	Effect of digital transformation on the automotive industry	Small and medium-sized enterprises lack digital transformation strategies, which may have a dramatic impact in the long term in Spain.	It focused on automotive sector in Spain	Focuses on telecommunications sector in Kenya
Duman, and Akdemir (2021)	A study to determine the impacts of industry 4.0 technology components on organizational performance	The transformation driven by Industry 4.0 technologies elevates the profitability and sales of companies	Focused on organizational performance in Turkey	The study will focus on telecommunication companies
Liu, Han, Li, Gupta and Sivarajah (2022)	Leveraging customer engagement to improve the operational efficiency of social commerce start-ups.	The study found that social media data increases demand forecasting accuracy and reduces operational costs in inventory management.	Their study focused on start-ups	This study will focus on established telecommunication companies
Chae, Koh, and Prybutok, (2014)	Information technology capability and firm performance:	Found no relationship between IT capability and organizational performance	Reviewed previous studies	Uses survey data

	contradictory findings and their possible causes			
Chan, Churchill, and Chiu, (2017)	Digital literacy learning in higher education through digital storytelling approach	Digitalization can act as an enabler of organizational memory in databases, increasing companies' learning capabilities	It focused on higher education institutions	Focus on operational efficiency of telecommunication firms in Kenya
Westerman, Bonnet, & McAfee, 2014	The nine elements of digital transformation.	Managers in all industries are using digital advances such as analytics, mobility, social media, and smart embedded devices as well as improving their use of traditional technologies such as ERP to change customer relationships, internal processes and value	Sampled senior managers	Sample all employees in various employment cadres

Source: Researcher (2023)

## 2.5 Conceptual Framework

### Independent variable

#### Digitalization

##### Digital literacy:

- Communication and social connection
- Storage and retrieval
- Training
- Digital sources

##### Organizational digital capability:

- Digital devices
- Digital transformation
- Level of awareness

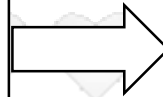
##### Digital investment:

- Digital strategy
- Organizational culture
- Business intelligence
- Financial element

### Dependent variable

#### Operational Efficiency:

- Customer satisfaction
- Quality service delivery
- Appropriate prioritization
- Product information



Source: Researcher (2023)

Figure 2.1 Conceptual Framework

Figure 1 illustrates the relationship between different variables in a fit to explain effect of digitalization on operational efficiency. This study seeks to test cause-and-impact relationship and digital literacy, organizational digital capability and digital investment are the independent variables which can generate some impacts on the dependent variable, operational efficiency. For instance, the firm can invest in the digital skills of its employees which then empower them to tackle organization operations, collaboration, and communication, allowing them to overcome the current challenges they face.

## 2.6 Operationalization of Study Variables

Operationalization is an important step in developing a methodologically wide-ranging study design. In order to operationalize a variable under this study, the researcher will begin with a concept and conceptualization of the topic that is clearly defined and outlined by a theoretical foundation.

A five-point Likert scale (1 = strongly disagree to 5 = strongly agree) will be used to measure the variables. Column 1 presents the variables, both independent and dependent defining them and providing the measurements details.

**Table 2.2 Operationalization of Study Variables**

Variable	Constructs	Operational Definition	Measurement Scales	Source(s)
Independent variable (Digitalization)	Digital literacy	Is an individual's ability to find, evaluate, and clearly communicate information through typing and other media on various digital platforms	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Douven, (2018)
		Training users to adapt to new technologies in the organization	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Gómez-Trigueros, Ruiz-Banuls, & Ortega-Sánchez, (2019).
		Ability to use new information from multiple digital sources presented in computer	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Bawden, D. (2008).
	Digital capability	Refers to the skills in ICT proficiency and attitudes that individuals and companies need if they are to thrive in today's world	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Douven, (2018)

		Allows companies to access and manage terabytes of data over the Internet through third-party service providers without incurring large up-front capital investments into their own on-premises IT server infrastructure	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Peppard, (2017).
		Describes a process that makes work processes more transparent, make it easier to track the real-time progress and reduce the incentives to shirk in the organization		Peppard, (2017).
	Digital investment	Is the process of acquisition of digital products and services.	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Douven, (2018)
		Measures the financial resources required to acquire digital tools to support operational work in an organization	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Iannarone, (2018).
Dependent variable (Operational Efficiency)	Customer satisfaction	The measurement used to determine how happy customers are with a firm's products, services, and capabilities	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Alexandrov, (2010)
		Used to measure consumers use of multiple types of	1=Strongly disagree 2= Disagree	Tse & Wilton (1988)

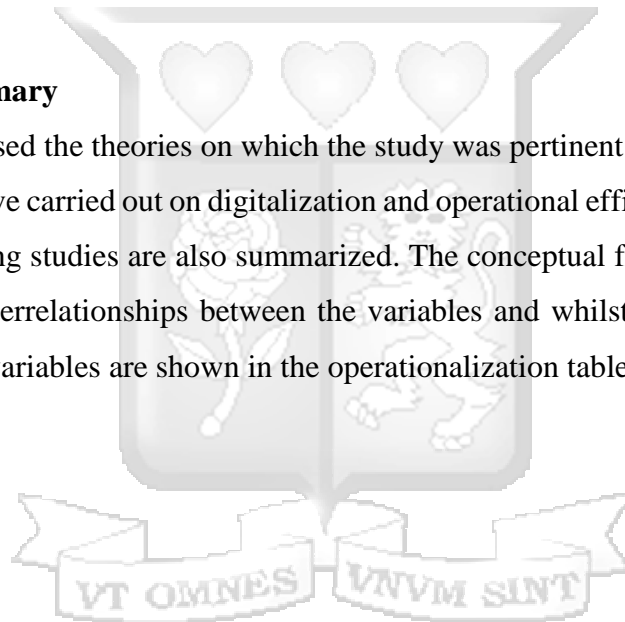
		expectation in their satisfaction evaluation process	3= Neutral 4= Agree 5= Strongly agree	
		Measurement of perceived performance or outcome against customer expectations.	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Kotler, (2017)
Quality service delivery		Is measured by reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding or knowing the customer and tangibles	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Zeithaml, Parasuraman & Bery, (1980)
		Measurement of subjective aspects on the conformity of the expected benefit with the perceived result	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Lewis, R.C. and Booms, B.H., (1983)
		Is the potential for worker's qualifications, quickness of service and customer satisfaction	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Parasuraman, Valarie Zeithaml and Berry (1985)
Appropriate prioritization		Is the act of putting tasks, problems, etc. in order of importance, so that you can deal with the most important first	1=Strongly disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly agree	Alexandrov, (2010)
Product information		Is the importance of the available information about a product characteristic in	1=Strongly disagree 2= Disagree 3= Neutral	(Lin, &Cheng, 2017)

		<p>helping customer evaluate the product. Appropriate information is the key to consumer's consumption in e-stores, that is why a vital question for companies is how information about products and services is presented to consumers on the Internet</p>	<p>4= Agree 5= Strongly agree</p>	
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**Source: Researcher (2023)**

### 2.7 Chapter Summary

The chapter discussed the theories on which the study was pertinent to as well as empirical studies scholars have carried out on digitalization and operational efficiency. The study gaps arising from existing studies are also summarized. The conceptual framework was derived by showing the interrelationships between the variables and whilst the measurement and description of the variables are shown in the operationalization table.



## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter discusses the research methodology adopted by the study and, it looks at research design, research philosophy, population of the study and Sampling technique. The chapter also discuss data collection methods, data analysis, research quality, ethical considerations, and chapter summary.

#### **3.2 Research Philosophy**

Research process involves determining its philosophical stance using a research paradigm. This study uses positivism which is associated with quantitative research and is considered a form of empiricism as first labelled by Augustine Comte in 19th Century. According to Philips and Burbules (2000), empiricism is one of the two forms of foundationalists that believe that knowledge can be objective and free from bias, values and researcher's beliefs. Additionally, Bryman (2008) states that positivism/empiricism is characterized by phenomenalism, deduction, objectivity and inductivism while Voyer et al (2014) emphasizes that the society and the people are often investigated using empirical observation/research.

This philosophy has been adopted in this study because it can integrate more than one research approaches and research strategies (quantitative approach). Many scholars supported quantitative research methods as a way of enhancing the understanding of a very complex social world that confronts positivism researchers (Bloomfield, & Fisher, 2019).

#### **3.3 The Research Design**

This study used descriptive research design. This research design is the most useful for describing phenomena or events about which little is known or for identifying innovative and emerging phenomena (Bloomfield, & Fisher, 2019). Moreover, the results of descriptive studies are usually used as the basis for further research. Therefore, descriptive studies must be well designed and implemented. Limitations of these designs include the lack of generalizability of the data and the potential for multiple interpretations of the data. A descriptive study may be concerned with the attitude or views towards anything such as attitudes, presidential form of government, right to strike, capital punishment, prohibition, and college autonomy among others.

### **3.4 Population**

Population can be defined as all people or items that one wishes to understand while sampling is the process of selecting a segment of the population for investigation. The population for a study includes individuals, dyads, groups, organizations, or other entities one seeks to understand and to whom or to which the study results may be generalized or transferred and is the principal group about which the research is concerned (Berndt, 2020). Populations create boundaries for the scope of a study and provide environmental and context cues for the reader. Such boundaries place natural delimitations upon the research to afford the researcher the proper focus so as not to present a one-size-fits-all set of results. Additionally, the definition of boundaries allows the researcher to clearly identify subpopulations, such as the target population, sampling frame, and sample, and to ensure alignment between these groups within the research (Casteel & Bridier, 2021). In this case, the target population is the specific, conceptually bounded group of potential participants to whom the researcher accessed that represented the nature of the population of interest (Ibid).

According to CA (2020) the telecommunication sector in Kenya is categorized into International Gateway Operators, Satellite Landing Rights Authorization, Submarine Cable Landing Rights Operators, Network Facilities Providers Tier 1, Network Facilities Providers Tier 2, and Network Facilities Providers Tier 3. In Kenya, there are three main mobile providers with the highest market shares in terms of mobile money transfer, domestic mobile voice and SMS Traffic: Airtel Networks Kenya Limited (32%), Safaricom Limited (66%) and Telkom Kenya Limited (2%) (CA, 2022).

The population for this study is employees aged 18 years and above serving in different employment cadres at Safaricom Ltd, Airtel Networks Kenya Ltd, and Telkom Kenya Ltd. The mobile network providers, in particular those in tier 2 shares similar characteristics allowing the researcher to create boundaries for the scope of a study and provide environmental and context cues for the audience. For example, the firms were selected because they share similar characteristics such as digital communication, simultaneous transmission, data encryption, transmission reliability and cell size. The list of employees in various categories in the selected firms were obtained from their respective human resource departments and therefore, the assumption is that the information provided was accurate and formed the target population.

**Table 3.1 Population**

<b>Description</b>	<b>Safaricom</b>	<b>Airtel</b>	<b>Telkom</b>	<b>Total</b>
Corporate affairs	34	26	19	79
Consumer business unit	24	17	12	53
Strategy and innovation	10	8	5	23
Technical & IT	6	4	3	13
Customer operations	42	37	33	112
Total	116	92	72	280
Percentage	41%	33%	26%	100%

**Source: Human Resource Databases, 2023**

### **3.5 Sampling Technique**

According to Krishnaswami and Satyaprasad (2010), sampling seeks to make an inference about an unknown parameter from a measurable sample static and to test a statistical hypothesis relating to population. Therefore, the researcher chose the sample using purposive sampling technique.

Purposive sampling was used in selecting the three main firms and the departments. The reason for adopting this sampling technique is based on the assumption that, given the aims and objectives of the study, specific kinds of people working in these selected organization may hold different and important views about the ideas and issues at question (Robinson, 2014). In addition, once the researcher had purposively selected the firms, the next step was to identify employees who would participate in the study and hence stratified random sampling technique was used. Zehnalova and Kubatova (2019) argue that researchers use stratified sampling technique to select particular kinds or groups of participants that need to be part of the final sample. Therefore, employees were them stratified by the characteristic of the participant or group, with a specific number allocated to each stratification. The categories utilized include departments, years of service, gender and location/branch.

Yamane (1967) provides a simplified formula to calculate sample sizes. This formula was used to calculate the sample sizes in Tables 3.2 and is shown below. A 95% confidence level and  $P = 0.05$  and the formula is  $n = N/1+N(e)^2$ . Because of the nature of the study, the researcher will select a sample of 165 respondents drawn from employees in various

departments and sections.

where:

n= sample size

N= Population

e= Level of precision

$$n = N/1+N(e)^2$$

$$n=280 / 1+280(0.05)^2$$

$$n=280 / 1+280 (0.0025)$$

$$n=164.705 (n=165)$$

The study selected a sample (n) of 165 respondents across the identified departments/units. Stratified sampling was used to select employees working in the five sections/departments. The target population's elements were divided into distinct groups or strata wherein each stratum the elements are similar to each other with respect to select characteristics of importance to the survey (Parsons, 2014). For example, the study identified employees based on their professional work in a specific department. This sampling technique has been because it increases the efficiency of a sample design with respect to survey costs and estimator precision.

**Table 3.2 Sample Size**

Description	Safaricom	Airtel	Telkom	Total
Corporate affairs	22	17	15	54
Consumer business unit	13	10	6	29
Strategy and innovation	6	4	3	13
Technical & IT	3	2	1	6
Customer operations	25	20	18	63
Total	69	53	43	165
Percentage	42%	33%	25%	100%

**n=165**

**Source: Researcher (2023)**

### 3.6 Data Collection Methods

The study collected primary data through a structured questionnaire. According to Mathers,

Fox and Hunn (2007) the main reason for using a questionnaire is because they are cost effective to administer and are free from bias. According to Mugenda and Mugenda (2003) the questionnaire method is a convenient method of collecting data since each item is targeting to address a particular objective.

The 5- point Likert-type scale was used to increase response rate and quality with special focus on reducing respondent frustration level. Literature suggests that a five-point scale is readily comprehensible to respondents and enables them to response their views in a better way (Alexandrov, 2010).

The questionnaires were distributed in the offices of respondents who might not be available during the actual data collection period. In addition, the researcher administered ten printed questionnaires as a pilot, and this allowed the researcher to clarify any issue raised by the respondents. Pinsonnault and Kraemer (1997) observed there are three main objectives for conducting research using a survey questionnaire when: Data of the research is based on quantitative methods, data collection instruments are used in research must be pre-defined, and when research work that requires to analyze finding of a sample to whole population.

The researcher submitted the complete proposal to the university for approval and upon receiving a letter for approval, the researcher pre-visited the selected pilot area to familiarize and seek permission to conduct research within their premises. During the actual data collection process, the researcher administered the questionnaires developed while others were dropped at the locations of the respondents who might have had busy schedules to be filled later but with monitoring from the researcher to increase responsiveness of the data collection process. The researcher in accordance with what was more conducive and comfortable for the study participants scheduled the date, time, and place for each data collection instrument. Research assistants were employed to assist in data collection process. These research assistants were trained for five days on data collection procedures, ethical considerations in research and other related activities. Each research assistant was given a number of questionnaires with the researcher herself leading the process.

### **3.7 Research Quality**

#### **3.7.1 Validity of Instrument**

Fendler (2016) defines validity as the degree to which evidence and theory support the

interpretation of test scores entailed using tests. The validity of an instrument is the extent to which it does measure what it is supposed to measure. Validity is the accuracy and meaningfulness of inferences, which are based on the research results. It is the degree to which results obtained from the analysis of the data represent the variables of the study. The research instrument was validated in terms of content and face validity. The content-related technique measures the degree to which the question items reflected the specific areas covered.

### 3.7.2 Reliability of Instrument

Reliability has been defined as the ability of a research instrument to consistently measure characteristics of interest over time. It is the degree to which a research instrument yields consistent results or data after repeated trials (Fendler, 2016).

If a researcher administers a test to a subject twice and gets the same score on the second administration as the first test, then the instrument is reliable. The researcher used Cronbach's Alpha to measure reliability. A Cronbach alpha is a measure of internal consistency, which is, how closely linked sets of items as a group. The alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale, is expressed as a number between 0 and 1 (Eisinga, Grotenhuis, & Pelzer, 2013).

**Table 3.3 Reliability results of questionnaire items**

Description	No. of items	Cronbach's alpha	Instrument quality
Digital literacy	9	0.845	Excellent
Organizational digital capability	7	0.776	Good
Digital investment	8	0.853	Excellent

**Source: Researcher (2023)**

As shown in a Table 4, every variable in the data collection instrument was in the good or excellent categories meaning the instrument was excellent to assess the operational efficiency of the telecommunication firms. Therefore, the quality of the instrument is very important in ensuring the data obtained are consistent and relevant. The reliability results are within Chuan's (2009) observation who stated that the minimum reliability value of a

quality research instrument is 0.6.

### **3.8 Data Analysis**

The study analyzed the data collected using descriptive analysis. Quantitative data from the questionnaire was coded and analyzed using the Statistical Package for Social Sciences (SPSS). The SPSS provides data for descriptive statistics, numerical outcome prediction and allows the researcher to present data in form of frequency and percentages. A regression analysis was used to examine the relationship between independent and dependent variables. The regression model will take form as shown below:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$$

Where:

Y = predicted value of the dependent variable y (Operational efficiency)

b0 = b3 are the sample estimates of the coefficients

X<sub>1</sub> = Digital literacy (independent variable).

X<sub>2</sub> = Organizational digital capability (independent variable).

X<sub>3</sub> = Digital investment (independent variable).

The study used one type of data analysis and included quantitative techniques technique. Quantitative technique was used to analyze data that is numerical. The researcher after receiving the questionnaires, coded them and entered the data into a computer to produce figures.

### **3.9 Ethical Considerations**

Ethical considerations are an important part of the planning stage of all social research projects. This examining effect of digitalization on operational efficiency involved human participants and hence became very important that research ethics approval is obtained. Also, it is important that approval is gained before commencement of data collection from the target respondents to make the study compliant.

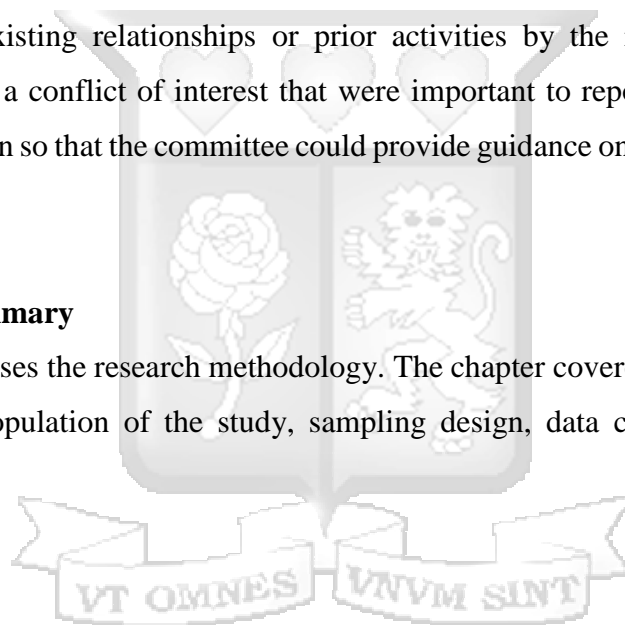
Several ethical considerations were made to win the trust and support of respondents. First is confidentiality and in this case, all responses received from respondents were treated with confidentiality and were not divulged to any third parties. In addition, the purposes of the

research will not be used for any other reason other than meeting the research objectives. The study will also consider one of the ethical issues, ethical expectations which has both increased and broadened in response to society's expectation of greater accountability. According to Zegwaard, Campbell, and Pretti (2017) in many educational institutions, to collect data from human participants for research purposes without ethical approval would place the researcher outside institution's ethical review regulations.

The study also maintained the identity of participants as confidential or anonymous and these assurances extended beyond protecting their names but also included the avoidance of using self-identifying statements and information. It was important to maintain anonymity and confidentiality of respondents as a crucial step in protecting the participants from potential harm. Existing relationships or prior activities by the researcher could have potentially created a conflict of interest that were important to report on within an ethics approval application so that the committee could provide guidance on managing any conflict of interest.

### **3.10 Chapter Summary**

This chapter discusses the research methodology. The chapter covered research philosophy and design, the population of the study, sampling design, data collection method, and analysis.



## CHAPTER FOUR

### DATA ANALYSIS AND PRESENTATION

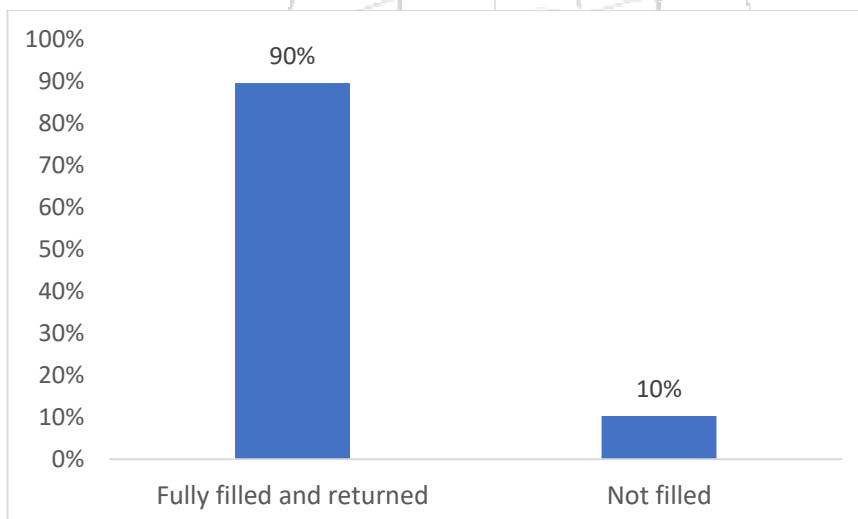
#### 4.1 Introduction

The study sought to research on the effect of digitalization on the operational efficiency of telecommunication firms in Kenya. The data collection for this study was done through structured questionnaires with both closed and open-ended questions from the surveyed respondents. Data editing and reconciliation were undertaken before data analysis was done. Data was entered using excel sheets to get the required data for presentation.

#### 4.2 Response Rate

During data collection, 165 questionnaires were constructed and administered where the researcher collected all the questionnaires after close of the activity. At the end of the study, only 148 questionnaires were returned with 17 returned unfilled and hence these were discarded by the researcher. The researcher utilized the returned questionnaires by coding and entering the data into a computer and analyzed the study's overall response rate was 91%. It is worth mentioning that this fairly high response rate for such a study is attributed to clarity and simplicity in the design of questionnaires, briefing offered to respondents on content in the questionnaire and finally purpose of the survey. The respondents were guaranteed that their replies would be treated in strict confidence.

**Figure 4.1 Response rate**

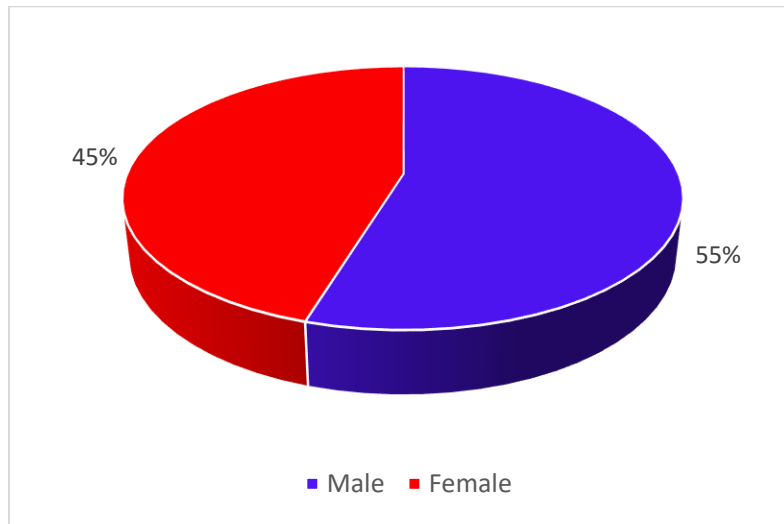


### 4.3 Demographic Information

#### 4.3.1 Gender

Figure 2 represents distribution of respondents by gender. The findings show that most respondents were male compared to female at 45% of the total respondents who participated in the study. This suggests all genders were represented in contributing to the topic under study.

**Figure 4.2 Gender**



#### 4.3.2 Highest level of academic qualification

Respondents were asked to state their highest level of academic qualification. The results are presented in Table 1. Majority of the respondents had bachelor's degree at 39% and diploma at 33%. Further, respondents with masters constituted 16% while those with PhD and others such as certificate course comprised 5% and 7% respectively. This means the level of literacy held by respondents allowed them to provide answers to the research questions during the actual data collection.

**Table 4.1 Highest level of academic qualification**

	Frequency	Percentage
PhD	8	5%
Masters	23	16%
Bachelors	57	39%
Diploma	49	33%
Others	11	7%
	148	100%

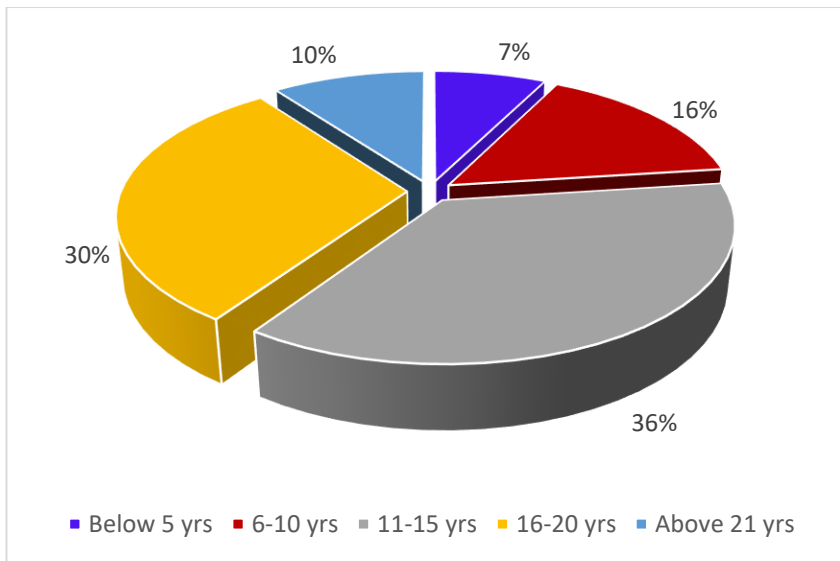
#### **4.3.3 Number of years of work experience in this organization**

The study findings on the distribution of respondents based on the number of years one had worked in their current organization are presented in Figure 3. It is clear from the findings that respondents with 11-15 years constituted 36% followed by respondents who had been with the current organization for 16-20 years at 30%. While 16% had been in the organization for 6-10 years, 10% had worked for 21 years and above with 7% having been in the organization for 5 years and below. The implications are that a significance population of the respondents had worked in the telecommunication firm for long and hence they were in a position to share experience with regards to digitalization and how it has impacted an organization can reduce waste in time, effort and materials while still producing a high-



quality service or product.

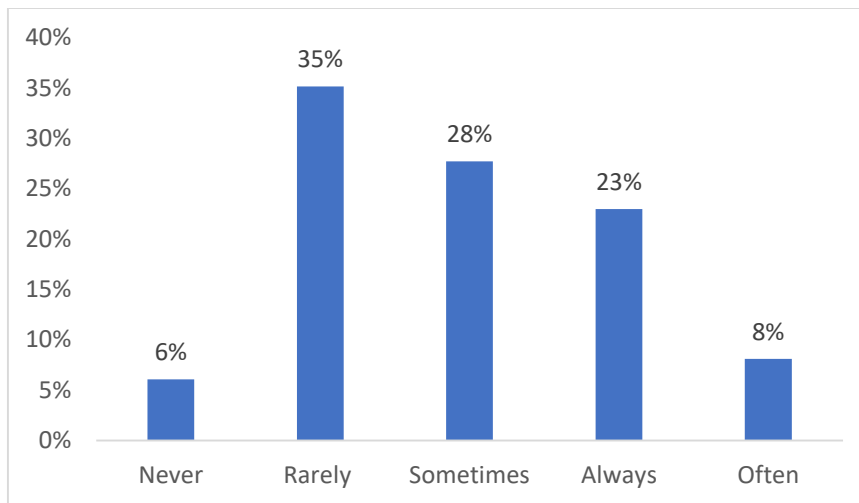
**Figure 2.3 Number of years worked in the organization**



#### **4.3.4 Frequency the organization acquires new technology.**

Most organizations have increasingly acquired new technologies to boost or improve their performance. However, results from this reveal that some companies rarely acquire new technology at 35%. As shown in Figure 4, 28% of the respondents believe that some firms in the telecommunication sector sometimes acquire technology with 23% stating they always acquire such technologies aimed at improving operational efficiency. Fewer number of respondents believe there are companies who never acquire new technology and hence this might affect their operational performance. This means different companies have different schedules or priorities and technology may not be a priority for some companies compared to the other. This implication most of the employees understands the level at which their firms had invested in technology, and it was possible that the study would benefit from the information collected.

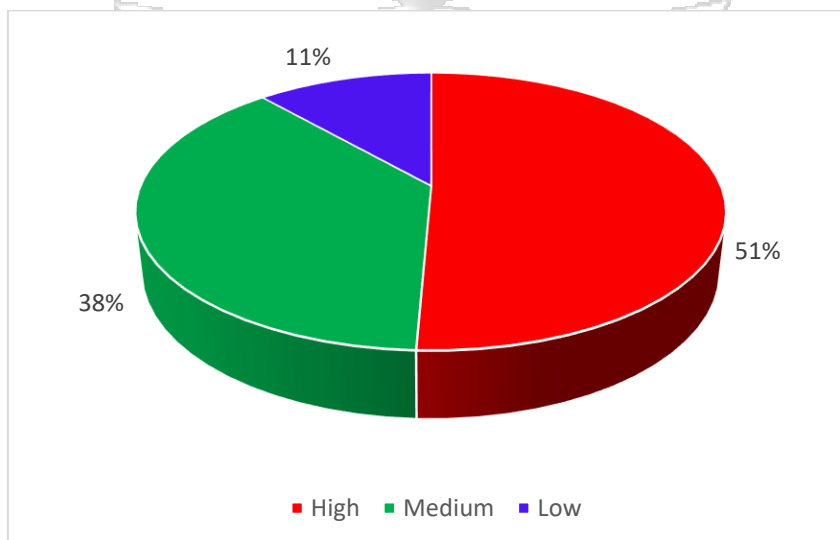
**Figure 4.4 Acquisition of technology**



#### **4.3.5 Rating the level of digitalization in your company**

Considering the role of digitalization in most organizations, this study asked respondents to rate level at which their organization had adopted digitalization. The findings are presented in Figure 4.5. The findings show that slightly over half rated it high, followed by 38% who placed it as medium with 11% in favour of low. This means most telecommunication firms have gained benefits – increased cost savings and significant improvement in production and service delivery.

**Figure 4.5 The level of digitalization in your company?**



#### 4.4 Descriptive Statistics

The study sought to find out whether employees in the telecommunication sector are able to manipulate diverse digital platforms.

##### 4.4.1 Digital Literacy

To study sought to examine the effect of digital literacy on the operational efficiency of telecommunication firms in Kenya. The findings are presented in Table 6.

**Table 4.2 Descriptive statistics for digital literacy**

Statement	N	M	SD
Our staff can communicate information through various digital platforms hence increasing customer satisfaction	148	2.459	3.458
Our company always conducts training of users to adapt to new technologies in the organization leading to enhanced service delivery	148	2.365	3.381
Our two-way communication system has enhanced interaction allowing staff to prioritize tasks	148	3.851	2.827
Our staff can use new information from multiple digital sources presented on various digital platforms hence increasing the firm's responsiveness	148	3.446	2.103
<b>Average score</b>		<b>3.03025</b>	<b>2.94225</b>

As indicated by a mean score of 2.459 and standard deviation of 3.458, the study findings show there were employees who could not communicate information using various digital platforms and this affects their ability to handle customers leading to lower customer satisfaction. However, most of the respondents agreed that nearly all the employees could interact with diverse platforms.

Digital platforms are changing the landscape of most markets and businesses. The prevalence of digital platforms and their significant economic and social impact have led information system researchers to pay increasing attention to this area. The study reports in a mean score of 2.365 and standard deviation of 3.381 that most companies within the telecommunication sector value the importance of enhancing knowledge of their employees through training (see table 6). It shows that majority agreed that companies have always trained their end users to adapt to emerging technologies and this has been reported to

enhance service delivery. However, fewer number of the respondents believe some companies don't conduct training of end users and hence employees might experience challenges in using new technologies affecting operational efficiency.

Furthermore, the study sought to find out the relationship between two-way communication and how it helps improve efficiency at the company. The findings are presented in Table 6. In a mean score of 3.851 and standard deviation of 2.827, the study findings show that majority of the respondents believe that two-way communication system had enhanced employee interaction leading to high prioritization of tasks. Moreover, the study findings show that this helped in switching the priority of tasks during execution allowing flexibility of changing objectives over time. The findings show that such organizations predominantly practice the two-way symmetrical model, and their work is characterized by the dimensions of symmetrical impacts and—to some degree—two-way communication. The study findings also show that there are some instances where two-way communication doesn't help improve operational efficiency because employees have unique traits that affects their interaction with others.

Digital platforms support heterogeneous needs of users who act as both goal seeking individuals and online community members.

The study indicates that employees in the telecommunication sector are able to utilize multiple digital sources presented on various digital platforms hence increasing the firm's responsiveness. This was demonstrated by a mean score of 3.446 and standard deviation of 2.103. In overall, the study findings show that effect of digital literacy on operational efficiency was reported in a mean score of 3.03025 and standard deviation of 2.94225 as seen in Table 6.

#### **4.4.2 Organizational Digital Capability**

To study sought to establish the effect of organizational digital capability on the operational efficiency of telecommunication firms in Kenya and the findings are shown in Table 7.

**Table 4.3 Descriptive statistics for organizational digital capability**

<b>Statement</b>	<b>N</b>	<b>M</b>	<b>SD</b>
Our organization always conducts a comprehensive assessment of our current digital maturity leading to enhanced operational efficiency	148	2.797	2.565
We have employed advanced digital devices that use basic information systems that organize work efficiently leading to customer satisfaction	148	2.764	2.306
Our digital system makes it easier to track real-time progress and reduces the incentives to shirking responsibilities in the organization	148	3.682	2.096
Our digital platform can absorb technical information when it is presented systematically and apply it impactively to aid in decision making hence increasing operational efficiency	148	3.27	1.333
<b>Average score</b>		<b>3.12825</b>	<b>2.075</b>

As shown in Table 7, most of the respondents could neither agree nor disagree that their organization often conduct comprehensive assessment of their current digital maturity which helps in enhancing operational efficiency. However, some telecommunication firms ensure they respond to developments and shift trend towards technology. Consequently, this helps firms in evaluating its existing digital capabilities. This was demonstrated by a mean score of 2.797 and standard deviation of 2.565 and this means there are digitally mature firms and hence they outstrip their industry competitors.

In addition, the findings show that telecommunication firms have increasingly adopted various digital tools and technologies making it possible to collect and analyze data rapidly and easily. This was confirmed by most of the respondents who agreed that their company had acquired advanced digital devices that can use basic information system in organizing work actively and this has led to higher customer satisfaction.

As shown in Table 7, the study reports in a mean score of 3.682 and standard deviation of 2.096 that telecommunication companies have digital systems that have helped in tracking real-time progress, and this has demonstrated its capability in increasing operational efficiency. However, there are few of the companies with digital system that has generated value or improved efficiency.

When asked to state whether their firms have digital platforms that can absorb technical information when it is presented systematically and apply it actively to aid in decision making hence increasing operational efficiency, level of agreement among respondents were demonstrated by mean score of 3.270 and standard deviation of 1.333. However, some respondents don't think they have digital system that absorbs technical information allowing employees to respond to particular issues within the production lines.

#### 4.4.3 Digital Investment

The study sought to find out the extent to which organizations have invested on digital tools. In particular, the examined the effect of digital investment on the operational efficiency of telecommunication firms in Kenya and the findings are presented in Table 8.

**Table 4.4 Descriptive statistics for digital investment**

Statement	N	M	SD
In the last two years, our organization has committed significant financial resources to acquire digital tools to support operational work	148	3.329	3.19
We have a strong digital organizational culture where we are motivated to digitize our services to enhance service delivery and customer satisfaction	148	3.291	3.24
We have invested heavily in business intelligence tools allowing us to assess our performance against other competitors	148	3.642	2.206
Our organization has a strong social media presence that includes partnerships with influencers leading to increased presence and enhancing our service and product uptake	148	2.804	1.708
Average score		3.2665	2.586

Most of the respondents could neither agree nor disagree that in the last two years, their organization had committed significant financial resources to acquire digital tools to support operational work. The study findings further show that some of the respondents believe their organizations committed financial resources. This was demonstrated by man score of 3.329 and a standard deviation of 3.190 meaning digital investment becomes key factor in a firm's level of IT innovations. In addition, there was agreement amongst significant number of the respondents who confirmed presence of strong digital organizational culture which has

motivated them to digitize most of its operations hence improving service delivery and customer satisfaction levels.

A telecommunication firms operates in an environment where fast and effective decision making is needed to ensure that the output is met with customer compliance. Therefore, adoption of business intelligence tools becomes very important. The study findings show in a mean score of 3.291 and a standard deviation of 3.240 show that that most telecommunication firms have invested heavily on business intelligence which has allowed them to assess their performance against that of industry competitors (see Table 8). The results confirm a significant relationship between business process performance and organizational performance for both service and non-service sectors. The findings further reveal some telecommunication firms have not given attention to business intelligence tools. For the firms that have implemented the digital technologies, there is capability of them fostering its success especially when coupled with the right information.

Additionally, the study examined whether telecommunication firms have strong social media presence (see table 8). A significant number of respondents indicated that they have used social media to enhance knowledge sharing within the firm, employees learn about collaborative teaching partners, team meetings and both informal and formal collaboration. This was demonstrated by a mean score of 3.642 and a standard deviation of 2.206.

#### 4.4.4 Operational Efficiency

The study examined whether operational efficiency of telecommunication firms in Kenya were affected by digitalization. The findings are presented in Table 9.

**Table 4.5 Descriptive statistics for operational efficiency**

Statement	N	M	SD
We regularly receive compliments from customers about their contentment regarding the delivery of our products and services through various digital platforms	148	3.047	2.824
Our organization always provides goods and services that are aligned with customers' expectations	148	3.703	2.734

Since we digitized, we have been able to undertake appropriate prioritization of work assignments	148	3.235	2.193
Our product information has been adequately displayed to our potential customers on various digital platforms enabling them to use less time in making purchase decisions	148	3.486	2.524
Average score		3.36775	2.56875

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The study findings show that some respondents could neither agree nor disagree that their organization often receive compliments using diverse digital platforms from customer regarding their service delivery. Majority of the respondents reported in a mean score of 3.047 and standard deviation of 2.824 that they regularly receive compliments from customers about their contentment regarding the delivery of their products and services through various digital platforms. In addition, the study found that a significant number of respondents were in agreement that many telecommunication firms have always provided goods and services that align to customer expectation (see Table 9). This was demonstrated by a mean score of 3.703 and standard deviation of 2.134.

In addition, the study examined how telecommunication firms utilize digital tools in enhancing its efficiency. The findings are presented in Table 9. In a mean score of 3.235 and standard deviation of 2.193, the study reports that majority of the firms with more digitalized services have been able to prioritize work activities. However, some who despites having their firms being digitalized, work assignments have not changed in terms of prioritization.

The study also found that displaying product information in different formats plays an important role in the telecommunication sector as it affects consumer behavior and sales. This was demonstrated by a mean score of 3.486 and a standard deviation of 2.524.

#### **4.5 Inferential statistics**

In this section, the study sought to find out how the variables are related to the operational efficiency and hence to determine the relationship, a correlation analysis was conducted. The findings are presented in Table 10. As noted by Jiang, Huang, and Deng, (2019) a correlation coefficient of zero indicates that no linear relationship exists between two

continuous variables, and a correlation coefficient of  $-1$  or  $+1$  indicates a perfect linear relationship. The strength of relationship can be anywhere between  $-1$  and  $+1$ .

**Table 4.6 Correlations of variables in the study**

		Digital literacy	Organizational digital capabilities	Digital investment	Operational efficiency
Digital literacy	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	148			
Organizational digital capabilities	Pearson Correlation	0.413	1		
	Sig. (2-tailed)	0.001			
	N	148	148		
Digital investment	Pearson Correlation	0.796	.688**	1	
	Sig. (2-tailed)	0.023	0.000		
	N	148	148	148	
Operational efficiency	Pearson Correlation	0.825**	.732**	.850**	1
	Sig. (2-tailed)	0.003	0.000	0.001	
	N	148	148	148	148

As indicated in Table 10, the study found a stronger correction between all the variables – digital literacy, organizational digital capabilities, and digital investment with a correlation coefficient of 0.825, 0.732 and 0.850 respectively. The study findings illustrate that the operational efficiency of telecommunication firms is strongly determined by digital literacy, organizational digital capabilities, and digital investment.

#### 4.5.1 Regression analysis

The study used three independent variables and a dependent variable hence regression analysis conducted describes the relationship between a dependent variable and the three independent variables. As such, the dependent variable consisted of operational efficiency

while the independent variables were digital literacy, organizational digital capabilities, and digital investment.

#### 4.5.2 Digital literacy and operational efficiency

The study sought to find out the effect of digital literacy on the operational efficiency of telecommunication firms in Kenya. The findings have been presented in Table 11.

**Table 4.7 Digital literacy and operational efficiency**

Multiple R	0.4899					
R Square	0.6422					
Adjusted R Square	0.5808					
Standard Error	86.1847					
Observations	148					
<b>ANOVA</b>						
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance (P-value)</i>	
Regression	1	8.7318	18.7016	3.529	0.001	
Residual	146	7.876	49.7950			
Total	148	16.6078				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	9.4607	2.5599	0.1158	0.9090	-400.5020	447.4234
Digital literacy	0.3521	1.0635	3.9043	0.0032	1.8362	6.3779

To estimate coefficients of linear regression equations, Table 10 provides multiple R, R Square, Adjusted R Square and Standard error of the estimates and this can be used to determine fitness of the regression model into the data. R is considered as a measure of the quality of predictor of the dependent variable – operational efficiency. R Square ( $R^2$ ) is the proportion of variance in the dependent variable that can be explained by the independent variables, and this is the proportion of variance accounted by the regression model above and beyond the mean model.

Adopting linear regression analysis to predict operational efficiency, the study found that digital literacy, is one of the three determinants for operational efficiency (with  $F=3.329$ ;  $P= 0.001$ ;  $R^2= 0.6422$  (See Table 11). The critical value of F, at the significance level of 0.05 with 5 degrees of freedom at numerator is very important and by comparing the values of it can be stated that not all regression coefficients are equal to zero.

In addition, the findings (Table 11) show the relationship between independent variable (digital literacy) and the dependent variable (operational efficiency). It shows that  $R=0.6422$  meaning there was strong coefficient of determination between digital literacy and operational efficiency of telecommunication firms. The findings further reveal that the value of 0.6422 of the independent variables (digital literacy) explains 64.22% of the variability of the dependent variable (operational efficiency). The F-test in the ANOVA tests whether the regression model is good fit for the data. Since  $P=0.001$  is less than 0.05, the model is said to be statistically significant in predicting how digital literacy can impact operational efficiency of the telecommunication firms in Kenya. As shown in Table 11, the unstandardized coefficient, B1, (coefficients) for digital literacy is equal to 0.3521 and this means that for each year increase in digital literacy among the telecommunication firms, there is an increase in operational efficiency of 35.21%.

#### 4.5.3 Organizational digital capability and operational efficiency

The study examined how organizational digital capability affected operational efficiency of telecommunication firms in Kenya.

**Table 4.8 Organizational digital capability and operational efficiency**

Multiple R	0.5896
R Square	0.6210
Adjusted R Square	0.4708
Standard Error	76.1843
Observations	148

ANOVA	3
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	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance (P-value)</i>	
Regression	1	9.2152	73.9016	4.829	0.000	
Residual	146	4.367	41.4625			
Total	148	13.5822				

	<i>Standard</i>					
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1.4607	2.5599	0.1584	0.9090	-400.5020	447.4234
Digital capability	0.4723	2.3846	3.7831	0.003	1.5293	7.4927

Table 12 displays findings for model summary, multiple R, R square, Adjusted R square and standard error. The findings show that the value of 0.6210 of the independent variables (organizational capability) explains 62.10% of the variability of the dependent variable (operational efficiency). Moreover, the study findings show that the independent variable (organizational digital capability) statistically predicts the dependent variable (operational efficiency) as illustrated by  $F(4.829)$ ;  $P=0.000$  ( $<0.05$ ).

The coefficient for organizational digital capability is 0.3304 and this means for 1% improvement in the digital capability will cause a 47.23% improvement in operational efficiency.

#### 4.5.4 Digital investment and operational efficiency

The study sought to examine the effect of digital investment on operational efficiency of telecommunication firms and the findings are presented in Table 13.

**Table 4.9 Digital investment and operational efficiency**

Multiple R	0.5409
R Square	0.6924
Adjusted R Square	0.4208
Standard Error	66.4147
Observations	148

ANOVA					
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance (P-value)</i>
Regression	1	10.2102	17.9016	4.602	0.002
Residual	146	4.368	49.5050		
Total	148	14.5782			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	21.3507	3.5599	0.1158	0.7290	-400.5020	517.3232
Digital investment	0.3304	7.4452	1.2079	0.0042	-17.7354	0.8706

Table 14 presents findings on model summary, ANOVA, and coefficient of determination. The coefficient of determination  $R^2$  indicating the percent of how much of the total variance is explained by the independent variable (digital investment) is 69.24%. When looking at the p-value of the t-test, it can be seen that the independent variable (digital investment) contributes to the model. Elsewhere, a correlation was conducted to examine relationship between independent variable (digital investment) and dependent variable (operational efficiency).

#### 4.5.5 Regression analysis for digitalization and operational efficiency

The study conducted multiple regression analysis to determine the effect of digitalization on operational efficiency of telecommunication firms in Kenya. The findings are shown in Table 14.

#### Table 4.10 Regression Results

Multiple R	0.5892
R Square	0.5982
Adjusted R Square	0.6232
Standard Error	66.2647
Observations	148

ANOVA						
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance (P-value),</i>	
Regression	1	8.2637	17.9016	2.722	0.001	
Residual	146	3.6372	59.5050			
Total	148	11.9009				

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	23.4607	2.5599	0.1158	0.9090	-400.5020	447.4234
Digital literacy	9.1521	1.0635	3.9043	0.0010	1.9262	6.3779
Digital capability	8.6723	2.3846	3.7831	0.0035	1.5293	7.4927
Digital investment	-14.2304	6.4452	-2.2079	0.0021	-27.7204	-0.7404

In adopting multiple regression analysis to predict operational efficiency, the study found that digital literacy, digital capability, and digital investment are the three determinants operational efficiency ( $F=2.722$ ,  $R^2=0.5982$  and  $P=0.001$ ). Furthermore, the findings show that the independent variables statistically predict dependent variable  $p=0.001$  ( $<0.05$ ) and hence the model is good fit for the data.

As shown in table 14, the coefficients indicate how much the dependent variable varies with an independent variable when all other independent variables are held constant. The two predictor variables are differently related to the criterion in the regression. For example, digital literacy has positive regression coefficient at 9.1521, digital capability has positive regression coefficient at 8.6723 while has positive regression coefficient at have negative coefficient at -14.445.

#### 4.6 Chapter summary

The chapter has presented findings based on the data obtained and includes descriptive statistics and regression analysis. The chapter has also presented findings on the mean and standard deviation as displayed in the table supported by the interpretations.

## **CHAPTER FIVE**

### **DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

The chapter presents details of discussions, conclusion and recommendations based on the observed data in chapter four.

#### **5.2 Discussions**

The main objective is to examine the effect of digitalization on the operational efficiency of telecommunication firms Kenya. The study was guided by the following specific objectives: To examine the effect of digital literacy on the operational efficiency of telecommunication firms in Kenya, to establish the effect of organizational digital capability on the operational efficiency of telecommunication firms in Kenya and to find out the effect of digital investment on the operational efficiency of telecommunication firms in Kenya. First, the study presents demographic information of the respondents and then the key summary of findings.

The study achieved a response rate of 90% and the data was deemed fit for analysis. The study findings demonstrate that when research is made of homogeneous populations (persons having some strong group identity) concerning their attitudes, opinions, perspectives, etc., toward issues concerning the group, significant response-rate bias is probably unlikely. Most of the respondents were male at 55% and regards their distribution based on their highest level of education majority had bachelors and diploma. The study further shows that a significant number of the respondents had worked in the organization for 11 years and above suggesting that they were in a position to provide the required information about digitalization and operational efficiency within the telecommunication sector. Considering the role of digitalization in most organizations, this study asked respondents to rate the level at which their organization had adopted digitalization. Generally, the majority of the respondents strongly believe that telecommunication firms often update its technology whenever there is emergence of new product.

##### **5.2.1 Effect of digital literacy on the operational efficiency**

The study findings show that a significant number of employees in the sector can interact

with digital platforms which helps them in performing tasks in the office.

These platforms allow firms to develop their own computing functionality and allows interaction of information. The study findings show that most firms who train its end user on emerging technologies benefit a lot as they increase service delivery. We can see from the findings that digital technologies always provide more facilities on economic performance since it enables massive network among the business, automation of business functions provides higher productivity, and smooth information flow makes proper decisions. The findings from this study were supported by another study by Liu et al (2022) who found that leveraging on digital platforms to enhance customer engagement which in turn leads to improved operational efficiency. In most telecommunication firms, employees impactively communicate using several digital platforms and this has increased customer satisfaction.

Several studies have indicated that digital literacy is linked to reading and learning preferences, demonstrating that individuals with a lower level of digital literacy are less likely to try out new technologies and adopt digital reading (Myrberg, & Wiberg, 2015; Ross, Pechenkina, Aeschliman, & Chase, 2017). The findings are in support of previous findings by Lloyd (2017) who reported in a study of digital literacy that operational efficiency depends on how well employees can engage in digital devices. The information-sharing module needs to facilitate free and spontaneous participation from the users. As sharing of codified information in online communities often involves impersonal, alienated, non-reciprocal social relationships and weak ties, the study reports that it important for the information-sharing module to be linked to popular social networking services.

The study findings show that business uncertainty plays a dominant role in the relationship between digital literacy and performance of the firms. However, according to the individual characteristics of digital literacy some dimensions are not significantly affected by the business uncertainty. Mostly, digital applications make more influence on business uncertainty than other dimensions. The findings show that while majority 51% believe that two-way communication systems had enhanced employee interaction leading to high prioritization of tasks. Moreover, the study findings show that this helped in switching the priority of tasks during execution allowing flexibility of changing objectives over time.

### **5.2.2 Organizational digital capability and the operational efficiency**

The second objective was to establish the effect of organizational digital capability on the operational efficiency of telecommunication firms in Kenya. The findings show that digital capability has a significant impact on organizational performance. By conducting digital maturity tests, firms can improve operational efficiency. It is important to note that digital capability is a composite capability driven by emerging digital technologies. It not only emphasizes the use of a certain digital technology (such as big data, and artificial intelligence) to gather, integrate and deploy specific company resources but also emphasizes the formation of comprehensive capabilities through the use of multiple digital technologies. Several studies measure the digital capability of firms from the number of computers, the number of IT software, ICT proficiency, and IT human resources, which obviously cannot reflect the intelligent, connected, and insightful nature of digital capability. Information technology related capabilities support the informatization and automation transformation of companies, while digital capabilities support the digital and intelligent transformation of companies.

The study findings show that online users can utilize different kinds of authenticated devices to access the network tool depending on the location. This agrees with previous studies which established that in organizational settings, digital skills have been shown to lead to several positive consequences for different employees and their organizations, the use of collaborative technology in organizations is increasing, and IT has been shown to enable innovation, growth, and new business development (Nambisan, Lyytinen, Majchrzak, & Song, 2017). If digital resources and devices are an inescapable part of current and future office duties, digital competency training for future employees becomes extremely relevant, given that employees in the telecommunication sector need to acquire these competencies in their initial training to integrate them into their practices as future employment practices. That is, the digital competence acquired during their initial training significantly predicts the integration of technologies in future work practice (Nikou & Aavakare, 2021).

A set of internet skill was suggested by Van Deursen and Van Dijk (2010), which contains: operational skills (basic skills in using internet technology), formal internet skills (navigation and orientation skills); information internet skills (fulfilling information needs), and strategic internet skills (using the internet to reach goals). In 2014, the same authors added communication and content creation skills to the initial framework (van Dijk & van Deursen). Similarly, Helsper & Eynon (2013) put forward a set of four digital skills:

technical, social, critical, and creative skills.

### **5.2.3 The effect of digital investment on the operational efficiency**

The third objective was to examine the effect of digital investment on the operational efficiency of telecommunication firms in Kenya. The majority, 44% of the respondents agreed that telecommunications firms have not fully committed adequate financial resources for digitalization. Furthermore, identifying digital investment as a mediator of the linkage between digital competence and information technology (IT) innovation is an important contribution, especially as researchers attempt to unlock the business value of digital transformation. This finding provides empirical evidence for what has been mostly anecdotal support that firms with the adequate IT competence to complement investments in digital technologies are more likely to gain a high level of IT innovation. The study findings reveal that allocation effect of digital technology capital mainly manifests in reducing resource mismatches and improving allocation efficiency, thereby reducing resource redundancy, improving energy efficiency and production efficiency.

The study of main keywords associated with digital skills has revealed that information literacy, ICT, communication, collaboration, digital content creation, research and decision-making skill are the most representative. In a structured way, the existing literature groups these skills in technological, cognitive, and social (Ng, 2012) or, more extensively, into operational, formal, information Internet, strategic, communication and content creation (van Dijk & van Deursen, 2014). In time, literature has become richer in frameworks, and prolific authors have improved their results. As such, more recent research (vaan Laar et al., 2017) uses the following categories: technical, information management, communication, collaboration, creativity, critical thinking, and problem solving. The findings from the current study lend support to various theoretical perspectives on strategic deployment of emerging digital technologies to achieve competitive advantage. Moreover, it concurs with previous studies which found that digital organizational culture is a significant predictor of the organizational readiness toward the implementation of the advanced business models with the help of digital technology (Zhen, Yousaf, Radulescu, & Yasir, 2021).

The findings from this study show that firms' social media initiatives lead to operational efficiency and innovativeness through an information-rich social network that yields knowledge-based advantage. Wu (2013) theorized and empirically demonstrated that

information diversity and social communication are the “two intermediate mechanisms” (p. 30) of an information-rich social network through which social media improve employees’ productivity. According to Aral and Van Alstyne (2011), information in local, closely connected network neighborhoods tends to be redundant, providing mainly repetitive information. Instead, structurally diversified contacts should offer novel paths through which new information flows (Burt, 1992).

It is important to note that due to the dominant mindset regarding customer complaints, some telecommunication firms call their customer feedback management and the corresponding platform for customers ‘complaint management’, which makes it almost impossible for customers to provide compliments. Therefore, firms should consider renaming their feedback management platform with the neutral term of customer feedback or customer compliments and complaints.

### **5.3 Conclusion**

The study observed that digital literacy, digital capability of the firm and digital investment showed significant impact on the operational efficiency suggesting the telecommunication firms are able to achieve their business goals without producing too much waste. For instance, as a high-level dynamic capability, digital capability can help telecommunication firms quickly respond to internal and external environment changes and provide innovative digital solutions according to market competition and customer needs. Lin and Lv (2019) used case studies to show that because digital technology presents all aspects of enterprise production, sales, and consumption in the digital form, transparent information results in personalized, customized, and experiential service consumption. Moreover, traditional business models do not break, consumers change to ‘productive consumers’, and sales channels of enterprises gradually shift from offline to online.

In addition, it is convenient to accurately grasp the relationship between information technology capital and operational efficiency. This study could help organizations actively inspire the potential of IT capital, improve the efficiency of regional carbon emissions, and strive to achieve the goal of carbon neutrality. The need for organizations to be both efficient and innovative has been an increasing concern for operations managers. Overall, the study concludes that digital literacy, organizational digital capability and digital investment affects operational efficiency especially for telecommunication firms. Li’s (2020) research

revealed that digital technology can actively drive the intelligent transformation of enterprise products and services and the creation of new marketing operations, which, consequently, can help improve enterprise market share and performance.

Digitalization is changing the environment in which firms operate and hence firms need to adjust their business models if they want to remain competitive. The latest technological advancements still affect “physical” elements in traditional business models. However, emerging forms of business models are prominently based on the adoption of digital infrastructures and the dematerialization of processes. This requires the adoption of strategies capable of attaining the highest degree of resource efficiency. Moreover, newer forms of ventures are starting to play a novel role as a hub between buyers and sellers in the exchange of goods and services (Caputo et al., 2021). Some companies are characterized by their barriers to change, based on prior experience, for example. According to Caputo et al. (2021) and Chesbrough (2010), an ordinary technology applied to great business models might be more impactful than a cutting-edge technology implemented in ordinary business models.

#### **5.4 Recommendations**

Based on the study findings, this study recommends that telecommunication firms should enhance the existing technologies especially on digitalization and other applications other than the sophisticated computer-related applications to increase the usage and information handling.

The study found that about 30% of the respondents believe there are firms which have not invested on business intelligence and hence there is need focus on intelligence system which will utilize data-processing machines for auto-abstracting and auto-encoding of documents and for creating interest profiles.

Telecommunication industry is one of few industries that has seen increasing operational costs over recent years due increased regulation and increased cyber security risks. Firms in this industry are turning to digital transformation and to drive efficiency and maintain a competitive edge. Many firms in this field are starting to realize that digitalization can help them maintain their market share and create new growth opportunities. Therefore, it is

recommended that there is need for the firms to consider transformation methodology to take advantage of emerging technologies without sacrificing efficiency.

### **5.5 Limitations and suggestions for future research**

This study has examined the effect of digitalization on operational efficiency in the telecommunication sector and therefore, future research can conduct studies in ICT capital investment on operational efficiency in the same sector. Since operational efficiency is influenced by regulation and considering government regulates the telecommunication sector, it becomes important for future researchers to investigate how government regulation affects digitalization process. In addition, there is need to undertake future studies on digitalization in other industry verticals. Another suggestion for future research is to examine how operationally efficient markets influence digital investment in Kenya.



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## APPENDICES

### APPENDIX 1: INTRODUCTION LETTER

Old Sangale Rd, Machakos Estate,  
P.O. Box 59857 00200, Nairobi, Kenya.  
Call: +254 788 41 416/7, Twitter: @SBSKenya  
Email: info@sbs.ac.ke or visit www.sbs.strathmore.edu



13<sup>th</sup> June 2022

To Whom It May Concern,

**RE: FACILITATION OF RESEARCH – PERIS WANDETO**

This is to introduce Peris Wandeto who is a Master of Commerce (MCOM) Student at Strathmore University Business School, admission number MCOM/136439. As part of our MCOM Programme, Peris is expected to do applied research and undertake a project. This is in partial fulfilment of the requirements of the MCOM course. To this effect, Peris would like to request for appropriate data from your organization.

Peris is undertaking a research paper on **“The impact of digitalization on the operational efficiency of telecommunications firms in Kenya.”** The information obtained shall be treated confidentially and shall be used for academic purposes only.

Our MCOM Programme seeks to establish links with industry, and one of these ways is by directing our research to areas that would be of direct use to industry. We would be glad to share our findings with you after the research, and we trust that you will find them of great interest and of practical value to your organization.

We appreciate your support and shall be willing to provide any further information if required.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Njoki Kiagiri".

Njoki Kiagiri  
Manager – Graduate Programmes  
Strathmore University Business School.



## APPENDIX 2: QUESTIONNAIRE

Dear Respondent,

This questionnaire is made to collect information for assistance in conducting a study on the Effect of Digitalization on the Operational Efficiency of Firms in the Telecommunication Industry in Kenya. As an employee working in the telecommunication sector, you have been selected together with others to participate in the study. So, I hereby request you to freely complete this questionnaire. Data filled in this questionnaire will be confidential and will only be used for academic purposes. Thank you in advance for your kind acceptance to participate in this exercise.

### Section A: Demographic Information

1. Gender. Tick as appropriate  
Male  Female
2. Highest level of academic qualification. Tick as appropriate  
PhD  Masters  Bachelors  Diploma  Others
3. How long have you worked in this organization? Tick as appropriate  
Below 5 yrs  6-10 yrs  11-15 yrs  16-20 yrs  Above 21 yrs
4. How can you describe your position in the organization? Tick as appropriate  
Top-level management  Middle level management  Lower Cadre
5. How often does your organization acquire new technology? Tick as appropriate  
Never  Rarely  Sometimes  Always  Often
6. How do you rate the level of digitalization in your company? Tick as appropriate  
High  Medium  Low

### Section B: Digital Literacy

The following statements relate to Digital Literacy. State the extent to which you agree with the statements with regards to Digital Literacy in your organization (where 1 – strongly

disagree (SD), 2- Disagree (D), 3 – Neutral (N), 4 – agree (A) and 5 – strongly agree (SA)

No	Statement	SD 1	D 2	N 3	A 4	SA 5
1.	Our staff can communicate information through various digital platforms hence increasing customer satisfaction					
2.	Our company always conducts training of users to adapt to new technologies in the organization leading to enhanced service delivery					
3.	Our two-way communication system has enhanced interaction allowing staff to prioritize tasks					
4.	Our staff can use new information from multiple digital sources presented on various digital platforms hence increasing the firm's responsiveness					

### Section C: Organizational Digital Capability

The following statements relate to Digital Capability. State the extent to which you agree with the statements with regards to Digital Literacy in your organization (where 1 – strongly disagree (SD), 2- Disagree (D), 3 – Neutral (N), 4 – agree (A) and 5 – strongly agree (SA))

No	Statement	SD 1	D 2	N 3	A 4	SA 5
1.	Our organization always conducts a comprehensive assessment of our current digital maturity leading to enhanced operational efficiency					
2.	We have employed advanced digital devices that use basic information systems that organize work efficiently leading to customer satisfaction					
3.	Our digital system makes it easier to track real-time progress and reduces the incentives to shirking responsibilities in the organization					

4.	Our digital platform can absorb technical information when it is presented systematically and apply it impactively to aid in decision making hence increasing operational efficiency					
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**Section D: Digital Investment**

The following statements relate to Digital Investment. State the extent to which you agree with the statements with regards to Digital Investment in your organization (where 1 – strongly disagree (SD), 2- Disagree (D), 3 – Neutral (N), 4 – agree (A) and 5 – strongly agree (SA))

No	Statement	SD 1	D 2	N 3	A 4	SA 5
1.	In the last two years, our organization has committed significant financial resources to acquire digital tools to support operational work					
2.	We have a strong digital organizational culture where we are motivated to digitize our services to enhance service delivery and customer satisfaction					
3.	We have invested heavily in business intelligence tools allowing us to assess our performance against other competitors					
4.	Our organization has a strong social media presence that includes partnerships with influencers leading to increased presence and enhancing our service and product uptake					

**Section E: Operational Efficiency:**

The following statements relate to Operational Efficiency. State the extent to which you agree with the statements with regards to Operational Efficiency in your organization (where 1 – strongly disagree (SD), 2- Disagree (D), 3 – Neutral (N), 4 – agree (A) and 5 – strongly

agree (SA)

No	Statement	SD 1	D 2	N 3	A 4	SA 5
1.	We regularly receive compliments from customers about their contentment regarding the delivery of our products and services through various digital platforms					
2.	Our organization always provides goods and services that are aligned with customers' expectations					
3.	Since we digitized, we have been able to undertake appropriate prioritization of work assignments					
4.	Our product information has been adequately displayed to our potential customers on various digital platforms enabling them to use less time in making purchase decisions					

**Thank you for your time and feedback**



### APPENDIX 3: NACOSTI RESEARCH LICENSE

REPUBLIC OF KENYA  
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 112489

**RESEARCH LICENSE**



This is to Certify that Ms. PERIS Muthoni WANDETO of Strathmore University, has been licensed to conduct research in Nairobi on the topic: **THE IMPACT OF DIGITALIZATION ON OPERATIONAL EFFICIENCY OF FIRMS IN THE TELECOMMUNICATION INDUSTRY IN KENYA for the period ending : 22/June/2023.**

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Director General  
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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## APPENDIX 4: ETHICAL APPROVAL



7<sup>th</sup> September 2022

Ms Wandeto Peris,  
peris.wandeto@strathmore.edu

Dear Ms Wandeto,

**RE: The Impact of Digitalization on the Operational Efficiency of Firms in the Telecommunications Industry in Kenya**

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU- master's** research proposal. Your application reference number is **SU-IERC1451/22**. The approval period is from **7<sup>th</sup> September 2022 to 6<sup>th</sup> September 2023**.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including (informed consents, study instruments, MTA) will be used
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 48 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 48 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to SU-ISERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke/> and obtain other clearances needed.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Ben Ngoye".

for: **Dr Ben Ngoye,**  
**Secretary; SU-ISERC**

**Cc: Prof Fred Were,**  
**Chairperson; SU-ISERC**



# APPENDIX 5: PLAGIARISM REPORT



## Document Information

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