

**ADOPTED TECHNOLOGY AND THE PERFORMANCE OF MICRO AND
SMALL ENTERPRISES IN NAIROBI**

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF
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AND MANAGEMENT) FROM KENYATTA UNIVERSITY.**

JULY, 2024

DECLARATION

I attest that the submitted research paper is solely my own effort and has never been submitted at any university to earn a degree.

Sign..... Date

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SUPERVISOR

I hereby verify that the above-mentioned research paper was done by the student under my supervision.

Sign..... Date

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DEDICATION

To My Beloved Family, for your unwavering support, and enduring patience throughout the journey of my studies, I dedicate this paper to you. Your encouragement and understanding have been my constant motivation, and your sacrifices have made this endeavor possible. This work is a testament to the strength of our bond, and it stands as a tribute to the values you have instilled in me. Thank you for being my rock and my inspiration. With all my love and gratitude. I will likewise not forget my friends who have been behind my back to see progress in my studies.

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ABBREVIATION AND ACRONYMS

MSE	Micro and Small Enterprises
SME	Small and Medium Enterprises
GDP	Gross Domestic Product
DOSM	Department of Statistics Malaysia
AI	Artificial Intelligence
MSME	Micro, Small, and Medium Enterprises
KAM	Kenya Association of Manufacturers
ICDC	Industrial and Commercial Developments Corporation
KIE	Kenya Industrial Estate
STEM	Science, Technology, Engineering and Math
MSEA	Micro and Small Enterprise Authority
CBD	Central Business District
KNBS	Kenya National Bureau of Statistics
TOE	Technology, Organization, and Environment
DOI	Diffusion of Innovation
ICT	Information Communication Technology
KSH	Kenyan Shilling
KNCCI	Kenya National Chamber of Commerce and Industry
KIR	Kenya Industrial Research
KIBT	Kenya Institute of Business Training

OPERATIONAL DEFINITION OF TERMS

- Artificial intelligence** the term encompasses the capability of computers to undertake responsibilities that are typically performed by humans.
- Internet of things** it refers to the collective network of devices connected to exchange data together or with a system over the internet or other communication networks.
- Micro and small enterprises** refer to businesses that employ up to 10 people.
- Technology** refers to innovation by an MSE to improve service or efficiency within the business.
- Adopted Technology** refers to the various technological tools, systems, and innovations that these enterprises have integrated into their operations to improve efficiency, productivity, and overall performance.

ABSTRACT

Micro and small enterprises around the world play an important role in spurring economic growth. In Kenya, the government introduced numerous policy approaches that targeted the development and promotion of Micro and Small Enterprises, most notably the Micro and Small Enterprises Act of 2012, which established the Micro and Small Enterprises Authority and introduced the Kenya Industrial Estate. Despite the efforts by mandated organizations and the government, studies indicate that 70 percent of Micro and Small Enterprises fail within three years, rendering their survival in the market space low. This was despite the efforts put in by the government of Kenya and other stakeholders to promote Micro and Small Enterprises in the country. Micro and Small Enterprises faced many challenges, including inadequate funding, low skill levels, infrastructure, political instability, and operating expenses. Technology and innovations were directly proportional to improvements in micro and small enterprises. Therefore, the study focused on adopted technology that businesses have employed, including the various technological tools, systems, and innovations that these enterprises have integrated into their operations to improve efficiency, productivity, and overall performance. The study was conducted in the Nairobi's City County. Various studies have been done on technology. However, these studies focused on market entry and technology adoption, with limited attention to the effect of technology on MSE performance. This study aimed to fill this gap by examining the effect of adopted technology use on the performance of MSEs in Nairobi City County. The study sought to ascertain the effect of marketing innovation, process and service innovation, product distribution innovation, and payment technology on the performance of micro and small businesses in Nairobi's Central Business District. The study's empirical model was based on the Cobb-Douglas production function. 270 Micro and Small Enterprises were selected from a target population of 752 in Nairobi's Central Business District, and the entrepreneurs were given a self-administered questionnaire. The questionnaire's reliability was established using Cronbach's alpha, which was 0.72. The collected data was analyzed, and diagnostic tests were performed to assess heteroskedasticity, multicollinearity, and normality. Some moderator variables, such as business management skills, gender, education, and number of years in operation were included in the model. Data analysis results revealed that marketing technology, process and service innovation, distribution technology, and payment methods innovation had a positive influence on the performance of Micro and Small Enterprises in Nairobi City County. Therefore, Policymakers were encouraged to push Micro and Small Enterprises to adopt technology-enabled marketing strategies. Providing incentives, training programs, and resources to help them establish and maintain an online presence.

CHAPTER ONE

INTRODUCTION

1.1 The Background

1.1.1 The Micro and Small Enterprise and Technology

Micro and Small enterprises (MSE) around the globe have emerged as an avenue for gainful employment (Mbiti, 2015). It has been seen as a means for entrepreneurs to be recognized socially and economically in society. In developing countries, SMEs are known as engines for creating gainful employment, aiding resourcefulness and innovation, creating new products, and distributing goods and services in the market thus leading to economic growth (Pelham, 2000).

Technological innovations are a set of activities that better the development and design of products, services, and the techniques involved in improving and redesigning existing products. Technology has been considered a critical factor in MSEs' market accessibility (Rosli & Sidek, 2013). It has also become an unavoidable requirement for businesses that seek to grow and retain an upper edge in terms of competition to incorporate technology and innovation to access new markets (Liu, H., Chen, & Mboga, 2020). Access to market and other resources as a result of enhanced technology boosts firm growth and creates employment as well as expansion into new markets.

With economic competition globally, MSEs will be required MSEs to reconsider their competitive position with their rivals both locally and globally. Thus, according to Rugman (1992), firms better their competitiveness by designing, producing, and marketing products and services that are superior to those being offered by their competitors. Due to this, there is growing competition globally which has led to

increased innovativeness by MSEs. Malaysia for example, is economically dominated by a large proportion of MSEs, where 98.5 percent of the business establishments are MSEs that cut across all sectors and sizes, and contribute 36.6 percent of Malaysian GDP (Glodec, 2020).

In Sub-Saharan Africa, the MSE sector has been recognized for its enormous contribution to development, and the growth of economies (Abisuga-Oyekunle, Patra, & Muchie, 2020). The governments and donors have recognized the important role the MSE plays in the development and growth of economies in emerging markets (Kuuya, 2015). The 2020 World Bank report on doing business showed that the overall climate of business in Sub-Saharan Africa had improved. The report also exhibited that levels of internet access, adoption of technology, and innovation improved although MSEs battled with other challenges linked to technology such as unreliable electricity supply (World Bank, 2020). MSEs in Africa are embracing digital services to improve their productivity. In South Africa for example, the State of Small Business Report showed that 78 percent of small businesses interviewed preferred accounting software to manage their financial records (Xero, 2019).

Kamer (2022) noted that over the last two decades, the MSE sector has experienced rapid growth. The success can be attributed to the internet penetration in the country which stands at 42 percent share of users. The growth of mobile money in Kenya has also uplifted MSEs which directly contributes to economic growth. Kendall (2012) found out that 99.5 percent of MSE owners used mobile money in their personal or business dealings and 67 percent used it for business.

1.1.2 Micro and Small Enterprises and the Role of Adopted Technology

Technology has become an important part of the world and MSEs are not left behind in embracing technology. MSEs that have embraced it have realized better returns in their businesses. Adopted technology assists these businesses in making themselves more efficient through improvements in value addition, payment of goods and services, and aiding marketing and distribution of goods and services (Kithae, 2012). Technology make work easier and improve productivity through the creation of better goods and reduction in time taken to produce goods and services. When used effectively, technology leads to wealth creation, increased productivity of labor, and greater living standards in the society. In many cases, when society adopts a specific technology widely, it will cause a positive effect. Coombs, Saviotti, & Walsh, (1987) assert that the effect of technology on an economic sector hinge on the level of diffusion of technology in a sector.

Adopted technology in businesses enables efficient production and easier distribution of goods and services. This will also lead to faster consumption of goods and hence better turnover which is an indicator of growth for the MSEs. It, therefore, means that technology enables faster growth (Kuuya, 2015). Technology also transforms marketing as it helps in the operationalization of products to target specific audiences, creating an market for specific customers. This leads to the establishment of a brand and growth loyalty with existing customers and development of new customers. The usefulness of adopted technology is enhanced when products acquire increased market value compared to their competitors.

Adopted technology may also affect levels of unemployment as it leads to structural unemployment as well as creating new jobs in the market. In Kenya where

unemployment is a major problem, new technology is appealing if it enables MSEs to create employment and aid in income distribution. If there is a rise in demand for a product because of an introduction of new technology or innovation, then firm output and other economic effects within the industry will be greater (Terzi, 2016). Thus, with the help of technology, the country has begun to transform from the third industrial revolution to the fourth, where emerging technology such as artificial intelligence (AI) used in the communications industry by Safaricom through chatbots to communicate to customers, and the internet of things have been adopted in a product such as car trackers. Through this, Kenya is among the countries with more technology hubs in Africa (World Bank, 2016).

1.1.3 The Government Policy on Micro and Small Enterprises

In Kenya, the Micro, Small, and Medium Enterprises (MSME) are over 7.41 million and contribute about 40 percent of the country's GDP (Wakiaga, 2022). Many of the MSEs are found in the informal sector commonly referred to as *the Jua Kali* sector (Republic of Kenya, 2005). The engaged activities within the sector are typically run by women or youth who mostly work for a living.

According to the Micro and Small Enterprise Act of 2012, micro-enterprises employ 10 or fewer people, small enterprises employ from ten to forty-nine and medium-sized enterprises that are not included in the act employ 50 to 99 people. The MSEs in Kenya are grouped into three the largest of them being the commercial sub-sector which includes vendors of consumer skills-based handiworks which take up to 60.6 percent of the population of MSMEs. The second largest are those in manufacturing which include engineering workshops and carpentry which make up 30 percent of the

population. Finally, the service sector which takes 10 percent comprises of MSEs offering computer and transport services among others (Republic of Kenya 2005).

Since independence, the government has prioritized the growth MSEs. It was first highlighted in sessional paper No. 10 of 1965, which discussed African socialism and its application to planning in Kenya (Republic of Kenya, 1965). It was based on government planning as a tool for socioeconomic development. It suffered bad leadership and governance in terms of implementation right from when the paper was adopted. This was succeeded by the development of the Kenya Industrial Estate (KIE) which was owned by The Industrial and Commercial Development Corporation (ICDC) in 1967 (Wanjohi, 2010). The major role of KIE was to promote indigenous entrepreneurship by financing and developing MSEs.

As the number of MSEs grew, they began to be a major part of government economic planning which was initiated in Kenya's development plan of 1974 – 1978. The concept was later developed by the establishment of a sessional no. 1 in 1986, which addressed economic management for renewed growth and recognized the value of MSEs (Republic of Kenya, 1986). The document later became a policy through the sessional paper no. 2 of 1992 on Jua Kali development, which gave recognition of the negative effects of its strict controls. The paper addressed MSEs and defined them as enterprises that employ less than fifty employees. In 2005, a policy paper on MSE development was created which highlighted several constraints to MSE development one of them being technology (Republic of Kenya, 2005). It was the sessional paper no. 2 of 2005 that touched on the development of MSE for wealth creation for poverty reduction. It highlighted how the constraints should be handled, thus resulting in the MSE Act being

passed in Parliament in 2012, which brought new rules to support Micro and Small enterprise development.

The government has shown commitment to supporting MSEs, since it is expected to create 1.3 million jobs, and contribute to Kenya's GDP by 15 percent through manufacturing sector by 2022 (Wakiaga, 2022). According to the Republic of Kenya (2019), 90.7 percent of generated employment in Kenya comes from MSEs. A lot has been done to promote the growth of MSEs and improve their relationship with the government. For example, the introduction of an online tax system for filing returns has enhanced the ease of doing business (World Bank, 2020).

Policymakers have noted that MSEs are important in curbing the problems of unemployment through entrepreneurship (Kuuya, 2015). Thus, Kenya has prioritized the development of skills that go in line with industrial demands and global trends for the SME sector through the development of Science, Technology, Engineering, and Math (STEM) subjects in the curriculum (Njogu, 2019). Through this, the industry can train technical graduates on the latest machinery and technology as they get ready for employment or create jobs with the training given. With this, the sector will create more jobs and increase its contribution to the economy through diversifying products and increasing its capacity to produce. However, for this to be achieved, the use of technology and machinery that is up to date has to be employed.

The contribution of MSEs to the Kenyan economy is enormous. They are a big factor in social development. Thus, the government offers support in terms of financing through credit, offering programs for training, improvement of infrastructure, raw materials, and technology (Wanjohi, 2010). In 2017, the government of Kenya introduced its agenda to grow the economy dubbed the Big Four agenda (Republic of

Kenya, 2017). One of the agenda was manufacturing which ensured the country's level of production increased. This agenda touched on the MSEs. One of the policies introduced that ensured it was achievable was easy access to credit by MSEs through MSEA (Micro and Small Enterprises Authority, 2021). By making credit more accessible, the policy aimed to foster an environment conducive to the growth and sustainability of MSEs, ultimately contributing to broader economic development and prosperity.

1.1.4 The Micro and Small Enterprise in Nairobi City

According to the MSE Act of 2002, Micro and Small Enterprises employ less than 10 people. Kenya's MSE sector is mostly domineered by MSEs that are mainly found in cities and towns (Republic of Kenya, 2020). It is estimated that there are over 157,846 MSEs in Nairobi County (Mutwiri, 2018). They deal in general wholesale and retail stores, transport services, communication, food stores, and industrial factories and workshops (Bowen, Morara, & Mureithi, 2009). In most of these MSEs, employment means that individuals work to make a living rather than for wages (Republic of Kenya, 2005).

The MSEs within Nairobi CBD with active registered license and a permanent premise are 752 with many of them in the category of general trade, wholesale, retail, and stores.

Table 1.1: Category of MSE in Nairobi CBD

MSE Category	Count of Business Category Name
Accommodation and Catering	19
Agriculture, Forestry, and Resources	1
General Trade, Wholesale, Retail, Stores	335
industrial plants, factories, workshops, contractors	117
Private Education, Health and Entertainment	10
Technical and Financial Services	148
Transport, Storage, and Communications	122
Grand Total	752

Source: Nairobi City County, Licensing Department (2022)

There are 8259 registered MSEs in Nairobi City with 752 of them found within the Nairobi Central Business District as per the data in Nairobi County (2022).

MSEs in Nairobi face unique challenges, including inadequate infrastructure, fierce rivalry, and high operating expenses which impede their expansion and viability (Waithaka, 2017). These difficulties are further compounded by a lack of technical expertise and restricted financing sources (Mwangi, 2020). Additionally, Nairobi's market is also dynamic and competitive, requiring MSEs to leverage on technology to remain viable.

With adoption of technology by MSEs in Nairobi, they can surmount these obstacles (Augustyn., 2020). Through the use of technology, MSEs can increase market reach, cut expenses, and operate more efficiently (Kiggima, 2017). Digital marketing platforms, for example, can assist MSEs to expand their reach, while e-commerce solutions allow businesses to function outside of physical boundaries. With the adoption of SMEs there is likely to be Improvement in inventory control, financial record-keeping, and customer relationship management, this might lead to development and prosperity of MSEs.

1.2 The Problem Statement

Micro and small enterprises (MSEs) are vital to the social and economic development of Kenya. They contribute significantly to employment creation, revenue generation, and fostering innovation, which drives economic growth and development (Mwangi, 2020). According to the Kenya National Bureau of Statistics (KNBS) (2020), MSEs in Kenya employ over 80 percent of the working population, highlighting their crucial role in the nation's economic growth. Thus, it is imperative to address the obstacles that hinder their contribution to the country's growth (Republic of Kenya, 2007).

Despite their importance, 70 percent of MSEs in Kenya fail within their first three years of operation (Barus, Muturi, Kibati, & Koima, 2017). This high failure rate results in job losses, reduced liquidity, increased insecurity, and adversely impacts economic growth. MSEs face numerous challenges, including inadequate funding, low skill levels, poor infrastructure, political instability, and high operating expenses (Khan, Khalique, & Nor, 2014). Other factors contributing to business closures include losses incurred from businesses and declining income levels. To survive in a competitive environment, MSEs must adopt use of modern technology. (Robbins, Coulter, & Vohra, 2009).

The Kenyan government, as the primary regulator and licensor, plays a crucial role in development and sustenance of MSEs. Since the 1980s, the government has collaborated with donor agencies to enhance productivity in the MSE sector by replacing outdated technology with modern alternatives. Despite the potential benefits of technological innovations, it remains unclear how or whether the use of technology has enhanced organizational performance (Abir & Chokri, 2010).

As a result, MSEs are increasingly turning to innovation and technology to remain viable. Senge, Carstedt, & Porter (2001) argue that adopting and using technology is a fundamental strategy for entrepreneurs to ensure sustainable growth while addressing the challenges faced by MSEs in a competitive environment. Therefore, understanding how different MSEs, categorized by factors such as education level, business experience, and age, perform due to the influence of adopted technology is essential for effective policymaking.

Previous studies have explored various areas related to performance of MSEs. Kuuya (2015) examined factors influencing technology adoption in the informal sector, Anjum (2018) studied the performance of technology adoption by SMEs, and Mutwiri (2018) investigated the effect of technology on market entry by SMEs. However, these studies focused on market entry and technology adoption, with limited attention to the impact of technology on MSE performance. This study aims to fill this gap by examining the effect of technology use on the performance of MSEs in Nairobi City.

1.3 Research Questions

The following important questions were the focus of the research:

- i. What effects do marketing innovations have on the performance of Micro and Small enterprises in Nairobi City?
- ii. What effects does payment technology have on the performance of MSEs in Nairobi City?
- iii. What is the effect of Process and service innovation on the performance of MSEs in Nairobi City?

- iv. What is the effect of product distribution innovation on the performance of MSEs in Nairobi City?

1.4 Objectives of the Study

The goal of the research was to analyze the effect of adopted technology on the performance of micro and small enterprises in Nairobi City County. The specific objectives are:

- i. To establish the effect of marketing innovations on the performance of MSEs in Nairobi City.
- ii. To establish the effect of payment technology on the performance of MSEs in Nairobi City.
- iii. To determine the effects of Process and service innovations on the performance of MSEs in Nairobi City.
- iv. To establish the effect of product distribution innovation on the performance of MSEs in Nairobi city.

1.5 Significance of the study

The study will be of importance to both the county, and national governments and also other stakeholders such as the donors. The findings of the study will offer a foundation for almost all government policies in the economic system regarding MSEs. The policymakers would be able to make policy improvements that will promote adoption technology. This will likely lead to swift growth of MSEs. Existing and potential entrepreneurs will find the information from the study useful, since they will be able to gather useful information on technology adoption and usage that other performing MSEs use and therefore take advantage of it.

Finally, the findings of the study will also be of significance to the donors especially those who support transfer of suitable technology to locals. Donors will be able to know the suitability of various technologies that can aid in the growth of the sector.

This study addresses a notable gap in the current literature by focusing specifically on the effect of adopted technology on the performance of Micro and Small Enterprises (MSEs) in Nairobi. This study adds insights that improve the literature available on the importance of technology in business success, especially in emerging economies, by looking at how various technologies affect MSE performance.

1.6 The Limitation and Scope of the Study

The target population were the owners or managers who dealt in retail and wholesale goods Nairobi City CBD. It was estimated that about 8259 registered MSEs were in Nairobi City County, with 752 of them found within the Nairobi Central Business District as per Nairobi County (2022). Only MSEs that dealt in goods and services and worked in a permanently rented premise were sampled. This was dictated by the necessity to avoid a lower response rate, given that most of them who didn't work in a permanent premise kept no records and worked temporarily. This meant that MSEs running their business in open spaces were not considered by the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, the study will focus on the theoretical and empirical literature relevant to the study. It is grounded on the contributions of various writers in the development of MSEs through technology and innovations. Finally, the chapter will give a reviewed summary.

2.2 Theoretical Literature

2.2.1 The adoption and diffusion process of technology theory

Diffusion and adoption of technology have different meanings. Diffusion of technology is the dispersal or spreading of a technology across a populace over time while adoption of technology is a measure of its implementation at a point in time (Thirtle & Ruttan, 1987). The adoption of technology is not a stationary process. Current adopters of technology might have been at an earlier time, non-adopters. Contrary, the current non-adopters of technology might have been the earliest adopters. The diffusion of innovation has proven to be an important theory for explaining the dynamics of communication. This leads to many studies going beyond an analysis of current adoption but rather historical documentation of adoption. The literature on the diffusion process takes an assumption that the cumulative adoption is an S-shaped curve with slow growth in the use of technology initially and then followed by an abrupt rise and it slows down as it approaches maximum. The logistic function is commonly used to portray the curve. The Y-axis represents the proportion of adoption, while the X-axis is for time.

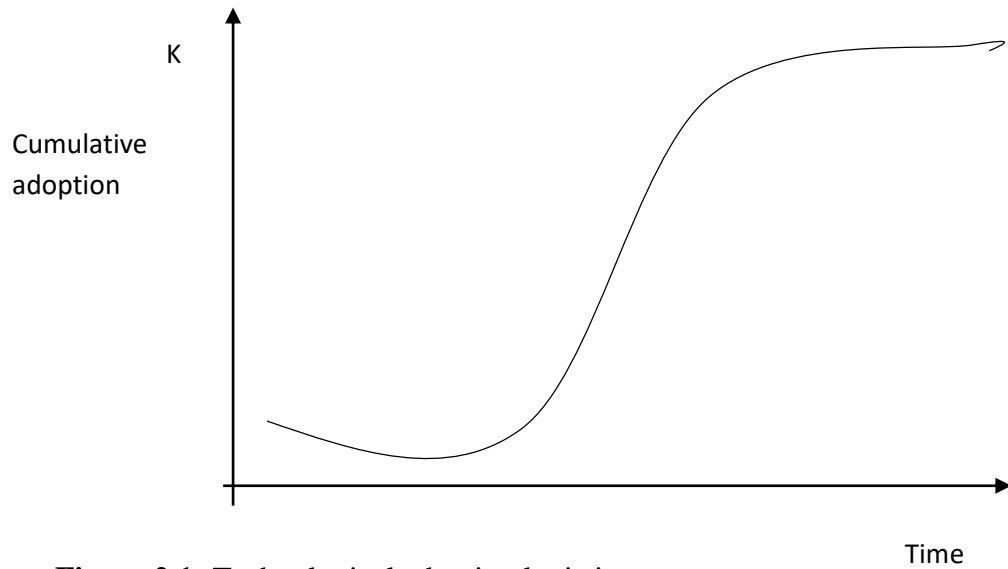


Figure 2.1: Technological adoption logistic curve
Source: Thirtle and Ruttan, 1987.

It can be expressed mathematically as:

$$Y_t = \frac{K}{(1 + e^{-a-bt})}$$

Where:

Y_t = The total adopters at time t in percentage

κ = The upper bound for adopters

b = constant associated with the rate of adopters

a = constant associated with the time beginning of adoption.

The logistic curve may be a common way of describing diffusion of technology but it is based on assumptions of diffusion. Other parameters remain constant for the time when the curve is fitted.

Surveys are done to obtain information on the history of adoption. Such analysis is useful for projecting future input demand to quantify the change in users of technology to be able to assess the impact on economic units. The theory applies to the study in that when an innovation is adopted it improves the performance of MSE. However, the theory assumes a homogeneous population of adopters, which may not reflect the diverse nature of MSEs in Nairobi. MSEs vary significantly in terms of resources, capabilities, and readiness to adopt new technologies

2.2.2 The Technology, Organization, and Environmental Context

The Technology, Organization, and Environmental Context (TOE) was advanced by Tornatzky and Fleischer (1990). The theory identifies a context in which a technological innovation is adopted and implemented (Figure 2.2). The technological context in this case explains the relevant technologies to the firm that are either internal or external. They comprise equipment, firm practices, and external technology available to an organization. The organizational context explains the scope, structure of management, and size of a firm. The context of the environment deals with the location of the business, like government, competitors, and the industry (Tornatzky & Fleischer, 1990).

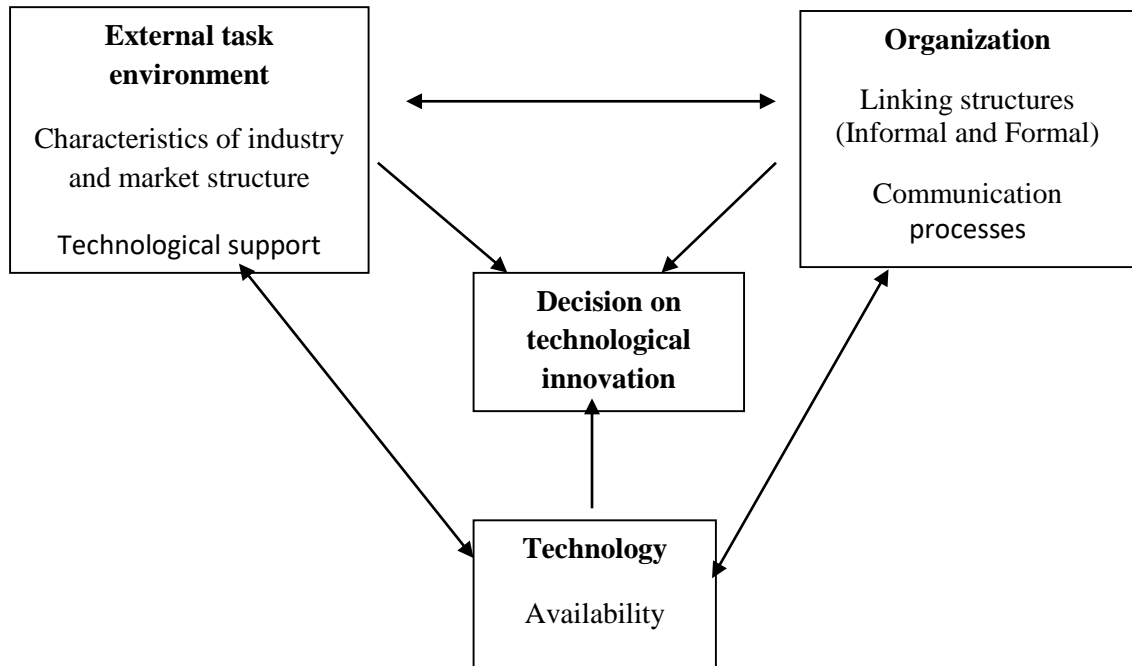


Figure 2.2: Technology, Environment, and Organizational Framework
Source: (Fleischer and Tornatzky, 1990)

The framework of the theory as it was dispensed initially and adopted later for technology studies provides a suitable framework for the analysis of innovations and technology studies. This theory has a solid foundation, though some of the factors observed within the three contexts differ according to studies.

The TOE framework is almost similar to the Diffusion of innovation theory by Rodgers (1995). Rodgers in his study underscored specific characteristics as drivers for innovations. A different factor in TOE is the environmental context. The study sought to determine how technology, environment, and organization affected the performance of MSEs.

2.2.3 Diffusion of Innovations

Rodgers in 1995 put forward that the theory was to find out the basis for researching on acceptance of innovation and adoption. Rodgers combined research from 508 studies

and came out with the theory. This theory explains the “process in which an innovation is transferred in a social system through the channel over time”.

Rogers put forward four essentials that impact the spread of ideas; innovation, social system, time, and communications channel. The process depends heavily on human capital. Innovation should be adopted vastly for the innovation to be self-sustaining.

Essentially, diffusion is the process of communicating in a social system of innovation over time. The study used mean and standard deviation as basic parameters to classify adopters. The theory explains that adoption and innovation happen after numerous stages; understanding, persuasion, decision, implementation, and confirmation which led to the establishment of the theory. The theory adopted an S-shaped curve where it comprises innovators, early adopters, early and late majority, and laggards as seen below;

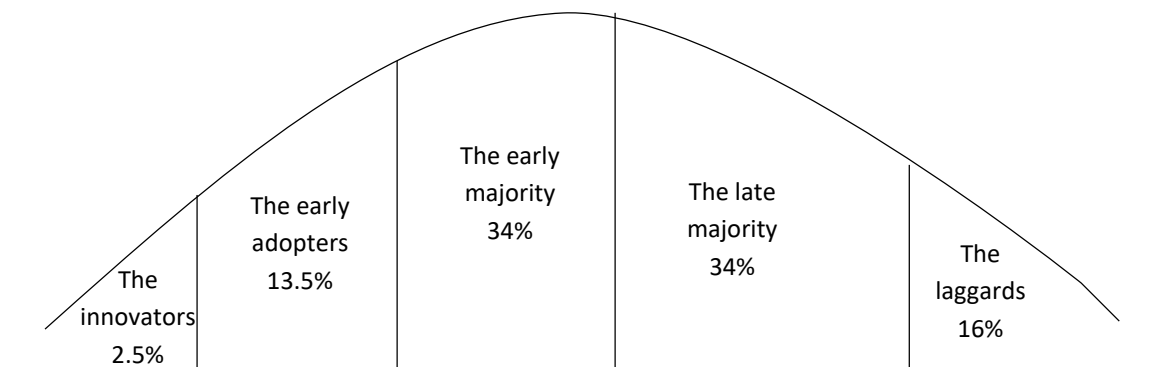


Figure 2.2: Adoption Categorization
Source: Adoption innovation curve (Rogers, 2003)

This normal distribution is broken down by Rogers into sections that lead to assigning adopters of innovation into categories as shown (Figure 2.2). Innovators here are a group of technology adopters who are fanatics, daring, and educated with numerous information on innovation. The early adopters of an innovation are a group of adopters

with popularity and education, they are social leaders. The early majority group is a cluster of pragmatic adopters with a deliberate intention to adopt. The late majority group is a cluster of conservatives with lower economic and social status. Laggards are a group of skeptics who hinge on their neighbors for information and are fearful of debt (Rogers, 2003). DOI provides a comprehensive framework for understanding how innovations are adopted within a social system over time. As indicated, Rogers identifies four major factors affecting this process: time, the social structure, communication routes, and innovation itself. These components are essential to understanding how Nairobi's MSEs adapt and use new technologies to enhance their operations.

2.2.4 Theory of Production

Theory of production is a concept in microeconomics that explains a firm's principle on how much goods and services it sells will be produced from a certain number of inputs; raw materials, labour, and fixed capital. The theory calculates the maximum amount of output Q that a firm can generate from a given set of inputs while keeping technology constant. This describes the production possibility frontier for vector inputs.

A firm's costs are dependent on two factors which are the technical relationship among inputs and outputs, and factor prices (the price of technology). The concept of the theory is explained in the production function. A production function demonstrates the relationship of variations in inputs and outputs. The amount of production that can be obtained from each combination of factors in the production function. It is illustrated as follows;

$$Q = f(L, K)$$

Where; Q– Firms Output

L– Labour input

K- Capital input

The quantities of the factors that are used by the firm dictate the output realized per period. However, it depends on some assumptions like the law of diminishing returns. Production functions can take different formations; a linear production function, and a Cobb Douglas among others. The Theory of Production is more suitable for this study as it provides a foundational framework to analyze how technological inputs affect the output and performance of MSEs. Its emphasis on the relationship between inputs and outputs aligned with the objectives of the study. The current study will find out how technological innovations in the capital (information technology innovations) affect performance.

2.3 Empirical Literature

Gibbs and Kraemer (2004) sought to study the determinants influencing e-commerce usage in ten nations using TOE and Institutional theory. The variables used in the study were; Organizational context (firm size, financial resources, organizational ability), Technological context (resources for technology), Environmental context (Government, legislation, External pressure) Controls, and industries (distribution, finance, and manufacture). Data was collected through telephone interviews from 2139 firms in 2002 from three sectors; manufacturing, distribution, and finance. Analysis of data was done by use of factor analysis and ordinary least squares and it was found that there were significant effects based on country such as firms from the USA having a

higher scope of use of e-commerce than other countries. Hence, firms with great technological infrastructure realize better strategic benefits from e-commerce. Therefore, the study strove to determine whether firms with technological infrastructure perceived greater strategic benefits from it.

Rono (2008) examined the performance of MSEs supported by Women's Enterprise Funds. The primary goal of the study was to identify the factors that influenced MSE performance. Descriptive statistics were used to calculate relevant statistics about MSE performance. A log-linear model demonstrated that market size was a significant factor in performance. The other variables included business skills and loan amount. The study did not consider the effect of technological adoption on MSE performance, an essential variable in MSE environments. The current study incorporated technology and collected a sample from the city of Nairobi to determine the effects on the performance of MSEs.

Tarutèa & Gatautis, (2013) analyzed the effect of ICT on the performance of MSEs. The research aimed to analyze the literature on the possible effects of ICT on the performance of MSE and to find the ones that determine business success. The research established that ICT had an impact on the external and internal improvements of communications and to have top performance, it is paramount to bring in ICT investment to the organization's goal. The study reveals that ICT affects communications both internally and externally, but it didn't go into detail about what performance indicators are used or how these gains added up to measurable business success.

Gathogo and Ragui (2014) investigated how capital and technology affected the performance of MSMEs in Kenya's manufacturing sector. The study sought to

determine the factors that contribute to the failure of small businesses. Capital, technology, management, and government policy were the primary factors investigated. The primary data was collected from Thika municipality and analyzed using descriptive and inferential statistics. The study found that technology was important, even though the MSEs were mostly manually driven. By concentrating on the manufacturing sector, the study does not capture the diverse challenges and opportunities present in other sectors of the MSE ecosystem, such as services or retail. The current study delved into more types of MSE which offered a more comprehensive understanding of the sector.

Kuuya (2015) studied the adoption of technology by MSEs in Kenya's informal sector, with the goal of investigating the factors that influenced adoption. The study drew on data from 320 respondents. The findings revealed that three of the five human factors had a significant impact on technology adoption. The factors include age, education level, and marital status. The study did not focus on the effect of technology and only focused on adoption. Therefore, this study attempted to borrow the variables and analyzed the influence the adoption of technology had on the performance of MSEs.

Oduori (2016) concluded that a higher level of innovation was observed among firms that targeted improving organizational competency and customer service through skills and knowledge. The study found that many firms are obliged to respond and adapt to the changing environment by being innovative to endure the competence pressure. The conclusion was satisfying customer needs as well as continuous improvements in the skills of employees was key to MSEs in Kenya. The study primarily focused on innovation related to organizational competency and customer service, potentially overlooking other areas of innovation such as product development, marketing

strategies, and technological advancements. The current study addressed these gaps by including a broader range of innovation aspects.

Anjum (2018) investigated how technology adoption affects the performance of SMEs in India. Primary and secondary data were gathered from a sample size of 300 and examined with logistic regression and linear regression. Factors including supplier relationship, formal strategy, organizational size, customer, innovation capability, innovation cost, and innovation sustenance were taken as variables that influence performance. The study showed that business performance is associated with the implementation of a good strategy relating to sales, profit earnings, and growth. It also showed that organizational size played an important role in explaining business performance. Business performance is noted to be influenced by organization size. Therefore, it can be determined that drivers of technology usage such as organization size influence MSE performance. The present study borrowed organization size and established if it had an effect on the performance of MSE.

Mutwiri (2018) investigated the effects of technological innovations on MSEs' market access in Nairobi County. The research aimed to determine how technological innovations affect market access. The target population was 1050 MSEs in Nairobi City County. The research carried out concluded that the value of product innovation contributes to market access. The study also concluded that improved customer relations have improved market understanding among MSEs. The current study borrowed product innovation and market innovation variables. However, this study did not include other important technology variables such as product distribution technology and process and service innovation variables. Thus the study aimed at

collecting data in Nairobi city and found out the effects of the adopted technology on performance.

2.4 Overview of the literature

It has been proven through literature that many factors aid the performance of MSEs. Rono (2008) in her study found that the most significant factor was market size. The importance of technology on the performance of these MSEs will be understated if it is not considered to be a factor. Adopter's age, education level, and marital status were found to be important factors in adopting a technology (Kuuya, 2015). There however exists a limitation if the study is not examined further to determine the positivity or negativity that the adoption of technology might have come with.

Anjum (2018) found out in his study on the performance of MSEs due to the adoption of technology in India that business performance was due to business owners having a good strategy relating to sales, profit earnings, growth, and size of the business. In Kenya, the issue of underperformance and performance of MSEs continues thus calling for further study in the area.

From the literature reviewed, a lot can be deduced from the roles played by technology and innovations. Beaver (2002) believes that innovation and technology are important elements for economic development and competitiveness in the industry. De Jong & Vermeulen (2006) assert that technological know-how is significant to large firms and MSEs. The studies reviewed revealed little innovations and MSE performance in Nairobi City. Thus, this research intended to fill the gap.

The performance of the firm is the outcome of meeting in internal and external objectives of the firm (Tan *et al.*, 2009). Thus, for the study, financial indicators were

good as a measure of performance but non-financial indicators are also good and rarely studied and can be used to judge the performance of the firms. The study used financial and non-financial indicators.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section covers the following areas: research design, model specification and estimation, variable measurement and definition, data analysis techniques, and diagnostic tests.

3.2 Research Design

The study followed a non-experimental research design. The cross-sectional data was analysed using both qualitative and quantitative methods. The sampling method was random, and data was gathered using an interview schedule. Inferential and descriptive statistics were computed. Gathering data through an interview schedule allowed for detailed and nuanced insights directly from the participants, which was essential for understanding the specific effects of technology adoption.

3.3 Theoretical Framework

The study adopted the theory of firm, specifically the Cobb-Douglas production function. Technology, labor, and capital were considered as inputs

A Cobb-Douglas production function for MSE firm i is expressed as follows:

$$Y_i = (A_i L_i)^\alpha K_i^\beta \quad i = 1, 2, \dots, n \quad (3.1)$$

Where:

n – The overall number of MSE firms

Y – Measure of Output/Sales

A – Technology

L – Labour

K – Capital

A L – effective labour

α and β – elasticities of effective labor and capital respectively.

Equation 3.1 can be linearized so that regression techniques can be applied.

$$\ln Y_i = \alpha \ln A_i + \alpha \ln L_i + \beta \ln K_i \quad (3.2)$$

Where; $\ln Y$ is the natural log of output, $\ln A$ is the natural log of technology or innovation adopted, $\ln L$ is the natural log of labor employed, and $\ln K$ is the natural log of capital in place. α and β are coefficients of natural logarithms of labor and capital respectively.

According to Romer (2019), the effectiveness of labour A captures other factors other than labour and capital which affect output. This includes knowledge and different types of technology that firms can use in production. In this regard, A in equation 3.2 can be disaggregated into different components including technology and other firms' characteristics.

3.4 Model Specification

Equation 3.2 is then specified to account for the different components of A as follows for the i^{th} firm

$$\begin{aligned} \ln y_i = & \alpha_0 + \alpha_1 Mrt_i + \alpha_2 Py_i + \alpha_3 Ps_i + \alpha_4 Pd_i + \alpha_5 Bm_i + \alpha_6 Pr_i + \alpha_7 Sec_i \\ & + \alpha_8 Ter_i + \alpha_9 \ln Fa_i + \alpha_{10} \ln Ne_i + \alpha_{11} M_i + \alpha_{12} F_i + \alpha_{13} \ln K_i \\ & + \varepsilon_i \end{aligned}$$

$$i = 1, 2, \dots, n \quad (3.3)$$

Where:

n – overall number of firms in the sample

3.5 Definition and measurement of variables

Table 3.1: Definition and measurements of variables

Variable	Definition	Measurement
y	MSE performance	Firms total output in shillings within a year (turnover)
Py	Payment technology	Measured as follows: Py = 1 for payment technology and 0 for not adopted
Mrt	Marketing innovations	Measured as follows: Mrt = 1 for Marketing innovations and 0 for not
Ps	Process and service innovations	Measured as follows: Ps = 1 for Process and service innovations and 0 for not adopted
Pd	Product distribution innovation	Measured as follows: Pd = 1 for Product distribution innovations and 0 for not adopted

K	Capital Stock	Value of physical capital of the firm in Shillings
M	Male Gender	Measured as follows: M = 1 for male ownership and 0 for female or joint ownership
F	Female Gender	F = 1 for female ownership and 0 for male or joint ownership
Ne	Number of employees	Measured by the number of employees in an MSE
Pr	Primary education as the Maximum level of education	Measured as follows: Pr = 1 for primary education and 0 for Secondary, tertiary, or none
Sec	Secondary education as the Maximum level of education	Measured as follows: Sec = 1 for secondary education and 0 for primary, tertiary, or none
Ter	Tertiary education as the Maximum level of education	Measured as follows: Ter = 1 for Tertiary education and 0 for primary, secondary, or none
Bm	business management skills	Measured as follows: Bm = 1 studied and 0 for not studied
Fa	Firm age	Measure of the number of years of business

3.6 Study Area and Target Population

The target population comprised businesses around the CBD, registered in Nairobi City, engaged in manufacturing, commercial and trade, and services. Particular attention was given to the owners or managers of MSEs. This area was chosen because Nairobi is Kenya's capital city, making it possible to find various types of innovations. According to Nairobi City County (2022), there were 8259 registered MSEs, with 752 of them located in the Nairobi Central Business District (CBD).

3.7 Sample Design and Sample Size

The sampling frame used for the research was established through a random sampling method, considering the nature and inconvenience of Nairobi City. The non-probability sampling method was chosen to have a sample that was easy to contact and reach. This sampling method involved participants who were available and willing to participate.

$$n_0 = \frac{1.96^2 \times P(1 - P)}{e^2}$$

where; n– the sample size

p – Proportion

e – error

$$\begin{aligned} n_0 &= \frac{1.96^2 \times 0.5(1 - 0.5)}{0.05^2} \\ &= 384 \end{aligned}$$

Because the target population of MSE firms is less than 10,000, the sample size will be adjusted as follows;

$$nf = \frac{n}{1 + \frac{n}{N}}$$

Where:

nf = desired sample size for a population of fewer than 10,000.

n = the estimated sample size

N = total population

$$nf = \frac{384}{1 + \frac{384}{752}}$$

$$=254$$

The targeted number was 340 to take account of non-response.

3.9 Research Instruments and Data Collection Procedure

Data was gathered using a questionnaire. It was administered to the MSEs in Nairobi City. Data was obtained from the MSE owners within the area of study. A questionnaire was administered to collect primary data.

3.10 Data Analysis

The gathered data was coded appropriately and entered for analysis. Before the responses were processed, data preparation was conducted on the completed questionnaires. This included tasks such as editing, coding, entering, and cleaning the data. The questionnaire's reliability was examined through Cronbach alpha and was found to be 0.72, which was regarded as reasonably sufficient for this study. To accomplish the objectives of the study, a cross-sectional regression equation was estimated. The following diagnostic tests were carried to ensure that reliable results were obtained:

- a) Heteroscedasticity – a linear regression model takes the assumption that an error term has a constant variance cross-sectionally. Heteroskedasticity occurs when the variance of an error term is non-constant. The consequence of this violation is that the parameter estimates or estimates of the coefficients are inefficient meaning that they no longer have the lowest variance amid linear and unbiased estimators (Brooks, 2008). As a result, tests of the hypothesis are no longer

valid. The test for heteroskedasticity is commonly undertaken using the White test. White's test uses the null hypothesis that the data is homoscedastic. If the P-value exceeds 0.05, we do not reject the null hypothesis. If the test is carried out and heteroskedasticity exists, then a correction is done on the regression using White robust estimates or the Newey-West procedure.

- b) Multicollinearity – this happens when there is a correlation between independent variables in a model. If ignored, the standard errors of the coefficients in a regression model will be high making the regression seem good but with insignificant variables. Another consequence of this is that the regression becomes very sensitive to small changes. It can be detected using the VIF. Multicollinearity is present when the value of the Variance Inflation Factor is more than 5. Correlation analysis is also used where a correlation coefficient of 0.8 or above in absolute terms indicates the presence of multicollinearity. One of the ways to correct it is to remove one of the collinear variables so that the problem goes.
- c) Normality - A normality test is a test to ascertain whether a sample has been picked from a normally distributed population. If ignored, the distribution will lack symmetry and may have extreme values. Bera-Jarque test can be used to determine the skewness and kurtosis that match a normal distribution. At the five percent significance level, the null hypothesis is accepted if the P-value is higher than 0.05. This can be corrected by cleaning data.

The estimated results were interpreted using the t-test to determine the significance of the variable coefficients and the F-test to determine the overall significance of the regression in terms of the R². Descriptive statistics on the variables will be calculated in terms of frequency and percentage. Furthermore, descriptive statistics for the

technology variables were obtained in the form of a frequency distribution of numbers and percentages.

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

The chapter provides a comprehensive overview of the descriptive statistics and empirical findings from the study on the effect of technology adoption on the operational performance of micro and small businesses in Nairobi City County. Furthermore, diagnostic tests were performed to verify the reliability of the study's results.

4.2 Descriptive Statistics

Table 4.1 shows the study's frequency distribution and the effects of adopted technology on MSEs in Nairobi City. The study considered the following variables: gender, level of education, business experience, business management skills, type of business, marketing innovation, payment method technology adoption, process and service technology adoption, and distribution technology adoption.

Frequencies and percentages for the education level, gender, business management skills, and type of business of the respondents are presented in Table 4.1:

Table 4.1: Descriptive Statistics

		Respondents	Percentage
Education Level	None	3	1.11
	Primary School	6	2.22
	Secondary School	46	17.04
	Tertiary	215	79.63
	Total	270	100.00
Gender	Both Genders (owned by a male & Female)	27	10.00
	Female	80	29.63
	Male	163	60.37
	Grand Total	270	100.00
Business Management	Not Studied	100	37.04
	Studied	170	62.96
	Grand Total	270	100.00
Type of Business	Accommodation and Catering	17	6.30
	Agriculture, Forestry, & Resources	1	0.37
	General Trade, Wholesale, Retail,	142	52.59
	Industrial plants, factories,	39	14.44
	Private education, Health,	4	1.48
	Technical and Financial Services	49	18.15
	Transport, storage,	18	6.67
	Grand Total	270	100.00

Source: Research Data 2023

Table 4.1 shows that majority of MSE owners in Nairobi City County (79.63%) had tertiary level of education. 17.04 and 2.22 percent of those surveyed had secondary and primary levels of education, respectively. Those with no education were 1.11 percent, this implies that a very small percentage of MSE owners in Nairobi City County did not have any formal education. From the descriptive statistics results it is clear that MSEs in Nairobi City County are being operated by educated persons. Educated people may be better at identifying market opportunities and meeting consumer needs. As a result, businesses that are well-aligned with market demands are more likely to succeed. It could also mean that with a big number of entrepreneurs being at tertiary level, it

could imply that more people are resorting to self-employment due to unemployment levels. The results were consistent with Waithaka (2017) who found out that the majority of business owners had attained an undergraduate degree which was an indicator that many entrepreneurs had a higher literacy level. The study was conducted in an urban area with numerous higher education institutions, which might be a factor that allows city residents to access higher education easily.

The majority of the MSE owners or managers were male who were 60.37, compared to females who accounted for 29.63 percent of the respondents. Reasons could be due to social factors such as parental care, where women are the caregivers, thus limiting their ability to fully participate in the full-time operation of businesses. Another reason could be that men have easier access to credit than women because they can easily obtain security and thus more men have ownership of the enterprises. The findings also showed that MSEs that are jointly owned by males and females accounted for 10.00 percent of the sample. These findings on gender distribution are consistent with Mutwiri (2018) who carried out a study on the effects of technology innovation on access to markets by small and medium enterprises in Nairobi and found that there was a gender imbalance in ownership of businesses where there were more male ownerships than female. It's important to note that these trends of one gender having more ownership over the other are evolving as there is an increasing awareness of the significance of diversity and inclusivity in business by government and development partners.

Table 4.1 shows that the majority of MSE owners (62.96%) had at least attended a training in Business Management, while 37.04 percent did not possess business management skills. It implies that with these skills, an entrepreneur can assist a business in gaining credibility, increasing efficiency, managing risks, implementing effective

strategies, cultivating a positive company culture, and expanding. However, at 37.04 percent, there is still a notable number of individuals who had not acquired any skill in business management. The results were consistent with Mwangi (2020) who conducted a study on entrepreneurship training and found that up to a third of business owners did not have any entrepreneurial training. Business management skills are important since it has been established that businesses whose owners possess the skill perform better.

On the type of Business, General Trade, Wholesale, Retail, and Stores categories held the largest share of businesses in the study with 52.59 percent. This could be because it requires minimal entry barriers, making it accessible to small entrepreneurs with limited resources. Technical and financial services was 18.15 percent, while industrial plants, factories, workshops, and contractors closed on the top categories at 14.44 percent. Agriculture, Forestry, and Resources was 0.37 percent, Private education, Health, and Entertainment at 1.48 percent, Transport storage and communication at 6.67 percent, and Accommodation and Catering at 6.30 percent. The results provide an insight into the diversity of businesses that are operated in Nairobi City County. The results were consistent with Mutwiri (2018) who found that most MSEs in Nairobi were involved in trade as opposed to manufacturing and service provision. The categorization was crucial for understanding consumer preferences, market trends, and competitive landscapes within specific industry segments.

Table 4.2 presents descriptive statistics of the MSEs in Nairobi City CBD. The variables are the number of years in operation, number of employees, turnover, and capital.

Table 4.2: Descriptive Statistics on Number of Years in Operation, Number of Employees, Turnover and Capital.

Variable	Mean	Standard Deviation	Minimum	Maximum
Sales in the last one year (KSh)	1,621,004	2,202,734	30,000	16,000,000
Physical capital (KSh)	1,201,571	2,413,696	10,000	30,000,000
Years in operation	5.52	3.82	1	20
Number of Employees	2.55	2.13	1	10

Source: Research Data 2023

Table 4.2 shows that the mean sales were KSh 1,621,004, which provided a sense of the typical number of sales that the business sampled made on average in the last one year. The standard deviation of KSh 2,202,734 showed the extent of variability in sales among these enterprises. The minimum and maximum sales figures were KSh 30,000 and KSh 16,000,000 respectively. The difference between the minimum and maximum values indicates the spread or dispersion of sales data which could be caused by competitive landscapes or economic downturns. This variable was of paramount importance as it helps assess the financial health and performance of these businesses. It provided insights into their revenue generation capacity, which is vital for identifying their economic contributions and evaluating their growth potential.

The physical capital had a mean value of KSh 1,201,571, the standard deviation was KSh 2,413,696, while the minimum and maximum values were KSh 10,000 and 30,000,000 respectively. Physical capital allows MSEs to scale their operations, expand, and compete in their respective markets. Businesses with higher physical capital may have a competitive advantage, while those with lower capital may face challenges in growth and development. The findings are consistent with the findings of Siba (2015) who conducted a study using parametric and semi-parametric regression techniques to examine returns on capital in Ethiopia's formal and informal sectors.

According to the study's findings, the annual return on capital was higher in the informal sector.

Years in Operation provided insights into the experience and stability of businesses. The average years of operation was 5.52 with a standard deviation of 3.82. The minimum was 1 year which represented newly established businesses, while the maximum was 20 years these were businesses that were well-established, and long-standing enterprises. The years in operation variable was instrumental in assessing the resilience and longevity of these businesses. It offered valuable information on factors that contributed to their survival, growth, and competitiveness. Newer businesses may encounter different challenges and have distinct needs compared to well-established ones. These data findings were similar to Mutwiri (2018) who found that most businesses in operation had been in existence for more than five years.

The number of employees played an important role in determining the size of these businesses. The mean number of employees was 2.55, and the standard deviation was 2.13. According to the study, the minimum number of employees was one and the maximum was ten, indicating that the businesses had a large workforce. The number of employees determines the size of the company, which can have an effect on their performance. Wanjiru (2020) found out that the business's employment capacity can be used to measure its performance. This implies that the number of employees or workforce size within a business can be used to predict the business's overall performance. In other words, it points toward a correlation between a business's ability to create job opportunities and its overall success or health.

Table 4.3 shows the percentage of MSEs in Nairobi City that had adopted marketing innovation, payment method innovation, process and service innovation, and distribution of products as a form of technology.

Table 4.3: Distribution of Marketing Innovation, Process and Service Innovation, Payment methods, and Product Distribution

Marketing Technology Adoption		Respondents	Percentage
	Yes	183	67.78
	No	87	32.22
	Total	270	100.00
Payment Technology Adoption	Yes	228	84.44
	No	42	15.56
	Total	270	100.00
Process and Service Technology Adoption	Yes	152	56.30
	No	118	43.70
	Total	270	100.00
Distribution Technology Adoption	Yes	167	61.85
	No	103	38.15
	Total	270	100.00

Source: Research Data (2023)

Table 4.3 shows that 67.78 percent of MSEs had adopted marketing innovation as a form of technology to improve the performance of their MSEs compared to 32.22 percent that had not adopted it. This implies that MSE products might have penetrated the market since the adoption of marketing technology, and this might have a positive impact on their performance. Marketing innovation is essential for businesses as it reflects their capacity to develop new strategies and approaches to reach and engage customers. Mutwiri (2018) found out that enhanced marketing increased understanding of customer needs and hence market penetration by MSEs.

The findings also revealed that many MSEs had adopted a payment method technology to improve the ease of doing business. 84.44 percent of the MSEs in Nairobi City CBD

have adopted a payment method technology as opposed to only 15.56 percent who have not introduced a payment method technology. The payment methods technology accepted by a business had significant effects on its operations. Businesses that have adopted payment technologies, for example, may have benefited from increased efficiency, lower transaction costs, and higher customer satisfaction. Putri, Yolli Eka, et al. (2019) did a study on methods of payment adopted in Indonesia's e-commerce and found that Payment options offered by the e-commerce platform influence customer purchasing decisions. Thus, this reflects on the overall business performance.

On product distribution technology, the findings revealed that 61.85 percent of the MSEs had adopted a product distribution technology as opposed to 38.15 percent who had not. This implies that MSEs who had adopted product distribution technology might improve the distribution of products and this might eventually lead to an improvement in their performance. Ron (2019) who studied on evolution of technology distribution found out that the Internet of Things (IoT) technology enables precise order and shipment monitoring, and simplifies the tracking of customer purchases, transportation, and supply locations.

4.4 Diagnostic Tests

4.4.1 Normality

To make sure the data collected for the study was normal, the Jarque-Bera test was employed. The Jarque-Bera test evaluates goodness-of-fit by figuring out if the sample data's kurtosis and skewness match those of a normal distribution.

Jarque-Bera normality test: 6.615 Chi (2) .0566

Jarque-Bera test for Ho: normality:

The Jarque-Bera statistic, according to the test results, is 6.615 and has a p-value of 0.0566, which is higher than the 0.05 significance level. As a result, the null hypothesis was not rejected, and the data did not deviate from the normal distribution. If normality is not met, for samples with a sufficiently large sample, the violation of normality assumption is inconsequential (Brooks, 2008).

4.4.2 Heteroscedasticity

To test for heteroskedasticity, the study adopted a White's test to check whether the data was homoscedastic.

White's test for Heteroskedasticity:

Ho: homoskedasticity

Ha: unrestricted heteroskedasticity

$$\text{chi2}(68) = 78.77$$

$$\text{Prob} > \text{chi2} = 0.1748$$

Table 4.4: Cameron & Trivedi's decomposition of the IM-test

Source	chi2	df	p
Heteroskedasticity	78.77	68	0.1748
Skewness	18.70	11	0.0667
Kurtosis	4.17	1	0.0412
Total	101.64	80	0.0517

Source: Research Data (2023)

A chi-squared statistic of 78.77 with a p-value of 0.1748 is displayed in the White's test results. Since the significance level of 0.05 is less than the p-value of 0.1748, the null hypothesis was not rejected. White's test results show that the variance of the errors does not differ significantly across different levels of the independent variables in the regression model.

4.4.3 Multicollinearity

The VIF was used in the study to examine Multicollinearity. Following Field's (2009) guidelines, VIF values exceeding 10 signal the existence of Multicollinearity. Table 4.5 presents VIF results, indicating the absence of multicollinearity.

Table 4.5: Variance Inflation Factor

Variable	VIF	1/VIF
Secondary	15.32	0.065268
Tertiary	13.95	0.071668
Male	3.23	0.309751
Female	3.08	0.324194
Primary	3.01	0.332474
Marketing Innovation	1.92	0.521245
Logarithm of Capital	1.88	0.533111
Process and Service Innovation	1.64	0.611066
Logarithm of Number of Employees	1.48	0.676925
Logarithm of Firm Age	1.35	0.740910
Payment Methods	1.27	0.789798
Product Distribution	1.24	0.809394
Business Management Skills	1.16	0.859430
Mean VIF	3.90	

Source: Research Data (2023)

Multicollinearity was not present in the model. If multicollinearity was present but ignored then R² would be high but the coefficients would have high standard errors so that it would make the regression model look good but the individual variables would be insignificant.

4.6 Effect of Technology Adoption on Performance of MSEs

The linear regression analysis was used to examine the effect of technology on the performance of MSEs in Nairobi City County CBD. The dependent variable for the study was the performance of MSE measured by turnover. The independent variables for the study were; Tertiary education, Secondary education, Primary education,

gender, firm age, capital, marketing innovation, product distribution innovation, payment technology, process and innovation, number of employees, and business management skills. The gender and education variables were categorical variables with three categories for gender; male, female, and jointly owned by a man and a woman. Education had tertiary, Secondary, Primary, and none variables. Thus, the study used both genders and none categories as a reference category for gender and education respectively. Table 4.6 presents the linear regression results.

Table 4.6: Regression Analysis

Variable	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
Log of Number of Employees	.3535332***	.0873235	4.05	0.000	.1815757	.5254907
Log of Years in Operation	-.1329461	.0861052	-1.54	0.124	-.3025045	.0366124
Log of Capital	.2701133***	.0408997	6.60	0.000	.1895736	.350653
Business management Skill	-.0632726	.1110931	-0.57	0.569	-.2820372	.155492
Process and Service Innovation	.3208985**	.1303894	2.46	0.015	.0641355	.5776616
Payment Methods	.3698337**	.1571081	2.35	0.019	.0604562	.6792111
Product Distribution	.2761561**	.1157955	2.38	0.018	.0481315	.5041808
Marketing Innovation	.7783317***	.1499832	5.19	0.000	.4829847	1.073679
Female	-.052762	.1946366	-0.27	0.787	-.4360407	.3305167
Male	.0966111	.1858903	0.52	0.604	-.2694444	.4626666
Tertiary	.4741027	.5026588	0.94	0.346	-.5157701	1.463975
Primary	.0241644	.5952256	0.04	0.968	1.147998	1.196327
Secondary	.6213918	.4916851	1.26	0.207	.3468709	1.589654
_cons	8.585286	.5090926	16.86	0.000	7.58278	9.587792
Linear regression				Observations	=270	
				F (13, 256)	=38.88	
				Prob > F	=0.0000	
				R-squared	=0.6254	
				Adj R-squared	=0.6064	
				Root MSE	=.8313	
*** Significant at 1%, **Significant at 5%						

Source: Research Data (2023)

The linear regression model finds that the variables related to capital, process and service innovation, payment methods technology, marketing innovation, and product distribution technology, as well as the number of employees, were statistically significant in explaining the performance of MSEs, with P-values of less than 0.05 at the 95 percent significance level. These findings are based on the regression results presented in Table 4.6. Consequently, independent variables such as tertiary education, secondary education, primary education, firm age, business management training, and gender dummy variables for males and females were found to be statistically insignificant at 5 percent level of significance with p-values being greater than 0.05.

The log of capital coefficient was positive and statistically significant at the one percent level. This means that if capital use increases by one percent, performance in terms of turnover will increase by 0.27 percent. The research findings aligned with those of Gathogo and Ragui (2014), who observed that capital was a critical factor in improving business performance and competitiveness.

At one percent, the number of employees' log coefficient was positive and statistically significant. This meant that for every one percent increase in the number of employees, MSE's performance increased by 0.354 percent. This is consistent with Rono's (2008) findings, which found out that the number of employees in a business had a positive effect on the performance of MSMEs.

A marketing innovation technology adopted had positive effects on MSE performance because its coefficient was positive and statistically significant at one percent. Marketing innovation technology could encompass various tools and strategies used for marketing purposes, such as digital advertising, social media marketing, or data analytics. When MSEs adopt such technology, it may lead to better market visibility,

improved customer targeting, and more effective marketing campaigns. This was consistent with Waithaka (2017) who found out that in the success of SMEs, innovation plays an indispensable part as a vital driver that helps SMEs adapt to changing market dynamics, enhance competitiveness, and ensure long-term sustainability.

Payment technology adoption was observed to have a positive influence on the performance of Micro and Small Enterprises, with a positive and statistically significant coefficient of five percent. Payment technology adoption could include the use of electronic payment systems or mobile payment apps. By embracing these technologies, MSEs can streamline their payment processes, enhance convenience for customers, and reduce transaction costs. Tarute and Gatautis (2014) concluded that Information and Communication Technology (ICT) significantly influenced the performance of organizations. To achieve optimal performance, ICT investments must be aligned with internal capabilities and organizational processes, ensuring seamless integration and efficiency. Drawing from a study conducted in Kenya concerning innovation and MSEs, it was determined that Small and Medium-Sized Enterprises (SMEs) that embraced innovation exhibited noticeable growth (Kiraka, 2013).

Process and service innovation proved to have a positive and statistically significant influence on the performance of Micro and Small Enterprises, with a coefficient of five percent. Process innovation involves improving the way a business operates, making it more efficient, cost-effective, and productive. Service innovation, on the other hand, pertains to enhancing the quality or variety of services offered to customers. According to Hughes (1997), MSEs that underwent expansion frequently adopted product or process innovation. Mutwiri (2018) revealed that the size of the firm performed a pivotal role in the adoption of innovation and moreover, it highlighted that product

innovation had the most substantial impact on SMEs' access to markets, closely followed by service innovation.

Adopted product distribution technology was found to have a positive effect on Micro and Small Enterprises' performance, as evidenced by its positive and statistically significant coefficient at five percent. This led to improved supply chain management, reduced delivery times, and potentially expanded market reach. Efficient product distribution is crucial for ensuring that products reach customers in a timely and cost-efficient manner, which can boost MSE performance. Mutwiri (2018) aimed at investigating the effects of technological innovations on access to markets, found out that SMEs were consistently enhancing their processes to deliver greater value to customers through innovation.

The ownerships of MSE in terms of male-only ownership and female ownership in relation to joint ownership were not important in determining the performance of MSE. The result was contrary to Karadag (2017), who conducted a study on the impact of industry, education level, and firm age on the financial performance of small and medium-sized enterprises in Turkey, and discovered that the education level of small business owners demonstrated a robust and favorable relationship with their performance. This was also seen in Education where, the tertiary level, secondary level, and primary level in relation to none were not significant in determining the performance of MSEs. It doesn't necessarily mean that these variables are unimportant in all situations, but rather that within the scope of this study and dataset, they did not show a significant effect on MSE performance.

This study shed light on the valuable role that technological innovation played in the improvement of MSE's performance. For instance, the online market emerged as a

significant channel for placing orders and conducting transactions through the Internet. According to Becheikh et al. (2006), technological innovation plays a crucial role in giving companies a competitive advantage when it comes to accessing markets. The World Wide Web serves as an exceptional platform for MSEs to expand and explore new market opportunities. Internet therefore plays a fundamental role in enhancing both market access and operational efficiency for organizations. The study is consistent with the theory of production where it argues that the performance of MSEs is well explained by capital and technology. This study aligns with the findings of various other studies, including Mutwiri (2018), Waithaka (2014), and Rosli, M. M., & Sidek, S. (2013), who observed that the integration of technology by small business owners led to enhanced business performance. The incorporation of technological innovation is widely believed to not only enhance an organization's performance but also drive growth and ensure its survival (Anjum, 2018).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter provides summary, conclusions, and policy implications arising from the effect of technology adoption on the performance of Micro and Small Enterprises (MSEs) in Nairobi City. Furthermore, it identifies potential areas for further research.

5.2 Summary

The goal of the study was to ascertain how the use of adopted technology affected MSE performance in Nairobi City. To accomplish this, the study analyzed four types of technology to see how they affect the performance of MSEs in Nairobi City County CBD. The four forms of technology used in the study were marketing innovation technology, product distribution technology, process and service innovation technology, and payment methods technology.

Previous studies on the performance of MSEs did not take into account the effects of various types of technology on MSE performance. This study addressed the knowledge gap by investigating the effects of marketing innovation technology, process and service innovation technology, distribution technology, and payment methods technology on the performance of MSEs in Nairobi City County CBD.

The objectives of the study were developed based on four key technological variables being assessed. As a result, the study sought to answer several questions, which include: What effect does the adoption of marketing innovations have on the performance of MSEs? How does the integration of payment technology influence MSE performance? What implications does the implementation of process and service innovations hold for

MSE performance? What is the effect of product distribution innovation and MSE performance?

Primary data was collected by administering questionnaire tailored to the specific requirements and objectives of the study. This questionnaire was an important tool for gathering relevant information and insights from participants, ensuring that the data collected was consistent with the objectives of the Study. Several diagnostic tests were performed, including tests for heteroscedasticity, multicollinearity, and normality. The study used a White's test to determine whether the data was homoscedastic and variance inflation factors (VIF) to investigate Multicollinearity. Cronbach alpha was employed to assess the questionnaire's reliability, which was found to be 0.72, deeming it adequate for this study. Analysis was conducted, and the four technological innovation variables were found to be positive and statistically significant in explaining the performance of MSEs.

The first objective of the study was to ascertain how marketing innovation affected MSE performance in Nairobi City. The outcomes showed that marketing innovation improved the performance of MSEs. This suggests that having a technology-enabled approach to marketing goods and services is critical for entrepreneurs with small businesses to effectively implement their business ideas and plans. On the other hand, the more a business engages in marketing technology or finds an online presence for its business, the greater the success of the MSE.

The second was to ascertain how the adoption of payment technology affects the performance of MSEs located in Nairobi County. The outcomes showed that the payment technology used had a positive effect on the performance of MSEs. This

suggests that introducing a technology to aid payment or to ease payment of goods and services by MSEs yields a positive input to the performance.

The third objective of the study aimed at assessing how process and service innovation influenced the performance of MSEs situated in Nairobi City. The findings established that process and service innovation technology adopted played a key role in shaping MSEs' performance. This underscores the effectiveness of integrating technology into the production processes of goods and services to facilitate business growth. These findings emphasized the importance of employing suitable technology to enhance quality and techniques within a business context.

This study's final objective was to find out how the performance of MSEs in Nairobi County was affected by the incorporation of product distribution technology in their business. The study's findings revealed that by using technological solutions to improve the way they deliver goods, MSEs experienced better business outcomes. This could be due to factors such as improved efficiency in reaching customers, faster and more reliable delivery processes, and potentially increased customer satisfaction.

5.3 Conclusion

In conclusion, the effects of multiple technological forms on the performance of MSEs within Nairobi City revealed that there was an association between technology adoption and MSE performance across different dimensions. The study's findings underscore the pivotal role of technology in shaping the success of MSEs, emphasizing the benefits of embracing innovative approaches to marketing, payment, production, and distribution to achieve enhanced performance and growth. This implies that adopting technology-driven methods can play a pivotal role in driving positive outcomes for these

businesses, underscoring the importance of keeping up with technological advancements in business operations.

5.4 Policy Implication

The following policy recommendations that can be implemented by stakeholders have been suggested. Firstly, policymakers including the two tiers of government and other key industry players such as KEPSA, MSEA, and KAM should encourage MSEs to adopt technology-enabled marketing strategies. In addition, the government and other key industry players should also provide incentives, training programs, and resources to help MSEs establish and maintain an online presence such as using online advertisement which could enhance their visibility, customer reach, and overall performance. With appropriate government investment in ensuring that the MSEs leverage the use of marketing innovation technology, the sector could witness a narrowing of the gap, particularly between struggling and prosperous MSEs.

Secondly, the Kenya National Chamber of Commerce and Industry (KNCCI), the Kenya Institute of Business Training (KIBT), and Kenya Industrial Research (KIR), ought to broaden their services to micro and small enterprises. These businesses make up a significant portion of the sector and are currently underrepresented. Due to a lack of business skills and expertise, a significant number of these enterprises have failed to progress from micro to small or large scales.

Thirdly, the Micro and Small Enterprise Authority (MSEA) should take additional steps to launch initiatives such as investing in research and development aimed at fostering innovation in production processes, which could significantly bolster the growth of MSEs. Implementing funding mechanisms, fostering research collaborations, and establishing innovation hubs by government could also assist MSEs in seamlessly

incorporating technology into their operations, ultimately enhancing the quality and efficiency of their products.

Lastly, the government and the concerned private sector players should find ways of introducing payment policies aimed at reducing charges and expenses related to its usage to businesses who have adopted the mode of payments as a form of technology. This could serve as an effective strategy for encouraging greater technology integration into business operations. By enabling them to harness technology more efficiently in their businesses, entrepreneurs would have; faster and more efficient transactions; convenience for customers hence customer satisfaction; save on costs associated with cash handling; improved cash flow management; flexibility to accept various payment methods; and improved financial management tools at their disposal. The mobile banking industry has in the past gained significant popularity among entrepreneurs in Nairobi due to its convenience and extensive accessibility. Although the uptake of the technology has been good, some of the entrepreneurs find it expensive to adopt in the business due to the costs incurred in transactions.

5.5 Areas for Further Study

The study looked into the effect of technology adoption on the performance of MSEs in Nairobi City. However, it is important to note that several other factors, such as geographical location, infrastructure accessibility, social media presence, and the availability of business support services, may also have a significant impact on their performance. As a result, further investigation is required to thoroughly examine the individual effects of these factors on the performance of micro and small businesses. This would provide a more thorough comprehension of the numerous factors that influence MSEs in urban environments such as Nairobi City, allowing policymakers

and stakeholders to develop more targeted strategies and interventions to support their growth and sustainability.

The study focused on MSEs in Nairobi's CBD, excluding medium and large enterprises. To gain an in-depth knowledge of the effect of adopted technology on enterprise performance, future research should broaden its scope to include medium and large enterprises. This broader investigation would enable meaningful comparisons between enterprise sizes, providing insights into how technology adoption affects performance across a range of business scales.

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APPENDICES

APPENDIX I: Questionnaire

My name is Kirui Michael Kiprono, and I am a Kenyatta University master's student studying economics. My research investigates the effects of technology adoption on the performance of MSEs in Nairobi City. In light of this, I respectfully request your assistance in providing pertinent information for my study. You can be confident that any information you share will be kept completely private and used only for research.

Tick where appropriate.

Background information

1. Owner or Managers

a) Highest level of education attained

Primary School	
Secondary	
Tertiary	
None	

b) Gender of the owner

Male	
Female	
Both Genders own	

c) Business management skills

Studied	
Not Studied	

2. Business Information

a) Type of business. Tick where appropriate

Accommodation and Catering	
Agriculture, Forestry, and Resources	
General Trade, Wholesale, Retail, Stores	
industrial plants, factories, workshops, contractors	
Private education, Health, and entertainment	
Technical and Financial Services	
Transport, storage, and communications	

b) Number of years in operation

.....
.....

c) Number of Employees

.....
.....

d) Business output in the last one year

.....
.....

e) Business Sales in the last one year

.....
.....

f) Value of physical capital of the MSE in Shillings






.....
.....

g) Within your industry, which of the following technological innovations have you adopted?

Tick where appropriate

Components	Yes	No
<i>Marketing:</i> The firm's products have penetrated the market very fast with the adoption of online marketing.		
<i>Payment Methods:</i> The adoption of Technology like Mpesa services has improved the collection of proceeds from sales		
<i>Process and service innovation:</i> The firm has adopted a technology to improve a product or service they offer		
<i>Distribution of products:</i> A firm has adopted an innovative way to deliver products.		

APPENDIX II: NACOSTI Research permit

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
RefNo: 966094	Date of Issue: 11/September/2023
RESEARCH LICENSE	
	
This is to Certify that Mr.. Michael Kiprono Kirui of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: ADOPTED TECHNOLOGY AND PERFORMANCE OF SMALL AND MICRO ENTERPRISES for the period ending : 11/September/2024.	
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