



---

**Electronic Theses and Dissertations**

---

2022

# The Influence of Management Information System capabilities on the supply chain performance of listed manufacturing firms in Kenya.

Wandili, Modestar

*Strathmore School of Management and Commerce*  
*Strathmore University*

## **Recommended Citation**

Wandili, M. (2022). *The Influence of Management Information System capabilities on the supply chain performance of listed manufacturing firms in Kenya* [Strathmore University].

<http://hdl.handle.net/11071/13155>

Follow this and additional works at: <http://hdl.handle.net/11071/13155>

**THE INFLUENCE OF MANAGEMENT INFORMATION SYSTEM CAPABILITIES ON  
THE SUPPLY CHAIN PERFORMANCE OF LISTED MANUFACTURING FIRMS IN  
KENYA**



**DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT  
FOR THE AWARD OF MASTER OF COMMERCE AT STRATHMORE UNIVERSITY.**

**SEPTEMBER 2022**

## 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.

© No part of this thesis may be reproduced without the permission of the author and Strathmore University

Name of Candidate: Modestar Wandili

Approval

The thesis of Modestar Wandili was approved by the following:

Name of Supervisor: Dr. Stella Nyongesa

School/Institute/Faculty: Strathmore University Business School

Dr. Angela Ndunge

Ag. Executive Dean

Strathmore University Business School.

Dr. Bernard Shibwabo

Director, Office of Graduate Studies.

## DEDICATION

My research project is dedicated to my parents and siblings. Their encouragement and support boosted my morale to do this research.



## ACKNOWLEDGEMENT

First and foremost, I would like to thank God for granting me the strength and courage to undertake the process of researching. I would like to thank Strathmore University for giving me a chance to enroll in this University. My gratitude goes to my supervisor, Dr. Stella Nyongesa for the guidance, support, and constructive advice she offered in the course of writing this project.



## TABLE OF CONTENTS

<b>DECLARATION</b> .....	<b>i</b>
<b>DEDICATION</b> .....	<b>ii</b>
<b>ACKNOWLEDGEMENT</b> .....	<b>iii</b>
<b>TABLE OF CONTENTS</b> .....	<b>iv</b>
<b>LIST OF TABLES</b> .....	<b>vii</b>
<b>LIST OF FIGURES</b> .....	<b>viii</b>
<b>ABBREVIATIONS/ACRONYMS</b> .....	<b>ix</b>
<b>DEFINITION OF TERMS</b> .....	<b>x</b>
<b>ABSTRACT</b> .....	<b>xi</b>
<b>CHAPTER ONE</b> .....	<b>1</b>
<b>INTRODUCTION</b> .....	<b>1</b>
1.1 Background of the study .....	1
1.1.1 The Manufacturing Sector in Kenya .....	2
1.2 Problem Statement.....	4
1.3 Research Objectives.....	6
1.4 Research Questions.....	7
1.5 Significance of the Study .....	7
1.7 Chapter Summary .....	8
<b>CHAPTER TWO</b> .....	<b>9</b>
<b>LITERATURE REVIEW</b> .....	<b>9</b>
2.1 Introduction .....	9
2.2 Theoretical Framework .....	9
2.2.1 Technology-Environment-Organization (TOE) Framework .....	9
2.2.2 Collaborative Network Theory .....	11
2.3 Empirical Review .....	12
2.3.1 Management Information Systems Capabilities .....	12
2.3.2 Supply Chain Performance .....	14
2.3.3 Management Information Systems Infrastructure Capabilities and Supply Chain Performance.....	16
2.3.4 Information Systems Human Resource Capabilities and Supply Chain Performance..	19

2.3.5 Information System Integration Capabilities and Supply Chain Performance .....	20
2.4 Research Gap .....	25
2.5 Conceptual Framework .....	25
2.6 Operationalization of Study Variables .....	27
2.7 Chapter Summary .....	29
<b>CHAPTER THREE .....</b>	<b>30</b>
<b>RESEARCH METHODOLOGY .....</b>	<b>30</b>
3.1 Introduction .....	30
3.3 Research Design .....	31
3.3 Target population.....	31
3.4 Sampling Design.....	31
3.5 Data collection methods.....	32
3.6 Data analysis.....	32
3.7 Research Quality.....	34
3.8 Ethical issues in research .....	35
3.9 Chapter Summary .....	36
<b>CHAPTER FOUR.....</b>	<b>37</b>
<b>DATA ANALYSIS, PRESENTATION, AND INTERPRETATION.....</b>	<b>37</b>
4.1 Introduction .....	37
4.2 Response rate.....	37
4.3 Demographics of respondents .....	38
4.3.1 Job Position.....	38
4.3.2 Years of Service .....	38
4.3.3 Level of Education .....	39
4.4 Descriptive Analysis .....	39
4.4.1 Information Systems Infrastructure Capabilities in Manufacturing Firms.....	40
4.4.2 Information Systems Human Resource Capabilities in Manufacturing Firms .....	41
4.4.3 Information Systems Integration Capabilities in Manufacturing Firms .....	42
4.4.4 Supply Chain Performance of Manufacturing Firms .....	43
4.5 Correlation Analysis .....	44
4.6 Diagnostic Analysis .....	46
4.6.1 Collinearity Test.....	46

4.7 Regression Analysis.....	48
4.8 Chapter Summary .....	55
<b>CHAPTER FIVE.....</b>	<b>56</b>
<b>SUMMARY, CONCLUSION AND RECOMMENDATIONS .....</b>	<b>56</b>
5.1 Introduction .....	56
5.2 Summary of Findings.....	56
5.3 Discussion of Findings.....	57
5.3.1 Information Systems Infrastructure Capabilities and Supply Chain Performance .....	57
5.3.2 Human Resource Capabilities and Supply Chain Performance.....	58
5.3.3 Information Systems Integration Capabilities and Supply Chain Performance .....	60
5.4 Conclusion.....	61
5.5 Recommendations.....	62
5.5.1 Policy Recommendations .....	62
5.5.2 Managerial Recommendations.....	62
5.5.3 Theoretical Implications .....	62
5.6 Limitations of the Study .....	63
5.7 Suggestions for Further Research .....	63
<b>REFERENCES.....</b>	<b>64</b>
<b>APPENDICES .....</b>	<b>82</b>
Appendix I: Letter of Introduction .....	82
Appendix II: Questionnaire.....	83
Appendix III: Ethics Research Approval.....	87
Appendix IV: NACOSTI Research License .....	88
Appendix V: List of Manufacturing firms that are listed in the Nairobi Securities Exchange..	89

## LIST OF TABLES

Table 2. 1: Summary of Gaps .....	23
Table 2. 2: Operationalization of Study Variables.....	27
Table 3. 1: Cronbach’s Test Results .....	35
Table 4. 1: Job Position of the Respondents.....	38
Table 4. 2: Number of Years in Service .....	38
Table 4. 3: Level of Education .....	39
Table 4. 4: Information Systems Infrastructure Analysis .....	40
Table 4. 5: Human Resource Capabilities Analysis.....	41
Table 4. 6: Information Systems Integration Capabilities Analysis .....	42
Table 4. 7: Supply Chain Performance Analysis .....	43
Table 4. 8: Correlation Analysis .....	45
Table 4. 9: Collinearity Test Results.....	46
Table 4. 10: Infrastructure Capabilities and Supply Chain Performance.....	48
Table 4. 11: Human Resource Capabilities and Supply Chain Performance .....	50
Table 4. 12: Integration Capabilities and Supply Chain Performance.....	52
Table 4. 13: Overall Results .....	54

## LIST OF FIGURES

Figure 2. 1: Conceptual Framework .....	26
Figure 4. 1 Response Rate .....	37
Figure 4. 2 Normality P-P Plot Test.....	47



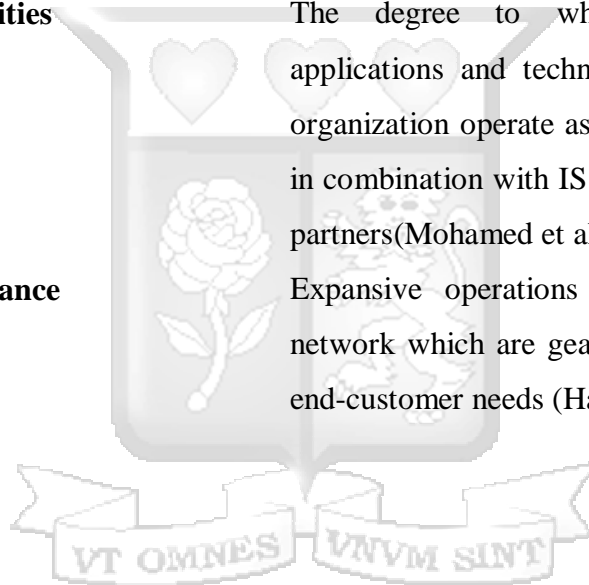
## ABBREVIATIONS/ACRONYMS

<b>CPF</b>	Consumer Packaged Foods
<b>SPSS</b>	Statistical Package for the Social Sciences
<b>ICT</b>	Information and Communications Technology
<b>IS</b>	Information Systems
<b>IT</b>	Information Technology
<b>KAM</b>	Kenya Association of Manufacturers
<b>MIS</b>	Management Information Systems
<b>MISI</b>	Management Information Systems Infrastructure
<b>SAP</b>	Systems Applications and Products
<b>SCM</b>	Supply Chain Management
<b>SCMS</b>	Supply Chain Management Systems
<b>SCP</b>	Supply Chain Performance



## DEFINITION OF TERMS

<b>IS Human Resource Capabilities</b>	The extent to which IT managers possess the appropriate skills and expertise to carry out IS/IT operations (Chanopas, Krairit & Khang, 2006).
<b>IS Infrastructure Capabilities</b>	Information Technology resources that are shared across supply chain partners for information integration and smooth operations (Rai, Patnayakuni, & Seth, 2006).
<b>IS Integration Capabilities</b>	The degree to which IS programs, applications and technologies of a central organization operate as a functioning whole in combination with IS technologies of their partners (Mohamed et al., 2013).
<b>Supply Chain Performance</b>	Expansive operations in a supply chain network which are geared towards meeting end-customer needs (Hausman, 2004).



## ABSTRACT

Changes in customer expectations and technology advancements have increased the need for a digital and integrated supply chain. The use of Information Systems (IS) in global supply chains allows manufacturing organizations to have better control over material and information flows across the supply chain. Scholars have examined the impact of Information Systems on supply chain management of organizations. However, there are mixed findings regarding this topic. As a result, this study sought to establish the influence of Information Systems (IS) on the supply chain performance of manufacturing firms in Kenya. This study entails a theoretical review of literature which will help discuss the primary models and frameworks supporting the study. The study was anchored on the TOE framework and the Collaborative Network Theory. The study adopted a positivist research philosophy. A descriptive cross-sectional survey design was used for this research. This research involved collection of primary data through the administration of structured questionnaires. The study targeted 26 manufacturing firms that are listed in the Nairobi Securities Exchange (NSE) as of 2021. The sample size for this study was 156 respondents (6 employees from the IT and procurement departments in each manufacturing organization). A response rate of 70% was achieved. The study utilized google forms and the drop and pick method to avail questionnaires to the respondents. SPSS v28 facilitated data analysis. Moreover, data was presented using bar graphs, charts, and tables. Descriptive and inferential statistics were used to draw conclusions from the analyzed data. Data collected from the respondents was analyzed using descriptive statistics, regression, and correlation analysis. The results show that most manufacturing organizations have integrated Information Systems to support their manufacturing operations. Correlation analysis results indicate that information systems infrastructure, human resource capabilities and information systems integration capabilities have a significant association with supply chain performance. Regression analysis results indicate that IS infrastructure, integration capabilities and human resource capabilities have a significant influence on supply chain performance. The study recommends that firms could assess their employees' IT skills to ensure that they are at par with rapidly evolving technologies. This will aid in establishing a baseline from which employee training and development could lead to desired results. The study also recommends that manufacturing organizations should ensure that IS capabilities are aligned with their manufacturing operations to achieve efficiency. Further, the study recommends that management should ensure interoperability of information systems to facilitate collaborative decision-making with other supply chain partners. The study however was limited by the COVID-19 pandemic which largely hindered efficient collection of the data for this study. Financial and time constraints also limited the researcher's ability to meet face to face with respondents in distant geographical locations hence may have hindered effective completion of some of the questionnaires. Future researchers could focus on the influence of IS capabilities on the supply chain performance of other participants in the supply chain like the suppliers. Future studies could also focus on other dimensions of IS capabilities and how they influence supply chain performance.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

Management Information Systems (MIS) are associated with the presentation of computerized database financial information that is programmed and organized in a way to produce regular reports on the operations for each level of management (Al-Mamary, Shamsuddin & Aziati, 2013). Management Information Systems (MIS) provide feedback that improves overall performance in each department of the firm. The evolution of Management Information Systems (MIS) was based on the need to perform tallying, accounting, record-keeping, and other forms of accountability in firm management (Laudon & Laudon, 2020). Business automation started in 1880s through tabulating cards which could be sorted and counted (Chintan, 2018). The evolution of computers further enhanced the use of management information systems, with almost every sector adopting MIS to enhance productivity and operations. According to Harnowo (2015), MIS is a computer system with both software and hardware that provides the backbone of the firm's operations. Management Information Systems (MIS) aid in providing up to-date accurate data on a variety of areas including inventory, financials, marketing, raw materials, research and development, personnel, and project timelines among other factors (Laudon & Laudon, 2020).

The advent of technology and the emergence of new business models has transformed businesses. Nowadays, firms utilize management information systems to sense and respond to rapidly changing customer demand, reduce inventory, and achieve high levels of efficiency (Silva & Lima, 2018). Firms integrate information systems into their supply chains to enhance performance as regards to cost reduction, improvement in customer service and faster delivery of the end-product to the customers (Kakhki and Gargeya, 2019). Information Systems (IS) are useful in coordinating supply chain activities and ensuring efficiency. It is impossible to execute an efficient supply chain without Information Systems (Varma & Khan, 2014)

Modgil and Sharma (2017) in a study on the pharmaceutical industries in India linked information systems and supply chain management, citing enhanced operational performance of a firm. The study noted that operational Information Systems (IS), infrastructural IS and operational information systems were critical for enhanced supply chain performance among the selected industries. Modgil and Sharma (2017) identified information sharing, information quality,

inventory management, and supply partnership as the four constructs that influence supply chain performance. Integrating information systems to various levels like strategic, operational, and infrastructural was associated with improved performance in supply chain operations. Similarly, Kakhki and Gargeya (2019) on a study titled “Information systems for supply chain management: a systematic literature analysis” cited information systems to have a significant impact on the supply chain management (SCM) processes like sourcing, delivering, and planning, thus enhancing the overall organizational strategy.

The manufacturing industry in Kenya faces challenges related to high operational costs, inadequate access to changing technology and lean production, low expertise to finished products, limited talent pool as well as lack of access to cheaply available inputs (SYSPRO & Strathmore University, 2019). In narrowing down to the supply chain processes, major challenges include inefficiencies especially in inventory controls, timely deliveries, and adequacy and lack of accuracy in information systems (Njagi & Muli, 2020). There may be need to streamline supply chain processes by incorporating Management Information Systems (MIS) to allow for integration of operations across supply chain partners to increase efficiency and profitability.

### **1.1.1 The Manufacturing Sector in Kenya**

The manufacturing sector in Kenya has seen a robust change in the last two decades (Chege, Ngui & Kimuyu, 2017). The successive governments from 2002 have focused on empowering the manufacturing sector to be a key pillar of economic development through exports, national outputs, and job creation (Adhiambo, 2018). For the two decades, steering industrial growth has been key for the government and its agencies, including creation of Special Economic Zones, niche products and industrial parks among others (Ministry of Industrialization, 2020). Kenya banks on regional markets for industrial development where markets are available for locally manufactured goods (KAM, 2020). Supportive regulation, access to markets, skilled human resources and innovation are some of the features describing the robust Kenyan manufacturing sector. From the Vision 2030, manufacturing has five key areas including development of iron and steel industry, establishment of small and medium industries (SMI) parks; development of industrial parks; promotion of development of regional specific industrial clusters in Garissa, Kisumu, and Mombasa. The other key area is the development of steel and iron industry, as well as skills development for the technical human resource for the entire manufacturing sector. According to KAM (2018), there

are over 800 manufacturing firms in Kenya. 26 of these companies were listed on the Nairobi Securities Exchange (NSE) as of 2021.

The major challenges associated with manufacturing sector in Kenya include the access to changing technology and lean production, access to sizeable farmland for production, and the high cost of operations among other localized challenges (Were, 2016). Low expertise to produce finished products and a limited talent pool especially for engineers draws back the progress of industrialization (Ministry of Industrialization, 2020). The Kenya Association of Manufacturers (KAM) noted that different taxation regimes, high costs of industrial inputs, high cost of financing, non-preference of locally made products over the imports, and the non-tariff barriers hindering exports. Other challenges mentioned by KAM (2018) are illicit trade, poor infrastructure, inadequate training, and capacity building that negatively influence the manufacturing industry in Kenya. Some of the challenges cut across the manufacturing sector while others are specific. The major companies found in the manufacturing sector in Kenya include iron and steel industries, machinery and machine tools, motor vehicle assembly, manufacturing of spare parts, and agro-processing (Ministry of Industrialization, 2020).

The Kenya Vision 2030 identifies the manufacturing sector as one of the priority sectors for achieving economic growth in Kenya. Therefore, the government in Kenya in co-ordination with the World Bank has designed strategies to accelerate the growth, productivity, and innovation of manufacturing organizations in Kenya (Kenya Climate Innovation Centre, 2020). In particular, the Ministry of Industrialization leverages on Information Systems (IS) solutions from the United States of America (USA) to enhance efficiency in the manufacturing operations and supply chain (Mutoka, 2020). This increased focus on the manufacturing sector by the government has encouraged manufacturing organizations to link with global supply chains to expand their operations and reach new markets (Chelimo, 2019). For this reason, manufacturing organizations are integrating MIS in their supply chains to allow for efficient information and material flows along the supply chain network. This goes to show that technology has been a primary driver in shifting into advanced manufacturing by manufacturing companies in Kenya (Mutoka, 2020).

The kind of supply chain performance reported for the variety of manufacturing industries includes both qualitative and quantitative approaches as mentioned by Beamon (1999) and Namusonge (2017). Along with these types of supply chain are the challenges in the field, that include increased

costs experienced along the supply chain; complexities associated with multiple channels to the market; consumer demands for speed, service, and quality; and the risks associated with the entire supply chain (Blume Global, 2021). Global supply chains of manufacturing organizations are also faced with other challenges, including delays, long-range logistics, language barriers, and most importantly, accountability and compliance (Brosch, 2015). Downstream effects of delays adversely affect running of firms' supply chain, and largely influencing the overall customer satisfaction with service delivery (Dunakin, 2021). Cost has also played a major factor in deterring investment in supply chain technology (White, O'Connor & Rowe, 2004). To overcome such challenges, the researcher hypothesizes that adoption of management information systems could foster improved supply chain performance.

## **1.2 Problem Statement**

The manufacturing sector in Kenya is regarded as the cornerstone of the economy (Sigilai, 2017). However, according to KAM (2018) the manufacturing sector's contribution to the economy has stagnated at 10% of the Gross Domestic Product (GDP) in the past decade. An economic survey conducted by KNBS (2021) indicates that the manufacturing sector experienced a negative growth of 0.1% in 2020. One of the major hindrances to growth is the state of automation in the manufacturing industry. According to Achieng (2021), the manufacturing sector constantly performs dismally because of the poor state of automation, lack of technical skills and use of outdated software to run manufacturing operations. Numerous manufacturers in Kenya use outdated technology to run outdated systems using obsolete machines because of the high costs of deploying new technology (Banga & Velde, 2018). Despite the growing benefits of IT in ensuring automation and efficient manufacturing operations, manufacturing companies in Kenya have limited access to due to the high cost of acquiring these technologies (Were, 2016). Based on the evidence above, it can be concluded that ICT has an implication in the growth and productivity of the manufacturing sector (Karahan, 2016).

Studies have been conducted in Central Europe and North America to determine this association. A study by Marinagi, Trivellas and Sakas (2014) investigated the impact of Information Technology practices on building competitive advantage throughout the supply chain. The findings from the survey of 76 manufacturing firms in Greece confirmed the crucial role of IT practices and techniques on the establishment of competitive advantage based on supply chain

management. Another study by Valverde and Saade (2015) examined the effect of e-supply chain management systems in the North American electronics manufacturing services industry. The results of the research revealed that e-supply chain management systems had a positive effect in enhancing key supply chain operations and in return improving performance across the supply chain.

Researchers in Africa have also studied the association between Management Information Systems and supply chain performance. One study assessed the effect of Information Technology (IT) tools on the supply chain performance of 56 online retailers in Nigeria. The study conducted by Awara, Udoh and Anyadighibe (2018) observed that the implementation of IT improved supply chain performance because it facilitated integrated information sharing between different partners in the supply chain. Kumar, Singh and Modgil (2020) explored the role of ICT in the South African agri-food supply chain and its effect on supply chain management practices. The results showed a positive relationship between ICT and supply chain management practices. Matay (2019) assessed the effect that ICT has on the supply chain management practices in Tanzania. The study utilized a case study which targeted 100 respondents in TANESCO, an electricity supply company. The study findings revealed that ICT significantly impacted supply chain management practices and in turn enhanced the financial performance of TANESCO. Morssi, Elhousseiny and Hammad (2020) analysed the impact of Internet of Things (IoT) on the supply chain performance of 9 companies in Egypt. The exploratory study utilized semi-structured questionnaires to arrive at a conclusion. The findings of the study showed that IoT had a positive impact on supply chain performance metrics.

In the last five years, there has been a tremendous adoption of information systems by manufacturing firms in Kenya in a bid to realize standardization and just in time insights (Chelimo, 2019). Studies have also been conducted in Kenya with regards to the relationship between information systems and supply chain performance. Otworu (2017) explored the impact of ICT on procurement efficiency in Kenya Breweries Limited. The study concluded that ICT had a positive impact on the procurement performance of Kenyan breweries. A study by Gakuubi (2018) analyzed the impact of ICT on organizational performance with reference to Nairobi Bottlers' logistics operations. The study concluded that Information Technology has played a positive role

in enhancing efficiency in Nairobi bottler's supply chain thereby increasing their competitive advantage.

Nyambura (2018) examined the moderating effect of Information Communication Technology (ICT) on supply chain and firm performance among manufacturing firms in Kenya. The study collected data from 76 manufacturing firms using questionnaires. The results of the study reveal ICT is a significant moderator of the relationship between supply chain performance and firm performance. Another study by Kaaria and Mwangangi (2017) analysed the role of Information Technology (IT) in the supply chain performance of the Judiciary of Kenya. The study surveyed 159 respondents in the Judiciary in Nairobi County. The findings of the study revealed that IT has a significant influence on supply chain performance of the Judiciary.

There are mixed findings on the relationship between management information systems and supply chain performance. While some scholars assert that MIS capabilities are vital for the enhancement of supply chain performance (Tripathy et al. (2016); Fawcett et al. (2017); Qrunfleh & Tarafdar (2013), others claim that there is no direct relationship between IS capabilities and supply chain performance (Siagan, Jiwa & Tarigan (2021); Zhang, Van-Donk & Vaart, (2016). Although studies linking management information systems and supply chain performance exist, limited studies have focused on management information systems capabilities with respect to supply chain performance. This study therefore sought to fill this knowledge gap by investigating the specific capabilities that information systems have to offer and their effect on the performance of supply chains of manufacturing firms in Kenya. Analysis in relation to the unique capabilities of management information systems is a distinctive contribution of this study.

### **1.3 Research Objectives**

The main objective of this study was to establish the influence of management information system capabilities on the supply chain performance of firms in the manufacturing sector in Kenya.

The specific research objectives were:

- i) To establish the influence of management information systems infrastructure on the supply chain performance of manufacturing firms in Kenya.
- ii) To determine the effect of management information system human resource capabilities on the supply chain performance of manufacturing firms in Kenya.

iii) To establish the effect of management information system integration capabilities on the supply chain performance of manufacturing firms in Kenya.

#### **1.4 Research Questions**

The broad research question was: What is the influence of management information system capabilities on the supply chain performance among manufacturing firms in Kenya?

The sub research questions were as follows:

i) What is the influence of management information system infrastructure on the supply chain performance of manufacturing firms in Kenya?

ii) What is the effect of management information system human resource capabilities on the supply chain performance of manufacturing firms in Kenya?

iii) What is the effect of management information system integration capabilities on the supply chain performance of manufacturing firms in Kenya?

#### **1.5 Significance of the Study**

To the policy makers in the manufacturing industry, the findings of the study can be employed in the formulation of policies that facilitate the implementation of IS capabilities that streamline manufacturing operations. Further, the findings can enable policy makers formulate policies that create a conducive climate for the growth and development of the manufacturing industry which is considered a priority sector for achieving economic growth in Kenya. To manufacturing firms, the study can offer insights on the various ways senior executives in firms, may use information systems to enhance decision making and in turn achieve operational efficiency in the supply chain. In addition, it can provide useful information to supply chain managers on the specific information systems capabilities that will help them run lean supply chains.

To the suppliers, this study can provide insights that may enable suppliers to acknowledge the importance of using information systems in their operations hence be in a better position to plan their operations in terms of logistics, inventory management and lead-time. Further, this study can serve as a basis for researchers who seek to explore and carry out further research. Besides, the study can offer baseline data needed by researchers to conduct related studies in countries that have similar features as Kenya. Academicians may also utilize this study in cross examining the

impact that information systems have on the efficiency of supply chains. Limited research has been done on the influence of management information systems on supply chain performance. Therefore, by offering a theoretical understanding and empirical support of the relationship between the two variables, the study offers a contribution to the existing literature. Further, through the analysis and data that this study has provided, future researchers may explore other capabilities that may influence supply chain performance.

### **1.6 Scope of the Study**

The study sought to establish the influence of IS capabilities on the supply chain performance of manufacturing firms, focusing on IS infrastructure capabilities, human resource capabilities and IS integration capabilities. Theoretically, the study was anchored on the Technology-Environment-Organization framework and Collaborative Network Theory. Further the study adopted a descriptive cross-sectional survey design and involved collection of data using structured questionnaires. Geographically, the study focused on manufacturing firms that were listed on the Nairobi Securities Exchange as of 2021. The targeted manufacturing firms were dispersed across these 7 counties: Kericho, Kiambu, Kitui, Machakos, Mombasa, Nairobi and Nakuru. The study examined the influence of MIS capabilities on supply chain performance from August to October 2021.

### **1.7 Chapter Summary**

This chapter presented a background of study that sets the context for this research. The chapter also presents a problem statement which outlines the problem addressed by the study. Furthermore, the chapter highlights the research questions and objectives; significance of the study and the scope of the study.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter discusses previous empirical studies on the effect of management information system capabilities on supply chain performance. The chapter also presents a review of the relevant theories that underpin the study and includes a conceptual framework and a summary of the gaps in the empirical literature that is reviewed.

#### 2.2 Theoretical Framework

A theory offers a general explanation for a certain incident or occurrence. It is a proposition that provides rational, systematic and a coherent explanation of a phenomenon of interest (Bacharach, 1989). Researchers should be familiar with theories related to their field of study (Ngumi, 2013). For this study, the Technology-Environment-Organization (TOE) framework and Collaborative Network Theory are regarded as being relevant in understanding the impact of information systems on supply chain management and consequently provides a theoretical foundation for this study.

##### 2.2.1 Technology-Environment-Organization (TOE) Framework

The Technology-Organization-Environment (TOE) Framework was developed by Tornatzky and Fleischer in 1990. The proponents of the TOE framework argue that 3 fundamental contexts-organizational, environmental, and technological- impact the way in which an organisation adopts and implements new technology (Lippert & Govindarajulu, 2006). The TOE framework is widely used in the adoption of technological innovations and has been proven as a valid framework to apply in research that involves adoption and implementation of novel technology (Chiu, Chen & Chen, 2017). However, the TOE framework applies to only large organizations and not Small and Medium Enterprises (SMEs) (Bryan & Zuva, 2021).

The technology aspect relates to the characteristics and usefulness of the innovation technology. It relates to both existing technological infrastructure in use and new innovations that may be relevant to the firm (Jesus, Pinheiro & Oliviera, 2019). Jere and Ngidi (2020) assert that an organisation ought to have the relevant MIS infrastructure and employee technical skills to ensure successful adoption of new technology. According to Awar, Ukoha and Igwe (2017), technology adoption is shaped by the pool of technological infrastructure both internal and external to the organisation as well as their compatibility and complexity. The compatibility between existing

MIS infrastructure in the organisation and the intended technological innovation influences the decision to adopt new technology (Salleh, Janczewski & Beltran, 2015). Technology that already exists in an organisation represents the limits of current technological capabilities while technology that exists outside the organization may influence further development of an organization's IT capabilities (Jacob & Touteberg, 2018). In addition to compatibility, organizations also consider perceived benefits of an innovation before implementing new technology. Perceived benefits refer to the extent to which organizations perceive that the new technology will be beneficial for the firm (Malik, Chadar, Vatanasakdakul & Chetty, 2021).

The organizational context refers to the level of available technological and financial resources in the organisation which facilitate the adoption of new technology (Abed, 2020). The technological context is defined in terms of quality of human resources, managerial structure, and availability of technological competence. Furthermore, Lihmash, Egdair and Ahmed (2019) define the organizational context in terms of availability of the necessary resources to successfully operationalize a technological innovation. According to Hwang, Huang, and Wu (2016) organisation resources refer to capabilities that organizations possess for future dynamic changes. The author goes on to state that these organizational resources relate to overall technological infrastructure that can support innovations. Another dimension of the organizational context is the quality of human resources. Metaxiotis (2009) asserts that it is not enough for an organisation to have technological resources only, and that it is critical to have competent and innovative IT managers who are able to implement new technology into the organisation. Evidence also suggests that organizations with the lowest level of satisfaction with new technology adoption lacked sufficient MIS skills and technical knowledge to implement the systems (Kuan & Chau, 2001). According to Ismail and Ali (2013) IT knowledge and technical skills are critical factors in the adoption of new technology. Organizational learning capability is another factor that influences technology adoption. Organizational learning refers to the ability to capture, store, disseminate and integrate new information in business decisions. This new knowledge ensures that the firm is sustainable in dynamic business environments (Yeh, Pai & Lee, 2014).

The third dimension of the TOE framework relates to the environment. The environmental context relates to an organization's relations with consumers and suppliers (Bryan & Zuva, 2021). Abed (2020) asserts that the relationship between the organisation and consumer plays a significant role

in the adoption of new technology. The author goes on to state that the satisfaction of consumer needs and expectations via the provision of electronic services, which allow for improved interactive relations, is a key driver of new technology adoption in organizations. Additionally, partner relationships are determinants of inter-firm IS adoption. The adoption of new technology by a powerful partner in the supply chain may influence other trading partners to pursue similar strategies (Lin & Lin, 2008). Support infrastructure for technology also influences the adoption of innovation. Baker (2012) states that the availability of skilled MIS consultants, managers and vendors is a key driver of technology implementation. This theory is applicable to the study as it seeks to help explain the significance of technological infrastructure and human resource technical skills in the adoption and implementation of new technology.

### **2.2.2 Collaborative Network Theory**

Collaborative networks constitute of a variety of independent organizations and people that collaborate to a common goal and whose interactions are supported by computer networks (Camarinha-Matos & Afsarmanesh, 2005). Collaborative networks are designed in such a way that there is effective co-ordination, shared decision-making, and collaboration with different external partners such as customers and suppliers to enhance knowledge sharing and acquisition which results in the expansion of the organizations' existing knowledge (Tavani, Tavani, Naude, Oghazi & Zeynaloo, 2018). This partnering is motivated by business, supply chain, market and technological evolutions that create uncertainty and pressure on independently operating firms (Durugbo, 2016). According to Chituc and Azevedo (2005) collaborative networks involve heterogenous organizations with different capabilities and competences that utilize IT to co-ordinate, combine and develop their operations. The authors outline 3 perspectives of collaborative networks including technological perspective, social perspective, and business perspective. Chituc and Azevedo (2005) define technological perspective as the interoperability and integration of IS infrastructures that support business operations.

Further, the social perspective relates to the interactions between partners in the supply chain while the business perspective refers to the alignment of partners' business operations within a network. The creation of collaborative networks advocates for the efficient sharing of information and informed decision making using MIS systems for enhanced organizational performance (Guerrini & Yamanari, 2019). According to Guerrini and Yamanari (2019), information and resource-

sharing, increased demand for a variety of products, innovation and enhancing operational performance are the major factors that encourage organizational collaboration.

The rapid development of technology determines new forms of collaborative networks (Ingram, 2009). These collaborative networks are evident in dynamic and highly integrated supply chains (Mezgar, 2004). Supply chains may take the form of collaborative networks whereby there is both vertical and horizontal collaborations among supply chain partners (Huang, Han & Macbeth, 2020). According to Camarinha-Matos and Afsarmanesh (2006), collaborative networks depend on the existence of MIS infrastructure. Information systems infrastructure enables flexible and coordinated information and resource-sharing across the supply chain (Parung & Bititci, 2008). Similarly, Ahuja (2000) maintains that the degree of connectivity between an organisation and its partners can influence both access to new knowledge and resource sharing. The author also argues that direct ties between partners can influence a firm's innovation performance. The theory is applicable to this study as it explains how technology-enabled integration allows for coordinated information-sharing and decision making between partners in a network thereby leading to enhanced innovation and operational performance.

## **2.3 Empirical Review**

The following section presents a discussion of previous empirical research that correlate with the objectives of this study. This section further discusses the findings of previous studies that relate to the influence of management information system capabilities on supply chain performance.

### **2.3.1 Management Information Systems Capabilities**

Management Information System (MIS) capabilities consist of multidimensional complex facets. Information systems capabilities refer to mechanisms for the classification and provision of knowledge that is mastered and successfully applied in business (Aydiner, Tatoglu, Bayraktar, & Zaim, 2019). MIS capabilities often indicate how well an organization can integrate and utilize Information Technology (IT) resources effectively. According to Zhiying, Kai and Yunfeng (2009), MIS capabilities can be recognized by evaluating how certain firms utilize and manage information effectively.

Different scholars propose different perspectives regarding MIS capabilities. For instance, Bhatt and Grover (2008) conceptualize MIS in terms of the following dimensions: MIS-related capabilities, dynamic capabilities, and value capabilities. Zhiying, Kai and Yunfeng (2009) define

MIS capabilities in terms of MIS human resources, MIS integration, MIS range and MIS-enabled intangible assets. In line with these views, Bharadwaj (2000) suggests MIS infrastructure, MIS-enabled intangible assets and human resource expertise as the main compositions of MIS capabilities. Ju-hong and Meng-hua (2009) classify MIS capabilities into three main dimensions including creative capabilities which is a combination of MIS human resource skills and intangible assets of the firm, dynamic capabilities which result from a combination of MIS infrastructure and human resource MIS expertise and finally static capability which consists of MIS infrastructure as a standalone element. A Study by Kariuki and Nzuki (2019) on the influence of Information Systems (IS) capabilities on organizational performance narrowed down to MIS infrastructure, MIS flexibility and system automation as the key factors that influence supply chain performance. Kariuki and Nzuki (2019) further explained that IS infrastructure focused on the information technology (IT), manufacturing technology, and design manufacturing technology had a direct effect on at least one time-based performance.

MIS infrastructure is vital in linking major suppliers and customers with an organization. According to Peppard, Lambert and Edwards (2000) MIS infrastructure is defined as a set of resources that are tangible and serve as a basis for present and future databases. MIS infrastructure is the foundation of information capabilities (Weill & Broadbent, 2000). MIS infrastructure may reinforce the competitiveness of an organization by allowing for integration between business processes and improvements in cycle time (Sambamurthy & Zmud, 1992). Bharadwaj (2000) argues that MIS infrastructure that lacks integration and compatibility within the systems, can adversely impede a firm's business processes. The author further states that a substantial amount of time and expertise goes into the development of an integrated MIS infrastructure. Jirma and Guyo (2017) note that MIS flexibility as well as integration is associated with improved performance of the supply chain. Integration, as well as automation in supply chain can improve inventory control and help in keeping records. MIS integration is based on how well an organization centralizes all its operations into a unit system to have a one-point control (Niu, 2010).

Despite being valuable to an organization, Glazer (1991) notes that MIS infrastructure on its own might not be sufficient for the success of an organization. To support this claim, Mithas, Ramasubbu and Sambamurthy (2011) state that an organization's ability to leverage its IS infrastructure to provide timely, reliable, and accurate information is dependent on the skills and

expertise of its human resource. Similarly, Bhatt and Grover (2005) suggest that while tangible assets like technological infrastructure can be duplicated by other organizations, sustainable performance typically relies on human resource expertise and superior MIS knowledge. Jean, Sinkovics and Kim (2008) state that human MIS resources are rare and hard to imitate which may result in sustainable competitive advantage for an organization. Human MIS resources in this case refer to technical and managerial skills (Bharadwaj, 2000). Technical skills comprise of programming skills, system design and analysis while managerial skills include decision-making, leadership, and project management skills. In this study, management information system capabilities were classified into three facets which include IS infrastructure, IS integration and IS human resource expertise.

MIS infrastructure can be defined as resources that are shared across supply chain partners for information integration and smooth operations (Rai, Patnayakuni, & Seth, 2006). MIS infrastructure comprise of technical infrastructure (software, hardware, networks, and other applications) and human infrastructure (skills and expertise of IS professionals) (Liu et al., 2009). Human resource MIS capabilities refer to the extent to which IT managers possess the appropriate skills and expertise to carry out IS/IT operations. They include technical skills and managerial skills. Technical skills comprise of programming skills, system design and analysis while managerial skills include decision-making, leadership, and project management skills (Chanopas, Krairit & Khang, 2006). IS integration is the degree to which IS programs, applications and technologies of a central organization operate as a functioning whole in combination with MIS technologies of their partners (Mohamed et al., 2013).

### **2.3.2 Supply Chain Performance**

Performance in supply chain operations is a total of the efforts of all the partners in the chain. Problems faced by one partner may stagnate the whole supply chain (Mehmeti, Musabelliu & Xhoxhi, 2016). The efficiency of a supply chain is contingent on the firm's ability to effectively manage information and material flows across the chain (Fayezi & Zomorodi, 2015). Hausman notes that supply chain performance (SCP) can extend to the activities initiated towards meeting the end-customer requirements like on-time delivery, product availability, availing necessary inventory, and having the capacity to deliver in a responsive manner. According to Namusonge (2017), supply chain performance can be measured qualitatively or quantitatively. Qualitative

measures refer to product quality and customer satisfaction while quantitative measures include order-to-delivery lead time, flexibility, delivery performance, resource utilization, and supply response time (Namusonge, 2017).

Supply chain management (SCM) is the process by which supply chain activities are managed to have an edge over competitors, while increasing the value of the customers (Pius, 2014). According to Lans (2019), challenges faced in supply chain management can inform the organization on the performance indicators to improve on, for them to satisfy their customers. Some of the performance indicators to consider in supply chain management include quality customer service (giving the right quality, quantity, and the right amount of cost), appropriate costing (for the raw materials, labor, and energy among others), and risk management especially for logistics. Further, Lans (2019) described supplier relationship, qualified personnel for handling technical issues, and handling unforeseen delays as other indicators of supply chain performance. Similarly, another study by Oláh, Zoltan and Popp (2017) identified the aspect of customer satisfaction as a measure of supply chain performance.

Supply chain performance is a multi-faceted concept. Several authors have conceptualized supply chain performance in terms of different indicators. According to Cai et al. (2009), supply chain indicators include time, cost, flexibility, product quality, innovation, and information resources. Aramyan et al. (2007) propose cost, time, quality, flexibility, responsiveness, and efficiency as the key indicators of supply chain performance. According to Elrod, Murray and Bande (2013) list financial cost, quality, time, and flexibility as effective measures of supply chain performance. Similarly, Shepherd and Gunter (2006) conceptualize supply chain performance in terms of responsiveness, flexibility, cost efficiency and quality. Based on existing literature, supply chain performance was measured using qualitative indicators relating to flexibility, product quality, supply chain responsiveness, cost, and time (Gunasekaran, Patel, & Tirtiroglu, 2001; De Toni & Tonchia, 2001).

### **2.3.3 Management Information Systems Infrastructure Capabilities and Supply Chain Performance**

Management Information Systems Infrastructure (MISI) is one of the vital elements of supply chain success (Udomleartprasert & Jungthirapanich, 2004). Present-day supply chains and their fundamental inter-organizational operations are profoundly ingrained in Information Systems (IS) infrastructure and its applications (Bush, Tiwana & Rai, 2010). For this reason, IS infrastructure can either enhance or constrain supply chain activities. According to Bush et al. (2010) supply chain MIS serves as a basis for the execution of procedures which shape inter-organizational integration between an organization and its supply chain partners. Supply chain MIS infrastructure is elemental in advancing an up-to-date collection of MIS capabilities (Irfan, Wang & Akhtar, 2019). MIS infrastructure capabilities comprise of technical infrastructure (software, hardware, business applications, and telecommunication networks) and managerial infrastructure (managerial knowledge, skills, and expertise) (Chanopas et al., 2006).

The relationship between MIS supportive infrastructures and supply chain performance was the focus of a study by Udomleartprasert and Jungthirapanich (2004). The aim of the study was to establish the relationship between supportive infrastructure such as technology and investment and supply chain performance. The researchers collected data by administering questionnaires to 2800 to large manufacturing companies based in the industrial area in Thailand. The findings of the study revealed that there was no direct relationship between IS supportive infrastructure and supply chain performance. Another study Bush et al. (2010) sought to address the interconnection between IS infrastructure and product design and their influence on supply chain performance. The study by Bush et al. (2010) was more explicit and inclusive than that by Udomleartprasert and Jungthirapanich (2004). The researchers conducted a longitudinal survey by collecting data from 102 firms in the USA across the manufacturing, agricultural sector, services, and retail industry. The study concluded that MIS infrastructure takes advantage of the information and material flows mechanism in a supply chain to enhance co-ordination and integration in the system. In addition, the inherent features of MIS help major manufacturers to meet present customer demand as well as anticipate future customer demands.

The findings of the study by Bush et al. (2010) however contrasted with those of Irfan (2019). The study by Irfan (2019) drew on the Dynamic Capabilities Theory to assess the impact of MIS

infrastructure capabilities on supply chain performance and agility. The researcher surveyed 218 firms in Pakistan and employed a structural equation model to arrive at a conclusion. The findings suggest that the MIS capabilities of IT infrastructure have no direct effect on supply chain performance and agility. Another study by Lau and Lee (2000) sought to provide insights on the design and implementation strategies for building an efficient and responsive supply chain system. The study carried out in Hongkong outlined the various system design and component modules for building superior supply chain information systems. The findings of the study propose that MIS infrastructure which leverage on advanced object development technologies such as Microsoft DCOM technology enhance the responsiveness of a supply chain network. However, this study was qualitative in nature and elicited subjectivity since the analysis was done without using empirical data.

Sundram et al. (2018) sought to explain the association between supply chain IS infrastructure management and supply chain performance. The researchers collected data through the administration of questionnaires to 248 Malaysian electrical and electronics manufacturing firms. The findings revealed a significant relationship between MIS infrastructure management and supply chain performance. Sundram et al. (2018) also posits that MIS infrastructure scales up the scope and effectiveness of the supply chain system of an organization by providing a means for expediting efficient information flow and exchange across supply chain partners. In addition, the researchers revealed that MIS infrastructure bears a great impact on the consolidation of information both within and outside the supply chain.

Unlike the other researchers who focused on manufacturing firms, a study by Jayaram (2000) focused on suppliers in North America. The study sought to examine the direct effects of MIS infrastructure on time-based performance of suppliers by surveying 57 top-tier suppliers in the North American automotive industry. The findings of the study reveal that MIS infrastructure and process improvements in a supply chain have a positive and complementary impact on one time-based performance of suppliers by streamlining cycle-time performance.

In Kenya, Milimo, Sagwa and Sakwa (2018) assessed the impact of IT infrastructure on the supply chain performance of public universities in Kenya. The study adopted a descriptive census survey approach. Questionnaires were administered to 31 public universities, the target respondents being 62 heads of the procurement and ICT departments in each university. The findings of the study

revealed that IT infrastructure had a significant influence of the supply chain performance of public universities in Kenya. The analysis of empirical data also led to the conclusion that public universities that integrated IT systems in their supply chains reaped the benefits of greater operational effectiveness and efficiency thereby enhancing customer satisfaction. The results of Milimo, Sagwa and Sakwa (2018) are consistent with those of Awara, Udoh and Anyadighibe (2018). The study by Awara et al. (2018) assessed the impact of IT Infrastructure tools on supply chain performance of online retailers in Calabar Metropolis area in Nigeria. The data collected from 2 online retailers was analyzed using the multiple regression model. The findings from the cross-sectional survey revealed that Information systems improved supply chain performance of online retailers by building the accumulation of knowledge about various supply chain partners hence enhancing decision making capabilities for online retailers.

Several researchers suggest that there is a direct relationship between MIS infrastructure capabilities and supply chain performance since the infrastructure aids in streamlining operations, communication and information flow across the supply chain system thereby enhancing the capability to reduce logistics lead time (Sundram et al., 2018; Irfan, Wang & Akhtar, 2018; Jayaram, Vickery & Droge, 2000). Nevertheless, another school of thought opines that the relationship between IS infrastructure and supply chain agility is not direct (Liu et al., 2009). The author goes on to state that the influence of MIS infrastructure on supply chain performance is dependent on a firm's absorptive capacity which entails the firm's ability to manage knowledge and manage change based on its knowledge management capability. Similarly, Udomleartprasert and Jungthirapanich (2004) argue that investing in supply chain infrastructure does not enhance performance in the supply chain. According to the authors, MIS infrastructures may influence performance in the supply chain but only through practices such as customer and supplier relationship management. Dissent therefore prevails as far as the influence of MIS infrastructure on supply chain performance is concerned. For this reason, there was need to carry out further research to assess the relation between MIS infrastructure capabilities and supply chain performance, which the current study focused on.

### **2.3.4 Information Systems Human Resource Capabilities and Supply Chain Performance**

In the phase of rapidly advancing technology, the part that MIS professionals play in enabling supply chain integration has become more and more vital (Saraf, Langdon & Gosain, 2007). In this regard, without skillful MIS personnel and their active participation in the supply chain operations, an organization's capacity to handle conflicting technology standards and changes in technology is constrained which can result in poor integration in business operations (Kumar & Disset, 1996). According to Wang, Chou, Lee, and Lou (2014), Management Information Systems (MIS) managers who possess project management skills, technology management skills and a comprehension of trends in technology, can integrate organizational data and IS systems, resolve technical problems and mitigate technological risks efficaciously.

Lee, Trauth and Farwell (1995) assessed the critical skills that IS professionals required in an organization. The study which was conducted in Boston, USA, targeted IS managers and consultants. The study was conducted by a group of academic investigators who were involved in a series of focus group discussions regarding MIS staff hiring requirements, future trends in IT professions and IS skills required for the success of business operations. The issues raised in the focus groups were then used in the development of questionnaires that were used in the data collection process. The authors concluded that organizations require MIS people with up-to-date technological knowledge and skills to effectively steer firm integration, co-ordination, and Business Process Reengineering (BPR). Similarly, Prajogo and Sohal (2013) focused on the skills and expertise of supply chain managers and the challenges they faced in supply chain management. The study used 920 questionnaires to collect data from supply chain managers in Australia. The findings from the data collected from Australian supply chain managers highlighted proficiency in the use of a wide range of IS technologies as an essential capability of supply chain professionals. Another study by Wang, Chou, Lee, and Hai (2014) examined the effect of intrafirm IT skills on interfirm coordination and in turn its effect on supply chain performance. Wang et al. (2014) collected data from 240 manufacturing firms in Taiwan to explore this relationship. A model comprising of 8 hypothesis was then developed and tested from the data collected using questionnaires. The results revealed a significant relationship between intra-organizational IT skills and supply chain integration and ultimately its performance. Further, the authors argue that

a lack of expert supply chain managers may limit the organization's ability to secure uncut benefits that result from more productive supply chain operations.

While the significance of MIS human skills has been broadly explored by in the past, there is no known empirical study that has assessed the impact of human resource MIS capabilities on supply chain performance. For this reason, it was found necessary to carry out further research to assess the relation between human resource MIS capabilities and supply chain performance.

### **2.3.5 Information System Integration Capabilities and Supply Chain Performance**

The MIS integration process among organizations, customers and suppliers is a significant part of supply chain management (Budiarto, Prabowo & Herawana, 2017). Distinct integrated supply chain systems are regarded as crucial determinants of supply chain performance (Lee, Kwon & Severance, 2007). According to Themistocleous, Irani and Love (2004), the integration of IS systems is a challenge to supply chain operators, since most partners run independent systems that cannot interact with each other. Themistocleous further states that autonomous IS that the partners in a supply chain run may not be designed to collaborate with each other hence resulting in a lack of effective flow of information within the system. In this regard, it is necessary for organizations to integrate IS in all operations across the supply chain to achieve the desired level of performance (Rai et al., 2006). Rajaguru and Matanda (2010) state that integration is pivotal in streamlining supply chain operations and capabilities of supply chain partners by expediting material and information flow from manufacturers to customers and information flow back to the manufacturers. Integrated IS aids in decision making and improves the degree of collaboration among supply chain partners by making information easily accessible when required (Carr, 2016).

A study Themistocleous, Irani and Love (2004) focused on Enterprise Resource Planning (ERP) systems as a means of realizing IS integration in the supply chain. Themistocleous et al. (2004) highlights the significance of enhancing supply chain performance by integrating IS with business operations. The author also identifies Enterprise Application Integration (EAI) as one technology that links various systems and applications resulting in more functional, less costly, and easily manageable IS infrastructures. Nevertheless, the findings of a study by Tarigan, Siagian and Bua (2019) contrast with findings of Themistocleous et al. (2004). The study by Tarigan et al. (2019) assessed the effect of IS integration on the supply chain performance of 40 companies in Indonesia.

Data was collected from medium and large manufacturing organizations using questionnaires and then analyzed using the partial least squares technique. The study concluded that integrated IS had no direct effect on supply chain performance.

Ghobakhloo et al. (2014) provided a more comprehensive view on the role of IS capabilities in the process integration and performance of a supply chain. The researcher examined the relationship between IS alignment and supply chain process integration. Questionnaires were used to collect data from 227 supply chain managers of leading manufacturing organizations in Malaysia. Ghobakhloo noted that IS integration and alignment ensured the development of novel knowledge through effective organization and processing of information acquired from the various partners in the supply chain thereby leading to effective decision making. Ganbold, Matsui, and Rotaru (2019) assessed the impact of technology-enabled supply chain integration on the operational performance of an organization. The study solicited data from senior managers of 110 manufacturing companies in Tokyo. The structural equation modelling approach was used to test the relationship between IS-enabled integration and supply chain performance. The findings of the study propose that IS capabilities notably enhanced integration between customers, suppliers while enhancing information exchange and synchronization capabilities between a central organization and their suppliers and customers (Ganbold et al., 2019). Further, the authors noted that IS-enabled integration in the supply chain had a positive effect in deducing inventory levels, decreasing the cost of production and ultimately enhancing an organization's delivery performance. However, the scope of the study was limited to firms listed in the first section of Tokyo Securities Exchange hence the findings cannot be generalized to the whole population of manufacturing firms in Tokyo.

Similarly, a study conducted by McCarthy-Bryne and Mentzer (2011) sought to establish the role of integrated infrastructure in creating joint value in the supply chain process. The authors employed a combination of in-depth interviews and the questionnaire survey method to collect data from 1500 CPF (Consumer Packaged Foods) manufacturers in USA (United States of America). The study revealed that integration in the supply chain resulted in a coordinated forecasting process between the suppliers, customers and manufacturers thereby expediting response to changes in customer demand for products with shorter life cycles (McCarthy-Bryne & Mentzer, 2011). This creates joint value in the sense that, it increases revenue for both the supplier and the manufacturing company besides fully satisfying customer needs (McCarthy & Golicic,

2001). Despite the unique contributions of this study, the various contingencies of supply chain integration such as barriers to integration are not mentioned. Additional empirical analysis should therefore be carried out to extend the findings of the study.

Nonetheless, Gallego et al. (2013) argues that merely having an integrated information system does not lead to enhanced supply chain performance. Gallego et al. (2013) conducted an assessment on 100 companies from Spain to establish the direct impact of IS integration on supply chain performance and successively its effect on organizational performance. A hierarchical multiple regression approach was used to test the relation between MIS capabilities, MIS integration and supply chain performance. The study concluded that integrated MIS may enhance supply chain performance only if they are aimed at connecting directly with customers and suppliers rather than interlinking the entire supply chain system. Correspondingly, Sezen (2008) notes that, while MIS integration and information exchange are significant in enhancing supply chain performance, designing the supply chain to link key suppliers and customers with the focal organization, plays a vital role in the realization of the desired level of returns.

In Kenya, Fahad (2013) conducted a study to determine the factors that influenced supply chain management of oil companies in Kenya. One of the objectives of the study was to establish the impact of integrated MIS infrastructure on the supply chain Management of oil companies in Kenya. The researcher collected data using questionnaires from 50 oil companies, the target respondents being all the employees in every oil company in Kenya. The findings of the study revealed that integrated MIS Infrastructure was considered an important factor in enabling efficient and effective supply chain management.

**Table 2. 1: Summary of Gaps**

<b>Author</b>	<b>Title</b>	<b>Findings</b>	<b>Research Gap</b>
Themistocleous, Irani, and Love (2004)	Evaluating the Integration of Supply Chain Information Systems.	The findings indicate that Enterprise Application Integration (EAI) technology aids in linking various systems and applications resulting in more functional and less costly IS systems.	The study focused on ERP systems while this study focused on specific information systems capabilities.
Fahad (2013)	Factors Affecting Supply Chain Management by Oil Companies in Kenya	The findings show that integrated Information Systems Infrastructure is considered an important factor in enabling efficient and effective supply chain management.	The study was limited to oil companies hence the results may not be generalizable to the whole population of manufacturing firms in Kenya.
Prajogo and Sohal (2013)	Supply Chain Professionals: A Study of Competencies, Use of Technologies, and Future Challenges	The findings of the study highlighted proficiency in the use of a whole range of information systems technology as an essential capability of supply chain professionals.	The study however fails to consider how human resource capabilities influence supply chain performance.
Lau and Lee (2000)	On a Responsive Supply Chain Information System.	The findings of the study propose that information systems infrastructure which leverage on advanced object development technology	The study was qualitative in nature since the analysis was done without using empirical data.

		enhance the responsiveness of a supply chain network.	
Awara, Udoh, and Anyadighibe (2018)	Information Technology Tools and Supply Chain Performance of Online Retailers in Calabar Metropolis, Nigeria.	The findings indicate that information systems improve supply chain performance of online retailers by building accumulation of knowledge about various supply chain partners hence enhancing decision-making capabilities for these retailers.	The study was limited to online retailers and did not focus on manufacturing firms.
Udomleartprasert and Jungthirapanich (2004)	The Supportive Infrastructure Enhancing Supply Chain Performance.	The findings of the study show that there is no direct relationship between information technology supportive infrastructure and supply chain performance.	The study was general in nature and did not focus on the specific capabilities of information systems.
Irfan, Wang, and Akhtar (2019)	Impact of IT Capabilities on Supply Chain Capabilities & Organizational Agility: A Dynamic Capability View.	IT infrastructure has an indirect effect on supply chain capabilities.	The study did not focus on manufacturing firms.

Source: Author (2022)

## **2.4 Research Gap**

The utilization of Management Information Systems (MIS) is regarded as a requisite for the effective management of today's intricate supply chains (Fasanghari, 2008). Citing Bayraktar, Tseng et al. (2011) posits that nowadays, most organizations are progressively integrating MIS systems in their supply chain operations to enhance their competitiveness in the local and global markets. Management Information System tools considerably augment the infrastructural solidity of a supply chain which allows for the delivery of the appropriate information at the right time (Tripathy, Aich, Chakraborty & Lee, 2014). This improves the competitiveness of the supply chain by coordinating and integrating the supply chain partners with inter-organizational functions. According to Ramayah, Sang, Omar and Dahlan (2008), inter-organizational integration between firms ought to be stressed in order to advance higher-level supply chain networks. In respect of this, extensive research has been conducted to establish supply chain performance and the impact of Information system capabilities on the same.

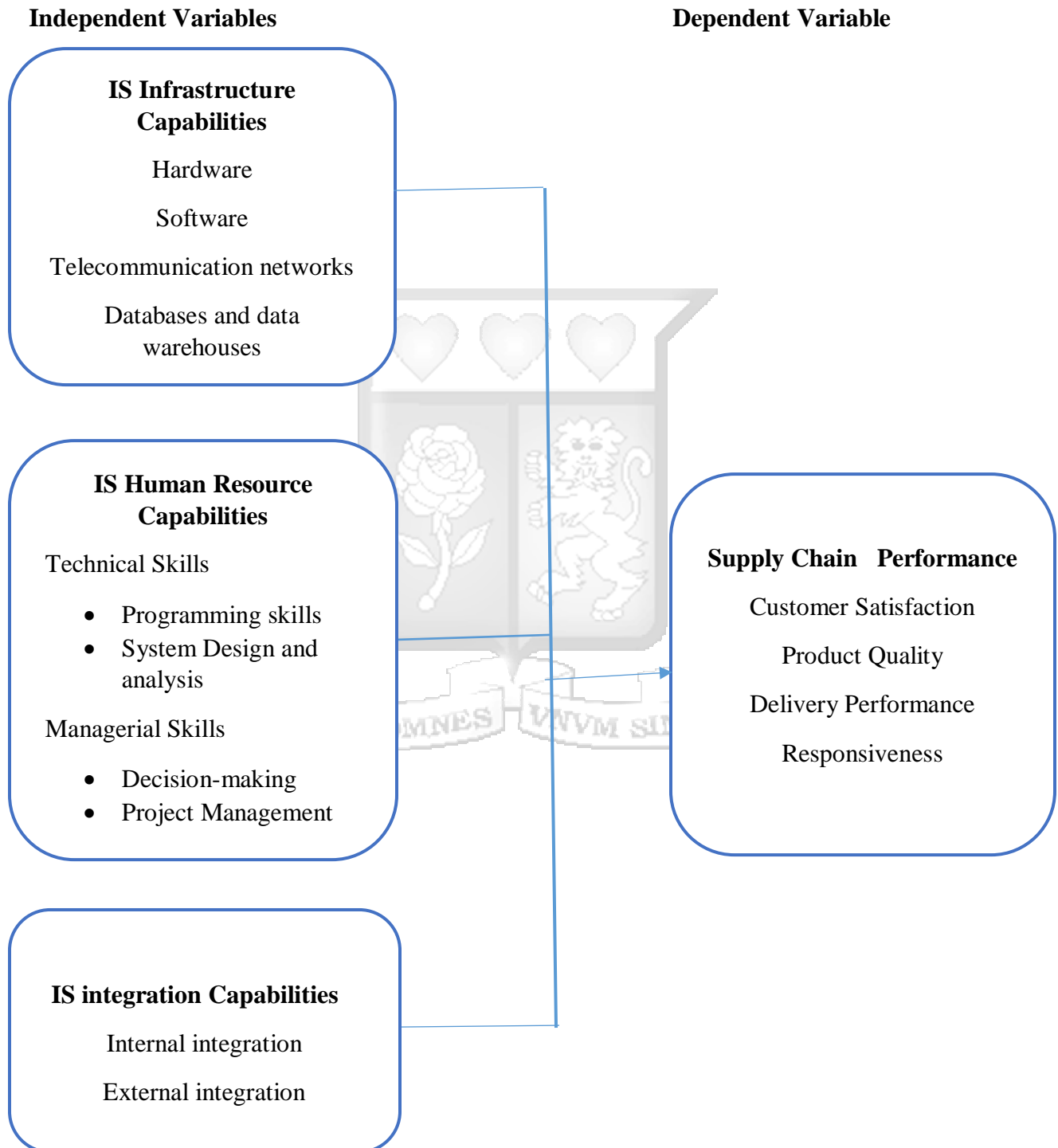
Nevertheless, there are conflicting results on the association between management information system capabilities and supply chain performance. While some scholars assert that IS capabilities are vital for the enhancement of supply chain performance (Tripathy et al. (2016); Fawcett et al. (2017); Fasanghari (2008), others claim that there is an insignificant relation between MIS capabilities and supply chain performance (Ramayah, Sang, Omar & Dahlan, (2008); Chae, Yen & Sheu, (2005). However, these studies have been conducted in developed nations therefore, the findings cannot be generalized to confront the issue of supply chain performance from the standpoint of a developing economy like Kenya. Prior research conducted in Kenya has centered on supply chain performance and MIS as an area of interest, yet it is unknown if studies have focused on the specific MIS capabilities and how they influence the supply chain performance. For this reason, a comprehensive study to establish the influence of IS on the supply chain performance of manufacturing firms in Kenya was carried out to fill this knowledge gap.

## **2.5 Conceptual Framework**

A conceptual framework provides the foundation and orientation of the study. It helps both the reader and the researcher to understand the contribution of the study to the body of knowledge (Crawford, 2020). The conceptual framework maps the relationship between the dependent and independent variables in a study. This study utilized the conceptual framework shown below to

portray the relationship between Management Information Systems (MIS) capabilities and supply chain performance.

**Figure 2. 1: Conceptual Framework**



**Source: Researcher (2022)**

Figure 2.1 illustrates how the dependent variable which is supply chain performance is influenced by independent variables which are; Management Information Systems Infrastructure capabilities, MIS Human Resource capabilities and Management Information System Integration capabilities.

## 2.6 Operationalization of Study Variables

The study variables in this study were measured as shown in table 2.1 below.

**Table 2. 2: Operationalization of Study Variables**

<b>Variables</b>	<b>Constructs</b>	<b>Operational Definition</b>	<b>Measurement Scale</b>	<b>Source</b>
<b>Independent variable: Management Information Systems Capabilities</b>	<b>Information System Infrastructure Capabilities</b>	IS infrastructure refers to resources that are shared across supply chain partners for information integration and smooth operations. IS infrastructure comprises of technical infrastructure (software, hardware, networks and other applications) and human infrastructure (skills and expertise of IS professionals)	5- Point Likert Scale 1= Strongly Disagree 5= Strongly Agree	Rai et al., (2006) Liu et al., (2013)
	<b>IS human resource capabilities</b>	Human resource IS capabilities refer to the extent to which IT managers possess the appropriate skills and expertise to carry out IS/IT operations. They	5- Point Likert Scale 1= Strongly Disagree 5= Strongly Agree	Chanopas, Krairit & Khang (2006)

		<p>include technical skills and managerial skills.</p> <p>Technical skills comprise of programming skills, system design and analysis while managerial skills include decision-making, leadership, and project management skills.</p>		
	<p><b>Information systems Integration capabilities</b></p>	<p>IS integration is the degree to which IS programs, applications and technologies of a central organization operate as a functioning whole in combination with IS technologies of their partners.</p> <p>IS integration includes internal and external integration.</p> <p>Internal integration refers to integration of IS applications within a firm while external integration is the integration of IS applications of two or</p>	<p>5- Point Likert Scale</p> <p>1= Strongly Disagree</p> <p>5= Strongly Agree</p>	<p>Saraf, Langdon &amp; Gosain, (2007)</p> <p>Mohamed et al. (2013)</p>

		more independent organizations.		
<b>Dependent Variable</b>	<b>Supply Chain Performance</b>	Supply chain performance relates to expansive operations in the supply chain network which are geared towards meeting end-customer needs. They include delivery performance, lead time management, inventory control and demand planning.	5- Point Likert Scale 1= Strongly Disagree 5= Strongly Agree	Hausman, (2004)

Source: Researcher (2022)

**2.7 Chapter Summary**

This chapter presented a review of the relevant literature on Information Systems capabilities and supply chain performance. Specifically, the chapter focused on the theoretical framework, empirical review of the literature on MIS capabilities and supply chain performance and the conceptual framework. The theoretical framework centered on the Collaborative Network Theory and the Technology-Organization-Environment (TOE) Framework. In addition, the chapter advanced a critique of the existing literature and identified gaps in the body of knowledge that was reviewed.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

This chapter contains an outline of the research design that were adopted in establishing the impact that management information system capabilities have on supply chain performance by studying manufacturing firms in Kenya. Furthermore, the chapter highlights details about the target population for the study, sampling, data collection and analysis procedures and later the ethical issues that will be taken into consideration while carrying out this study.

#### 3.3 Research Philosophy

Research philosophy refers to a system of assumptions pertaining the development of knowledge (Saunders, Lewis & Thornhill, 2016). Research philosophy is a belief about the way in which data about a phenomenon should be collected, analyzed, interpreted and utilized. It helps us validate the varied assumptions the researchers may have about the nature of knowledge (Business Research Methodology, 2021).

There are 4 philosophical views of research: pragmatism, positivism, realism and interpretivism (Ryan, 2018). Pragmatism research philosophy recognizes that there are many ways of interpreting phenomenon and carrying out research and that there are multiple realities (Creswell & Clark, 2011). Realism assumes a scientific approach to the development of knowledge (Dean, Joseph, Roberts & Wight, 2006). Interpretivism asserts that knowledge is subjective hence a researcher can never be entirely separated from their personal views and beliefs which ultimately inform the way in which they collect, interpret and analyze data (Ryan, 2018). Finally, positivism adheres to the perspective that only fact-based information obtained through observation and measurement is reliable (Park, Konge & Artino, 2020). The researcher's role in this philosophy is limited to that of data collection and interpretation.

The research philosophy underpinning this study is positivism. It was considered appropriate for this study because the methodology relies on scientific evidence obtained through data collection and interpretation of the data in an objective manner.

### **3.3 Research Design**

A research design refers to a structure used by researchers to merge various components of the study in a systematic manner to constructively solve the research problem at hand (Trochim, 2006). The research design that was employed for this study includes a cross-sectional descriptive survey. A cross-sectional survey allowed the researcher to draw inferences from data collected at one point in time. According to Wang (2020) a cross-sectional survey is an observational design for collecting data and making inferences about a target population at a single point in time. More precisely, a research design that involves quantitative research methods was employed. A descriptive survey was employed because the study described the characteristics of management information systems in terms of its specific capabilities. Deductive reasoning was applied in determining the influence of information systems on supply chain performance since the researcher drew conclusions based on existing theories and prior studies.

### **3.3 Target population**

A population refers to an entire group that a researcher is interested in studying (Cooper & Schindler, 2014). The population for this study constituted 26 manufacturing companies that are listed in the NSE (Nairobi Securities Exchange) as of 2021. Listed manufacturing firms were considered appropriate for this study because according to Mutsembi (2019), listed companies provide a good representation of the performance and operational conditions of the entire sector.

### **3.4 Sampling Design**

A sample is a subset of the entire population from which a researcher collects data (McCombes, 2021). The study used the census technique for sampling since the whole population of manufacturing firms that are listed in the Nairobi securities Exchange was studied. Judgmental sampling was then employed in the selection of the respondents for this study. Judgmental sampling entails the selection of participants in a research based on the qualities that the participants possess through the identification of individuals that are well-informed and proficient with the phenomenon under study (Etikan, Musa & Alkassim, 2016). The study targeted 6 respondents from the IT (Information Technology) and manufacturing department of each manufacturing firm targeting a total of 156 respondents. The researcher booked appointments with the overall heads of the manufacturing and IT departments in each organization to seek the authorization for carrying out research in their department. The researcher also presented an

introductory letter from Strathmore University as proof of the research being for academic purposes only.

### **3.5 Data collection methods**

Primary data entails data collected from firsthand sources for purposes of answering research questions (Allen, 2017). Primary data for this study was collected using structured questionnaires which were developed based off the study objectives. The questionnaires used were adapted for this study. The researcher modified some items of the questionnaire to fit the objectives of this study. The questionnaires were self-administered to the respondents who in this case were employees in the manufacturing and IT department of each manufacturing organization. Questionnaires of a structured nature were used in the data collection process since they allowed for collection of substantial information from a myriad of respondents within a short stretch of time. The researcher provided ample time for the participants to answer questions without supervision, interference, and guidance from the researcher. This helped the researcher to steer clear of any bias. The questionnaires were self-administered to the respondents. The researcher utilized google forms and drop and pick method to avail questionnaires to respondents.

The questionnaires were divided into five sections. The first section covered questions on the general background information about the respondents. The second section contained statements on the influence of IS infrastructure capabilities on supply chain performance. The third section contained statements on the influence of IS human resource capabilities on supply chain performance. The fourth section contained statements on the impact of IS Infrastructure integration capabilities on supply chain performance. Finally, the last section contained statements on supply chain performance.

### **3.6 Data analysis**

The researcher verified questionnaires collected from the respondents to ensure that the data was complete and accurate. Questionnaires with data errors were eliminated. Each questionnaire was coded for data entry which allowed the researcher to reduce large quantities of data collected from the respondents into a form which could be handled more easily by the data analysis software. SPSS and excel data sheets were used for data entry.

Descriptive and inferential statistical methods were utilized in drawing inferences from the quantitative data that was analyzed. Descriptive statistical techniques included measures of central

tendency such as Mean, Variance and Standard Deviation while inferential statistical techniques included regression analysis. The regression model was used to assess and explain the relationship between information systems and supply chain performance.

The regression model that was used is presented below:

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

Where:

**Y** is the dependent variable which is supply chain performance.

**$\beta_0$**  is a constant.

**X** denotes independent variables.

**X<sub>1</sub>** denotes IS infrastructure capabilities.

**X<sub>2</sub>** denotes IS Human Resource capabilities

**X<sub>3</sub>** denotes IS infrastructure integration capabilities.

**$\varepsilon$**  is the error term.

The study conducted regression diagnostics to ensure that the model assumptions are met. The study utilized the normality and collinearity tests. In addition, Spearman's correlation coefficient was used in measuring the strength of the relationship between MIS capabilities and supply chain performance. A correlation coefficient above 0 indicates a positive linear relationship between variables. A value between 0 and 0.19 indicates a very weak positive association, a value between 0.2 and 0.39 indicates a weak positive correlation between variables, 0.4 to 0.59 is moderate, 0.6 to 0.79 is strong and finally 0.8 to 1 indicates a very strong relationship between variables.

IBM-SPSS (Statistical Package for Social Sciences) v28 expedited data analysis by facilitating data manipulation, categorization and reviewing. Tables, graphs, and charts were used in the presentation of analyzed data.

### **3.7 Research Quality**

Research quality pertains to judgement with respect to the match between research questions, methodology, selection of respondents, data interpretation and protection against inferential and systematic error (Boaz & Ashby, 2003). Quality scientific research relates to a process that attempts to ensure the accuracy, credibility, consistency and applicability of the study results. Research quality of quantitative research is generally assessed in terms of its validity, reliability and objectivity.

#### **3.7.1 Research Validity**

Validity of research pertains to how accurately a research method measures what it intends to measure. Research validity regards to how well the collected data covers the actual scope of investigation (Taherdoost, 2016). There three types of research validity including content validity, construct validity and face validity. Content validity is the extent to which the items on a questionnaire are representative of the entire population that the research seeks to measure (Rusticus, 2014). Construct validity is the degree to which the instrument of measurement in research matches the construct of interest (Brown, 2000). Face validity is the extent to which an assessment subjectively appears to measure the construct of interest (Haradhan, 2017).

The questions were pre-tested to achieve research validity. The testing facilitated the revision and improvement of the questions so that the respondents faced no challenges when answering the queries (Beri, 2013). Furthermore, since the timing and accuracy of the questionnaires was essential to the study, a pre-testing stage was imperative in ensuring that the study compiled relevant findings (Cooper & Schindler, 2014). The supervisor was consulted for further input before sending the questionnaires to random respondents.

#### **3.7.2 Reliability**

Reliability of research is the extent to which the measure of a construct is consistent under different conditions (Drost, 2011). There are three types of validity in social sciences research including test-test reliability, test-retest correlation and internal consistency. This study adopted the internal consistency method to test for reliability. Internal consistency is measured using the Cronbach's alpha. Cronbach's alpha was adopted as a measure of the reliability of the instruments used in this study. Reliability of the questionnaires was determined using the Cronbach's test. Reliability was

determined using 15% of the target population. 10 questionnaires that were distributed to the respondents and effectively filled were used in the reliability test. Generally, a Cronbach alpha that falls between 0.6 and 0.7 is considered an acceptable level of reliability while an alpha of 0.3 is termed as a good level of reliability (Ursachi, Horodnic, & Zait, 2015). The Cronbach's test results are presented in table 3.1 below. The number of items denotes the number of questions asked under each variable as presented in the questionnaire in

**Table 3. 1: Cronbach's Test Results**

Variables	Cronbach's Alpha	Number of Items
IS Infrastructure capabilities	.761	6
Human resource capabilities	.718	4
IS Integration capabilities	.756	5
Supply chain performance	.823	5

**Source: Author (2022)**

### **3.8 Ethical issues in research**

Ethical clearance was sought from Strathmore University Review Committee. Ethical clearance is necessary for studies that involve human subjects (Cooper & Schindler, 2014). Strathmore University Review Committee issued the approval for conducting the survey after determining the capacity of the study to adhere to honesty, accuracy, and sufficient protection of the human participants in the manufacturing sector. The research permit for this study was issued by NACOSTI. Further, the research was voluntary in nature. Participants declared their interest to participate in the survey before the researcher issues any questionnaire.

The objective of allowing voluntary participation was to reduce any selection bias that could impair the expected outcomes of the study (Black, 2010). Furthermore, consent was sought to ascertain the commitment of the respondents to taking part in a study that hopes to examine the effect of management information systems on supply chain performance in the Kenyan manufacturing sector. The study guaranteed the participants privacy and confidentiality. The data collected was not divulged to third parties and was only for the purposes of accomplishing the objectives of the cross-sectional survey as recommended by Saunders, Lewis, and Thornhill (2016). In addition, the researcher ensured ethical consideration through acknowledging the

authors whose literature influenced the content of this study. This was to avoid any incidents of plagiarism.

### **3.9 Chapter Summary**

This chapter outlined the research philosophy that underpinned this study including the research design that was employed for the purpose of this study. The chapter also highlights the sampling design, data collection and data analysis procedures adopted for the study. In addition, the research validity and reliability measures that were employed to ensure the quality of research, are also outlined.



## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION, AND INTERPRETATION

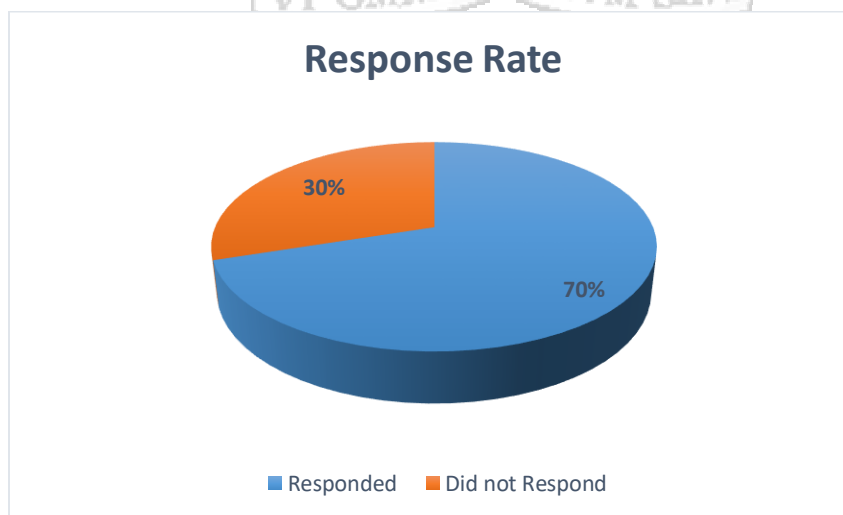
#### 4.1 Introduction

The following chapter presents a critical analysis made on the results and findings from the data collected. The data was collected using structured questionnaires that contained a set of questions based on the research objectives and the theories underpinning this study. Descriptive and inferential statistics were used to draw conclusions from the analyzed data.

#### 4.2 Response rate

The study targeted 26 manufacturing organizations that are listed in the Nairobi Securities Exchange and from each organization 6 respondents were selected. 156 questionnaires were therefore issued but only 109 questionnaires were effectively filled by the respondents and collected by the researcher to facilitate data analysis. The researcher utilized google forms and the drop and pick method to avail questionnaires to the respondents. The response rate was 70% which is considered suitable by various authors, for instance, according to Mugenda and Mugenda (2003), a response rate that represents 50% of all respondents is termed as good while a response rate above 69% is rated as sufficient. Similarly, Nulty (2008) suggests that a response rate of 50% or more is considered acceptable in social research while Fincham (2008) proposes that achieving a response rate approximating 60% or more should be the focus of researchers.

**Figure 4. 1 Response Rate**



**Source: Primary Data (2022)**

### 4.3 Demographics of respondents

The study established the general background information of the respondents, focusing on their job position, number of years of service and their level of education.

#### 4.3.1 Job Position

The study analyzed the job position of each respondent in the manufacturing organization. The data obtained is as shown in Table 4.1 below.

**Table 4. 1: Job Position of the Respondents**

<b>Job Position</b>	<b>Frequency</b>	<b>Percentage</b>
Top-level managers	28	25.7%
Middle-level managers	69	63.3%
Lower-level managers	12	11%
<b>Total</b>	<b>109</b>	<b>100%</b>

**Source: Primary Data (2022)**

The results indicate that majority of the respondents, 63.3%, are middle-level managers, 25.7% of the respondents are top-level managers while 11% are lower-level managers. The findings imply that most of the respondents have interacted with the organization's information systems hence were able to provide the necessary information to solve the research problem. The findings could also imply that middle-level managers were more willing to participate in the research.

#### 4.3.2 Years of Service

The study also investigated the length of service of the respondents in manufacturing firms. The data obtained is as shown below.

**Table 4. 2: Number of Years in Service**

<b>Years of Service</b>	<b>Frequency</b>	<b>Percentage</b>
Less than 5 years	21	19.2%
5-10 years	58	53.3%
10-15 years	27	24.7%
Over 20 years	3	2.8%
<b>Total</b>	<b>109</b>	<b>100%</b>

**Source: Primary Data (2022)**

The results indicate that majority of the respondents, 53.3% have served their organizations for close to 10 years, 24.7% have served for over 10 years, 19.2% have worked in their organizations for less than 5 years while only 2.8% of the respondents have served for over 20 years. The findings imply that the respondents have monitored the impact of information systems on supply chain performance over a span of several years hence can offer reliable information to answer the research problem at hand.

#### 4.3.3 Level of Education

Additionally, the study analyzed the level of education of the respondents. The data obtained is as shown in Table 4.3 below.

**Table 4. 3: Level of Education**

Level of Education	Frequency	Percentage
Diploma	18	16.5%
Graduate	75	68.8%
Post-graduate degree	16	14.7%
<b>Total</b>	<b>109</b>	<b>100%</b>

**Source: Primary Data (2022)**

The results indicate that majority of the respondents, 68.8% are university graduates, 16.5% have attained a diploma while 14.7% have attained a post-graduate degree. This implies that the judgements on the influence of information systems on supply chain performance were based on views from respondents who had an advanced level of education and who were able to discern the different capabilities of information systems and the possible effects on supply chain performance.

#### 4.4 Descriptive Analysis

Descriptive analysis often includes a summary of data in an organized manner which describes the relationship between variables in a sample (Kaur, Stoltzfus & Yellapu, 2018). This often includes measures of central tendency such as the mean and standard deviation. This study utilized a 5-point Likert scale (where 1= Strongly Disagree and 5= Strongly Agree) to collect data from manufacturing organizations in Kenya. The data analysis generated means and standard deviations from the findings of the data collected from respondents. The interpretation of the mean was based

on the following criteria: 1.8-1 was interpreted as strongly disagree, 1.9-2.6 represents disagree, 2.7-3.4 was interpreted as somewhat agree, 3.5-4.2 was agree and finally 4.3-5 was strongly agree.

#### 4.4.1 Information Systems Infrastructure Capabilities in Manufacturing Firms

The study sought to determine the effect of Information Systems Capabilities on supply chain performance. This section provided the respondents with 6 statements on IS infrastructure. The means and standard deviations of the responses are presented in the table below.

**Table 4. 4: Information Systems Infrastructure Analysis**

	N	Mean	Std. Deviation
The organization has integrated the necessary IS Infrastructure to support manufacturing operations	109	4.21	.410
The organization continuously upgrades and replaces key IS applications and systems to suit the changing environment	109	3.72	.655
The IS Infrastructure employed by the organization is easy to use and maintain by any kind of user	109	4.05	1.187
The IS infrastructure is flexible in the sense that it is easy to make the necessary changes in the software	109	3.83	.786
The organization ensures that there is alignment between IS infrastructure and manufacturing operations to ensure that they work in synergy	109	3.74	.542
The organization has automated most of the manufacturing processes	109	3.71	.751
Overall Results	109	3.871	.722

**Source: Primary Data (2022)**

The findings reveal that most manufacturing firms have integrated Information Systems infrastructure to support their manufacturing operations based on the mean of 4.21 and standard deviation of .410. The findings show that there is agreement that manufacturing organizations continuously upgrade Information Systems applications to suit the changing environment (Mean= 3.72, Standard Deviation= .655). The findings also indicate agreement that the Information System Infrastructure used in manufacturing organizations are flexible and easy to maintain (Mean= 3.83, Standard Deviation= .786). Finally, the respondents agree that there is alignment between

Information Systems and manufacturing operations (Mean= 3.74, Standard Deviation=.542) and that the organizations have automated most of their manufacturing operations (Mean=3.71, Standard Deviation= .751). The overall results indicate a mean of 3.871 and a Standard Deviation of 0.722. The mean indicates that the respondents show agreement with regards to the state of IS infrastructure implemented in their respective organizations. The standard deviation indicates a moderate variability in the responses given by managers in manufacturing firms.

#### 4.4.2 Information Systems Human Resource Capabilities in Manufacturing Firms

The study sought to determine the effect of Human Resource Information Systems Capabilities on supply chain performance. This section provided the respondents with 4 statements on IS infrastructure. The means and standard deviations of the responses are presented in the table below.

**Table 4. 5: Human Resource Capabilities Analysis**

	N	Mean	Std. Deviation
The organization has employed IS professionals with the highest proficiency in IT skills.	109	3.85	.538
The organization has ensured that there is training and development for IS professionals for further upskilling	109	3.65	.678
IT managers have the necessary balance of technological and interpersonal skills	109	4.18	.820
The organization encourages employees to share their innovative ideas.	109	3.87	.584
Overall Results	109	3.89	.655

**Source: Primary Data (2022)**

The findings in Table 4.5 indicate that the respondents agree that organizations recruit IS professionals with the highest proficiency in IT skills (Mean= 3.85, Standard Deviation= .538). The findings also indicate agreement that manufacturing organizations promote training and development for IS managers for further upskilling (Mean= 3.65, Standard Deviation= .678). Further, the findings indicate agreement that IT managers in manufacturing firms have the necessary balance of technological and interpersonal skills (Mean= 4.18, Standard Deviation= .820) and that managers are encouraged to share their innovative ideas (Mean= 3.87, Standard Deviation= .584). The overall results indicate a mean of 3.89 and a Standard Deviation of 0.655.

The mean indicates that the respondents show agreement with regards to the quality of human resource in their respective organizations. The standard deviation indicates a low variability in the responses given by managers in manufacturing firms.

#### 4.4.3 Information Systems Integration Capabilities in Manufacturing Firms

The study sought to determine the effect of Information Systems Integration Capabilities on supply chain performance. This section provided the respondents with 5 statements on IS infrastructure. The means and standard deviations of the responses are presented in the table below.

**Table 4. 6: Information Systems Integration Capabilities Analysis**

	N	Mean	Std. Deviation
The organization has ensured that there is maximum connectivity and interoperability of systems across several organizational participants in the supply chain	109	4.25	.898
The organization has employed IS systems that retain the expected level of functionality in a dynamic environment	109	3.69	1.237
The IS systems allow for optimal decision-making collaboration both within and outside the organizational boundaries	109	3.86	.563
The IS meets the needs of users while performing assigned manufacturing operations effectively	109	3.78	1.109
The organization has employed IS systems that are repairable and can be easily corrected without disrupting their functionality	109	3.81	.574
Overall Results	109	3.878	.876

**Source: Primary Data (2022)**

The findings indicate that the respondents somewhat agree that manufacturing organizations ensure that there is maximum connectivity and interoperability of information systems across several organizational participants in the supply chain (Mean= 4.25, Standard Deviation= .898). There is also agreement that manufacturing firms employ information systems that retain optimal functionality in a dynamic environment (Mean= 3.69, Standard Deviation= 1.237). The respondents also agree that IS systems allow for collaborative decision making between

manufacturing firms and their supply chain partners (Mean= 3.86, Standard Deviation= .563). The findings also indicate agreement that information systems meet the needs of users by effectively supporting manufacturing operations (Mean= 3.78, Standard Deviation= 1.109). The overall results indicate a mean of 3.878 and a Standard Deviation of 0.876. The mean indicates that the respondents agree that their respective organizations have been able to achieve maximum interoperability with their partners by leveraging on management information systems. The standard deviation indicates a moderate variability in the responses given by managers in manufacturing firms.

#### 4.4.4 Supply Chain Performance of Manufacturing Firms

The dependent variable for this study was supply chain performance of manufacturing organizations. This section provided the respondents with 5 statements on IS infrastructure. The means and standard deviations of the responses are presented in the table below.

**Table 4. 7: Supply Chain Performance Analysis**

	N	Mean	Std. Deviation
There is significant improvement in the quality of products delivered to the customers	109	4.05	.637
The organization has experienced an increase in customer retention and an improvement in customer satisfaction	109	3.80	.614
The organization has achieved efficiency in manufacturing operations	109	3.79	.532
There is an improvement in the competitiveness of the organization's products relative to those of other manufacturing companies	109	4.14	.727
The organization can respond effectively to short-term changes in customer demand and supply	109	3.75	.881
Overall Results	109	3.906	.678

**Source: Primary Data (2022)**

The findings of the descriptive analysis on supply chain performance indicate that there is agreement among the respondents that the use of information systems has resulted in significant improvement in the quality of their products (Mean= 4.05, Standard Deviation= .637). There is also agreement that manufacturing organizations have experienced increased customer retention and improved customer satisfaction (Mean= 3.80, Standard Deviation= .614). The results also indicate agreement that there is an improvement in the competitiveness of the organizations' products relative to those of other manufacturing firms offering similar products (Mean= 4.14, Standard Deviation= .727). In addition, there is agreement that manufacturing organizations can respond effectively to short-term changes in customer demand (Mean= 3.75, Standard Deviation= .881). The overall results indicate a mean of 3.906 and a Standard Deviation of 0.678. The mean indicates that the respondents show agreement with regards to the level of supply chain performance in their respective organizations. The standard deviation indicates a low variability in the responses given by managers in manufacturing firms.

#### **4.5 Correlation Analysis**

Spearman's correlation analysis was used to establish the association between the independent variables and the dependent variable as shown in Table 4.8 below. According to Schober, Boer and Schwarte (2018), a correlation coefficient above 0 indicates a positive linear relationship between variables, a value between 0 and 0.19 indicates a very weak positive association, a value between 0.2 and 0.39 indicates a weak positive correlation between variables, 0.4 to 0.59 is moderate, 0.6 to 0.79 is strong and finally 0.8 to 1 indicates a very strong relationship between variables.

**Table 4. 8: Correlation Analysis**

			Supply Chain Performance	Infrastructure Capabilities	Human Resource Capabilities	Integration Capabilities
Spearman's rho	Supply Chain Performance	Correlation Coefficient	1.000	.452**	.235**	.384**
		Sig. (2-tailed)	.	.000	.009	.000
		N	109	109	109	109
	Infrastructure Capabilities	Correlation Coefficient	.452**	1.000	.178*	.243**
		Sig. (2-tailed)	.000	.	.030	.000
		N	109	109	109	109
	Human Resource Capabilities	Correlation Coefficient	.235**	.178*	1.000	.147
		Sig. (2-tailed)	.009	.030	.	.067
		N	109	109	109	109
Integration Capabilities	Correlation Coefficient	.384**	.243**	.147	1.000	
	Sig. (2-tailed)	.000	.000	.067	.	
	N	109	109	109	109	

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

**Source: Primary Data (2022)**

The results of the correlation analysis indicate a moderate and positive relationship between Information Systems Infrastructure and supply chain performance (Rho= .452). Information Systems Infrastructure also has a significant effect on supply chain performance (Sig= .000<.05). The findings further show a weak relationship between human resource capabilities and supply chain performance with human resource capabilities having a significant effect on supply chain performance (Rho= .235, Sig= .009< .05). Further, the findings also reveal a weak and significant association between IS integration and supply chain performance (Rho= .384, Sig= .000< .05). A weak correlation coefficient indicates that there is a minimal relationship between IS capabilities and supply chain performance.

## 4.6 Diagnostic Analysis

Before running regression tests, the study conducted regression diagnostics to ensure that the model assumptions are met. The study utilized the normality p-p plot and collinearity tests as described below.

### 4.6.1 Collinearity Test

The study used Variance Inflation Factors (VIF) to ensure that there is no linear relationship between predictor variables in this study. A VIF value that is equal to 1 indicates lack of correlation among predictor variables while a value that is more than 5 indicates a high correlation among predictor variables.

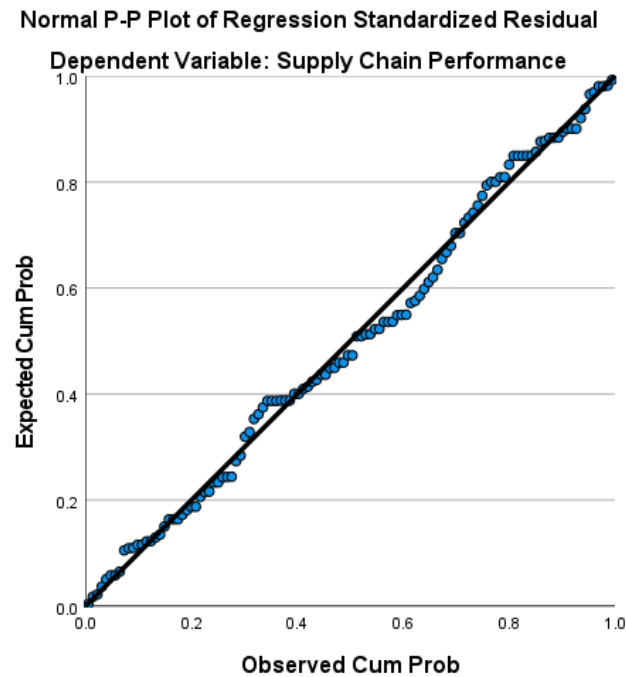
**Table 4. 9: Collinearity Test Results**

Model	Collinearity Statistics	
	Tolerance	VIF
1		
(Constant)		
Infrastructure Capabilities	.882	1.226
Human Resource Capabilities	.751	1.331
Integration Capabilities	.863	1.142

**Source: Primary Data (2022)**

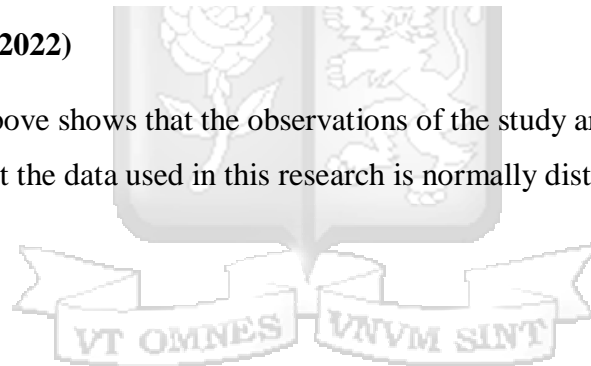
From Table 4.9 above, infrastructure capabilities, human resource and integration capabilities have a VIF of 1.226, 1.331 and 1.142 respectively. This implies that there is no correlation among the independent variables hence the data could be subjected to regression analysis.

**Figure 4. 2 Normality P-P Plot Test**



**Source: Primary Data (2022)**

The normality p-p plot above shows that the observations of the study are fitted within the normal curve hence implying that the data used in this research is normally distributed.



#### 4.7 Regression Analysis

The study employed a multiple linear regression analysis to estimate the relationship between IS capabilities and supply chain performance.

**Table 4. 10: Infrastructure Capabilities and Supply Chain Performance**

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.452 <sup>a</sup>	.179	.175	2.35455		
a. Predictors: (Constant), Infrastructure Capabilities						
ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.254	3	.418	6.432	.000 <sup>b</sup>
	Residual	6.934	106	.065		
	Total	8.188	109			
a. Dependent Variable: Supply Chain Performance						
b. Predictors: (Constant), Infrastructure Capabilities						
Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.352	.315		7.468	.000
	Infrastructure Capabilities	.283	.067	.452	4.223	.000
a. Dependent Variable: Supply Chain Performance						

**Source: Primary Data (2022)**

The coefficient of determination ( $R^2$ ) from the analysis is .179. This implies that 17.9% of the changes in supply chain performance are explained by information systems infrastructure capabilities. The other 82.1% is attributed to other factors that are not included in this study.

The study also utilized Analysis of Variance (ANOVA) test to assess whether the regression model is statistically significant. The output from the ANOVA test indicates a p-value which is less than

0.05 (Sig= .000< .05) which shows that the model above is statistically significant in explaining the relationship between the independent and dependent variables in this study.

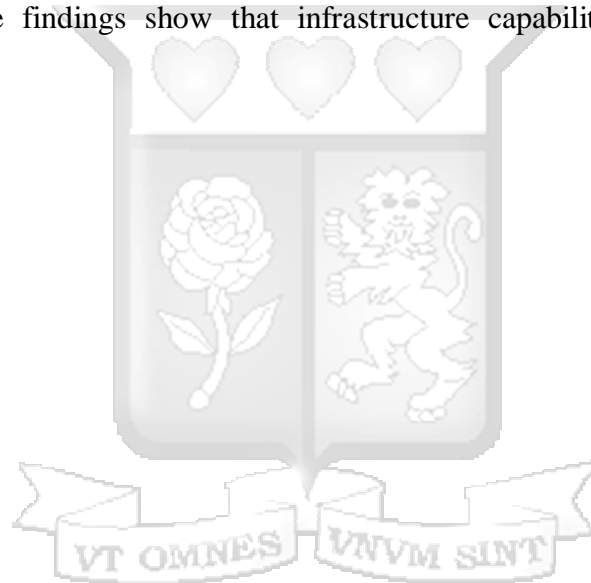
The resulting regression equation from the coefficients in Table 4.10 above is:

$$Y = 2.352 + .283X_1$$

The above equation can be interpreted as follows:

A unit increase in IS infrastructure capabilities will result in a .283 increase in supply chain performance.

The findings also indicate that the regression model ( $\beta = 2.352$ ) is statistically significant (sig= .000< .05). Further, the findings show that infrastructure capabilities (Sig= .000< .05) is statistically significant.



**Table 4. 11: Human Resource Capabilities and Supply Chain Performance**

Model Summary						
Model	R	R Square	Adjusted R Square		Std. Error of the Estimate	
1	.235 <sup>a</sup>	.064	.061		.28431	
a. Predictors: (Constant), Human Resource Capabilities						
ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.527	3	.172	1.909	.009 <sup>b</sup>
	Residual	9.765	106	.092		
	Total	10.292	109			
a. Dependent Variable: Supply Chain Performance						
b. Predictors: (Constant) Human Resource Capabilities						
Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.134	.251		12.474	.000
	Human Resource Capabilities	.147	.072	.235	2.042	.009
a. Dependent Variable: Supply Chain Performance						

**Source: Primary Data (2022)**

The coefficient of determination ( $R^2$ ) from the analysis is .064. This implies that 6.4% of the changes in supply chain performance are explained by human resource capabilities. The other 93.6% is attributed to other factors that are not included in this study.

The study also utilized Analysis of Variance (ANOVA) test to assess whether the regression model is statistically significant. The output from the ANOVA test indicates a p-value which is less than 0.05 (Sig= .009 < .05) which shows that the model above is statistically significant in explaining the relationship between the independent and dependent variables in this study.

The resulting regression equation from the coefficients in Table 4.11 above is:

$$Y = 3.134 + .147X_2$$

The above equation can be interpreted as follows:

A unit increase in the human resource capabilities will result in a .147 change in supply chain performance.

The findings also indicate that the regression model ( $\beta = 3.134$ ) is statistically significant ( $\text{sig} = .000 < .05$ ). Further, the findings show that infrastructure capabilities ( $\text{Sig} = .009 < .05$ ) is statistically significant.



**Table 4. 12: Integration Capabilities and Supply Chain Performance**

Model Summary <sup>b</sup>						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.384 <sup>a</sup>	.145	.139	2.57293		
a. Predictors: (Constant), Integration Capabilities						
ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.837	3	.279	4.089	.000 <sup>b</sup>
	Residual	7.231	106	.068		
	Total	8.068	109			
a. Dependent Variable: Supply Chain Performance						
b. Predictors: (Constant), Integration Capabilities						
Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.834	.323		8.765	.000
	Infrastructure Capabilities	.268	.066	.384	4.061	.000
a. Dependent Variable: Supply Chain Performance						

**Source: Primary Data (2022)**

The coefficient of determination ( $R^2$ ) from the analysis is .145. This implies that 14.5% of the changes in supply chain performance are explained by information systems capabilities. The other 85.5% is attributed to other factors that are not included in this study.

The study also utilized Analysis of Variance (ANOVA) test to assess whether the regression model is statistically significant. The output from the ANOVA test indicates a p-value which is less than 0.05 (Sig= .000 < .05) which shows that the model above is statistically significant in explaining the relationship between the independent and dependent variables in this study.

The resulting regression equation from the coefficients in Table 4.12 above is:

$$Y = 2.834 + .268X_3$$

The above equation can be interpreted as follows:

A unit increase in the IS integration capabilities will result in a .268 increase in supply chain performance.

The findings also indicate that the regression model ( $\beta = 2.834$ ) is statistically significant ( $\text{sig} = .000 < .05$ ). Further, the findings show that integration capabilities ( $\text{Sig} = .000 < .05$ ) is statistically significant.



**Table 4. 13: Overall Results**

<b>Model Summary<sup>b</sup></b>						
Model	R	R Square	Adjusted R Square		Std. Error of the Estimate	
1	.568 <sup>a</sup>	.375	.371		2.35319	
a. Predictors: (Constant), Infrastructure Capabilities, Human Resource Capabilities, Integration Capabilities						
<b>ANOVA<sup>a</sup></b>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.947	3	.636	11.116	.002 <sup>b</sup>
	Residual	6.065	106	.056		
	Total	8.012	109			
a. Dependent Variable: Supply Chain Performance						
b. Predictors: (Constant), Infrastructure Capabilities, Human Resource Capabilities, Integration Capabilities						
<b>Coefficients<sup>a</sup></b>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.218	.364		6.085	.000
	Infrastructure Capabilities	.269	.068	.367	3.953	.011
	Human Resource Capabilities	.142	.079	.228	1.761	.026
	Integration Capabilities	.233	.072	.297	3.236	.019
a. Dependent Variable: Supply Chain Performance						

**Source: Primary Data (2022)**

The coefficient of determination ( $R^2$ ) from the analysis is .375. This implies that 37.5% of the changes in supply chain performance are explained by information systems capabilities. The other 62.5% is attributed to other factors that are not included in this study.

The study also utilized Analysis of Variance (ANOVA) test to assess whether the regression model is statistically significant. The output from the ANOVA test indicates a p-value which is less than 0.05 (Sig= .002 < .05) which shows that the model above is statistically significant in explaining the relationship between the independent and dependent variables in this study.

The resulting regression equation from the coefficients in Table 4.13 above is:

$$Y = 2.218 + .269X_1 + .142X_2 + .233X_3 + .364$$

The above equation can be interpreted as follows:

A unit increase in the IS infrastructure capabilities will result in a .269 increase in supply chain performance.

Similarly, a unit increase in human resource capabilities will result in a .142 increase in supply chain performance of manufacturing organizations.

Finally, a unit increase in integration capabilities will result in .233 increase in supply chain performance.

The findings also indicate that the regression model ( $\beta = 2.218$ ) is statistically significant (sig= .000 < .05). Further, the findings show that infrastructure capabilities, human resource capabilities and integration capabilities are statistically significant (Sig= .011 < .05, Sig= .026 < .05 and Sig= .019 < .05 respectively).

#### **4.8 Chapter Summary**

This chapter outlined the response rate achieved after the distribution of questionnaires to the respondents. It also provided a summary of the demographics of the respondents including their age, level of education and year of service. Additionally, the chapter presented a descriptive analysis of the data collected which included two measures of central tendency: the mean and standard deviation. The results of the correlation and regression analysis of the collected data are also presented in this chapter.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

The following chapter presents a summary and discussion of the findings, recommendations, suggestions for further research and the conclusions made from this study.

#### 5.2 Summary of Findings

Management Information systems play an increasingly vital role in ensuring cost reductions, and the responsiveness of a supply chain by integrating supply chain partners. Additionally, information systems allow organizations to collect real time information along the supply chain to swiftly react to predictable changes in the market. Nevertheless, studies conducted to assess the effect of information systems on supply chain management report mixed findings. This study sought to establish the influence of information systems capabilities on supply chain performance. The Technology-Organization-Environment (TOE) framework and the Collaborative Network Theory provided the theoretical foundation for this study. The Technology-Organization-Environment (TOE) framework outlines 3 fundamental contexts- organizational, environmental, and technological that influence the way in which organizations implement new technology. The Collaborative Network Theory explains how technology-enabled integration between manufacturers and suppliers can promote innovation and enhance their operational performance.

The research philosophy underpinning this study is positivism. The study's population was 26 manufacturing firms that were listed in the Nairobi Securities Exchange as of 2021. The target respondents for this study were 6 employees in each manufacturing firm. The response rate from the study was 76%. Further the study established that most of the respondents, 63.3% were middle-level managers. The study also established that majority of the respondents 53.4% have worked in manufacturing firm for close to 10 years. The findings also reveal that majority of the respondents 68.1% are university graduates. Additionally, correlation and regression analysis results indicate that information system infrastructure and integration capabilities have a significant influence of supply chain performance while human resource capabilities have no significant effect on supply chain performance.

### **5.3 Discussion of Findings**

This section presents a discussion of the findings in light of the research objectives.

#### **5.3.1 Information Systems Infrastructure Capabilities and Supply Chain Performance**

The study aimed at assessing the use of information system infrastructure in manufacturing organizations. The descriptive analysis results reveal that most manufacturing firms rely on information systems to support their manufacturing operations. The findings also indicate that manufacturing firms are required to continuously upgrade and replace key MIS applications to suit the changing environment for them to remain competitive in the industry. In line with this Bhutto (2008) argues that organizations are forced to upgrade MIS technology because of the shift from moderating dynamic to high velocity dynamic markets including evolution in technology. The analysis of the results also leads to the conclusion that most manufacturing firms employ MIS infrastructure that is flexible and easy to use by all users in the organization. This implies that all information systems resources are sharable and usable by all users across the organization. Consistent with this, Anwar and Masrek (2013) posit that a flexible MIS infrastructure facilitates full utilization of MIS applications for strategic purposes.

Further, the regression results indicated that there was a significant relationship between MIS infrastructure and supply chain performance ( $\text{sig} = 0.000 < .05$ ). The regression coefficient also shows that supply chain performance increases when manufacturing organizations deploy, develop, and reconfigure MIS capabilities. The findings are in line with a study by Sundram et. al (2018) who argued that MIS infrastructure scales up the effectiveness of the supply chain systems by expediting information and material exchanges across the supply chain. The study by Sundram et. al (2018) was anchored on the Resource-Based-Theory and the Systems theory. The Systems theory closely relates to the Collaborative Network Theory used in this study. Both theories focus on collaborative relationships between various partners in a network and how these relationships create value for the partners involved. Furthermore, the findings of this study are consistent with the findings by Awara, Udoh and Anyadighibe (2018) whose study revealed that Information systems improved supply chain performance of online retailers by building the accumulation of knowledge about various supply chain partners hence enhancing decision making capabilities for online retailers. The study was grounded on the Task Technology Fit Theory by Goodhue and Thompson (1995). This theory closely relates to the TOE framework because the theory focuses IT used in organizations and how it helps achieve organizational

efficiency by enhancing management's decision making.

The correlation analysis revealed that MIS infrastructure has a significant effect on supply chain performance (Sig= .000<.05). The results also indicated that there was a positive association between MIS infrastructure capabilities and supply chain performance. In line with this, a study by Milimo, Sagwa and Sakwa (2018) revealed that IT infrastructure had a significant influence on supply chain performance. The author further argued that organizations that integrated IT systems in their supply chains reaped the benefits of greater operational effectiveness and efficiency thereby enhancing customer satisfaction. The study by Milimo, Sagwa and Sakwa (2018) was anchored on the Collaborative Network Theory which has also been applied in this study. The findings of the current study support the propositions of the TOE framework which is founded on the belief that technology adoption is shaped by the pool of technological infrastructure both internal and external to the organisation as well as their compatibility, complexity, and benefits.

Evidence from the studies above suggests that information systems infrastructure is essential for managing resilient, efficient, and sustainable supply chains. However, to ensure sustainable supply chain performance, manufacturing firms need to build on newer IS infrastructure capabilities to enable them to navigate the dynamic business environment and adapt swiftly.

### **5.3.2 Human Resource Capabilities and Supply Chain Performance**

The second objective of the study was to establish the extent to which human resource capabilities were utilized in manufacturing organizations. The descriptive analysis revealed that manufacturing organizations recruit MIS professionals with proficient IT skills. Moreover, firms ensure that there is training and development for MIS professionals for further upskilling. The findings are in line with the views of Prajogo and Sohal (2013) highlight proficiency in the use of MIS as a key capability that MIS managers should have. In addition, Lee, Trauth and Farwell (1995) argue that IS managers require up-to-date tech skills to effectively steer firm integration and Business Process Reengineering (BPR). Further, descriptive analysis results reveal that manufacturing organizations ensure that IT managers had the necessary balance of technical and interpersonal skills. This reflects the views of Koh, Lee, Yen and Havelka (2004) who opine that MIS managers need a combination of technical and interpersonal skills which play a vital role in MIS project management.

Further, the regression results indicated that there was a significant relationship between human resource capabilities and supply chain performance ( $\text{sig} = .000 < .05$ ). The regression coefficient also shows that supply chain performance decreases when manufacturing organizations leverage on MIS professionals' skills in the maintenance of MIS infrastructure. The findings correspond with those of Wang, Chou, Lee, and Hai (2014) whose study revealed that there was significant relationship between intra-organizational IT skills and supply chain integration and ultimately its performance. The theoretical perspective for the study by Wang, Chou, Lee, and Hai (2014) was the Human Capital Theory which is founded on the belief that human productivity can be enhanced by focusing on education and training. The theory slightly relates to the TOE framework currently employed in this study because the TOE framework has an aspect of human resources.

These previous studies on human resource capabilities imply that technology innovation is a key driver of changes in technological skills needs. Disruption caused by changes in technology often make IS managers' skills obsolete hence the need for upskilling through training and development. This implies that the benefits of technology change can be considerable when IT managers possess the necessary tech skills needed for change.

The correlation analysis revealed that human resource capabilities had a significant effect on supply chain performance ( $\text{Sig} = .009 < .05$ ). The results also indicated that there was a weak association between human resource capabilities and supply chain performance. In line with this, a study by Prajogo and Sohal (2013), concluded that supply chain managers need to acquire skills and competences in both social and technical aspects to run efficient operations. Unlike this current study, the study by Prajogo and Sohal (2013) used the Socio-Technical Theory. The findings are therefore consistent with the propositions of the TOE framework which highlights the quality of human resource as one of the factors that organizations consider when adopting new technology.

### 5.3.3 Information Systems Integration Capabilities and Supply Chain Performance

The results of the descriptive analysis revealed that the respondents agree that IS systems allow for optimal decision-making collaboration both within and outside organizational boundaries. In line with this, Carr (2016) posit that integrated MIS aids in decision-making and allows for collaboration among supply chain partners by allowing for ease of access of vital information. Further, the findings show that organizations employ MIS systems that are repairable and can be easily corrected without disrupting their normal functionality. This always ensures effective and continuous information flow across the supply chain. As a result, partners remain well-informed with up-to-date information in real time hence enable them to make better informed decisions. Improved demand forecasting allows firms to respond quickly to changes in customer demands. In line with this, Alvares (2019) states that easily repairable systems allow for continuous manufacturing operations and prevents stoppage of production activities.

The regression results indicate that there is a significant relationship between MIS integration capabilities and supply chain performance ( $\text{sig} = 0.000 < .05$ ). The regression coefficient also shows that supply chain performance increases when manufacturing organizations ensure that there is maximum connectivity and interoperability of information systems across several organizational participants in the supply chain. Centralized cross-operational data allows supply chain partners to collaborate thereby improving their working relations and increasing work-flow efficiency. Consistent with this, Rajaguru and Matanda (2010) state that interoperability of management information systems is vital in expediting material and information flow across the supply chain thereby streamlining supply chain operations. The study by Rajaguru and Matanda (2010) was underpinned by the Dynamic Capabilities Theory and the Congruency Theory. The Congruency Theory was used by the authors in explaining the role of compatibility in facilitating supply chain integration. Similarly, the TOE used in this study also highlights compatibility of IS infrastructure as one of the key factors that influence adoption of new technology by an organization.

The correlation analysis revealed that IS integration capabilities have a significant effect on supply chain performance ( $\text{Sig} = .000 < .05$ ). The results also indicated that there was a positive association between IS integration capabilities and supply chain performance. These findings are reinforced by a study carried out by Ganbold, Matsui and Rotam (2019) whose findings indicated that IS-

enabled integration in the supply chain positively impacted delivery performance in the supply chain. Ganbold, Matsui and Rotam (2019) grounded their study on the Relational View Theory and the Resource-Based View theories. These two theories reflect the behaviour and structure of collaborative networks according to (Durugbo, 2016) Similarly, McCarthy-Bryne and Mentzer (2011) argued that integration in the supply chain resulted in a coordinated forecasting process between the suppliers, customers and manufacturers thereby expediting response to changes in customer demand for products with shorter life cycles. This implies that integration facilitates improved demand forecasting which allows firms to respond quickly to changes in customer demands. A synchronized supply chain system facilitates direct collaboration between the firm and its customers; therefore, firms can respond to customer needs in a quick and efficient manner. McCarthy-Bryne and Mentzer (2011) used Supply Chain Value Integration model as the theoretical perspective for their research. This theory closely relates to the Collaborative Network Theory applied in this study in the sense that both theories have been used in supply chain integration research to explain the relationship between different partners in a supply chain network.

The findings therefore support the propositions of the Collaborative Network Theory which posits that collaborative networks promote effective co-ordination, shared decision-making, and collaboration with different external partners such as customers and suppliers which enhances operational performance.

#### **5.4 Conclusion**

In conclusion, the study noted that IS infrastructure and IS integration capabilities significantly influence supply chain performance. Consequently, it is imperative for manufacturing firms to integrate the necessary IS infrastructure to support their operations, ensure that there is alignment between IS infrastructure and manufacturing operations for optimal performance and automate most of their manufacturing processes. Additionally, the findings reveal that connectivity and interoperability of IS infrastructure and flexible IS systems allow for optimal decision-making collaboration between supply chain partners, resulting in enhanced supply chain performance.

Finally, the results indicate that human resource capabilities have a significant influence on the supply chain performance of manufacturing firms hence firms ought to assess their employees' IT skills to ensure that they are at par with rapidly evolving technologies. This will aid in establishing

a baseline from which employee training and development could lead to desired results. The study further recommends that manufacturing companies should recruit employees with the necessary technological skills and competencies necessary for the effective operation of IS systems.

## **5.5 Recommendations**

### **5.5.1 Policy Recommendations**

The findings of the study highlight the significant impact that MIS capabilities have on supply chain performance. This study recommends that policy makers in the manufacturing industry should formulate sound policies that encourage and facilitate the implementation of MIS capabilities that will ensure automation of manufacturing operations.

### **5.5.2 Managerial Recommendations**

The study recommends that managers in manufacturing organizations should integrate IS systems to support manufacturing operations. This will streamline manufacturing operations by getting rid of unnecessary and repetitive tasks. The management of manufacturing firms are advised to continuously upgrade MIS applications and systems for them to respond to customer needs effectively. Management should also work toward automating most of their manufacturing operations to reduce manufacturing lead time, enhance product quality and achieve increased productivity and efficient use of raw materials.

Furthermore, the study suggests that managers should ensure that there is maximum interoperability of MIS systems across several supply chain partners including customers and suppliers. This ensures effective and efficient flow of information and materials. In addition, it will allow for optimal decision-making collaboration both within and outside the organization. Manufacturing firms should also employ MIS systems that are easily repairable to retain the expected level of functionality in a dynamic environment.

### **5.5.3 Theoretical Implications**

This study makes a theoretical contribution by explaining how the development of IS capabilities in an organization may influence supply chain performance. The study drew from the TOE framework to better understand how the adoption and implementation of technological innovations is influenced by the technological, environmental, and organizational aspects both internal and external to an organisation. The results from the study highlight advanced IT technical skills and

up to date MIS infrastructure as important aspects that organizations consider when integrating IS capabilities into their operations hence confirming the applicability of TOE framework in IT adoption research. The Collaborative Network Theory was also applied in explaining how the organizations leverage on IT to achieve co-ordination and collaboration with other supply chain partners that delivers greater operational performance. The findings indicate that MIS integration positively and significantly influences supply chain performance hence the Collaborative Network Theory can be applied in similar studies.

### **5.6 Limitations of the Study**

The research was carried out during COVID-19 pandemic which largely hindered efficient collection of the data for this study. The study also focused on firms that are listed in the Nairobi Securities Exchange hence the findings may not be generalized to the whole population of manufacturing firms in Kenya. Further, financial and time constraints limited the researcher's ability to meet face to face with respondents in distant geographical locations hence may have hindered effective completion of some of the questionnaires.

### **5.7 Suggestions for Further Research**

The study focused mainly on manufacturing firms in the supply chain hence there is need for future studies to consider the effect of information systems on the performance of other supply chain partners like suppliers. The findings also limited itself to 3 dimensions of MIS capabilities. Future studies can consider other dimensions of MIS capabilities such as MIS flexibility.

## REFERENCES

- Abed, S. S. (2020). Social Commerce Adoption Using TOE Framework: An Empirical Investigation of Saudi Arabian SMEs. *International Journal of Information Management*, 53.
- Achieng, E. M. (2021). Advanced Manufacturing Technology as a Strategy in Enhancing Performance of Large Manufacturing Companies in Kenya.
- Adhiambo, I. D. (2018). Kenya's Industrialization and Development Agenda: An assessment of the Effects of Policy Changes on Operation of Export Processing Zones.
- Ahuja, G. (2000). Collaboration Networks Structural Holes and Innovation: A Longitudinal Study. *Administrative Science Quarterly*, 45(3), pp. 425-455.
- Albarran, J. W., & Scholes, J. (2005). How to get published: seven easy steps. *Nursing in Critical Care*, 10:7, pp. 2-7.
- Alkhafaji, S. (2011). Review of Information Systems and Business Challenges. *Review of IS and business challenges*.
- Allen, M. (2017). *Primary Data Analysis*. The SAGE Encyclopedia of Communication Research Methods. Retrieved from SAGE Research Methods: <https://methods.sagepub.com/reference/the-sage-encyclopedia-of-communication-research-methods/i11221.xml>
- Al-Mamary, Y. H., Shamsuddin, A., & Aziati, N. (2013). The Impact of Management Information Systems Adoption in Management Decision Making: A Review. *Management Information Systems*, 8(2013), pp. 10-17.
- Almazán, D. A., Tovar, Y. S., & Quintero, J. M. (2017). Influence of information systems on organizational results. *Contaduría y Administración* 62(2), pp. 321-338.
- Alvarez, G. P. (2019). Real-time Fault Detection and Diagnosis using Intelligent Monitoring and Supervision Systems. *Doi: 10.5772/intechopen.90158*.

- Anwar, N., & Masrek, M. N. (2013). The Impact of IT Infrastructure Flexibility on Strategic Utilization on Information Systems: A Conceptual Framework. *International Conference on Advanced Computer Science Applications and Technologies (ACSAT)*.
- Aramyan, L. H. (2007). Measuring Supply Chain Performance in the agri-food Sector.
- Auramo, J., Inkiläinen, A., Kauremaa, J., Kempainen, K., Kärkkäinen, M., Laukkanen, S., . . . Tanskanen, K. (2005). The roles of information technology in supply chain management. *In 17th Annual NOFOMA Conference*, (pp. 9-10).
- Auramo, J., Kaureema, J., & Tanskanen, K. (2005). Benefits of IT in supply chain management: an explorative study of progressive companies. *International Journal of Physical Distribution & Logistics Management*, 35(2), pp. 82-100.
- Awa, H. O., Ukoha, O., & Igwe, S. R. (2017). Revisiting Technology-Environment-Organisation Theory for Enriched Applicability. *The Bottom Line*, 30(1), pp. 2-22.
- Awara, N. F., Udoh, E. G., & Anyadighibe, J. A. (2018). Information technology tools and supply chain performance of online retailers in Calabar Metropolis, Cross River State, Nigeria. *Global Journal of Social Sciences*, 17(2018), pp. 55-67.
- Bacharach, S. B. (1989). Organizational Theories: Some Criteria for Evaluation. *The Academy of Management Review*, 14(4), pp. 496-515.
- Baker, J. (2011). The Technology-Organization-Environment Framework. In *Information Systems Theory- Chapter 12* (pp. 231-245). Hamburg: University of Hamburg, Germany.
- Banga, K., & Velde, D. W. (2018). *Digitalisation and the Future of Manufacturing in Africa*.
- Bayraktar, E., Gunasekaran, A., Koh, S. L., Tatoglu, E., Demirbag, M., & Zaim, S. (2010). An efficiency comparison of supply chain management and information systems practices: a study of Turkish and Bulgarian small- and medium-sized enterprises in food products and beverages. *International Journal of Production Research*, 48(2), pp. 425-451.
- Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management*, 19(3), pp. 275-292.
- Beri, G. C. (2013). *Marketing Research*. New Delhi: Tata McGraw-Hill Education.

- Beske, P., Land, A., & Seuring, S. (2014). Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature. *International Journal of Production Economics*, 152, pp. 131-143.
- Bharadwaj, A. S. (2000). A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation. *MIS Quarterly*, 24(1), pp. 169-196.
- Bhutto, A. (2008). Dynamic Technological Capability (DCT) Model for the Next Generation of Technology Evolution.
- Black, K. (2019). *Business Statistics: For Contemporary Decision Making, 10th Edition*. New Jersey: Wiley.
- Boaz, A., & Ashby, D. (2003). *Fit for Purpose? Assessing Research Quality for Evidence Based Policy and Practice*. London: ESRC UK Centre for Evidence Based Policy and Practice.
- Brosch, A. (2015, July 27). Retrieved from Inbound Logistics: A Thomas Company: <https://www.inboundlogistics.com/cms/article/6-global-supply-chain-challenges-to-ignore-at-your-own-risk/>
- Brown, J. D. (2000). What is Construct Validity? *Shiken: JALT Testing & Evaluation SIG Newsletter*, 4(2), pp. 8-12.
- Bryan, J. D., & Zuva, T. (2021). A Review on TAM and TOE Framework Progression and How These Models Integrate. *ASTECS Journal*, 6(3), pp. 137-145.
- Budiarto, D. S., Prabowo, M. A., & Herawan, T. (2017). An Integrated Information System to Support Supply Chain Management & Performance in SMEs. *Journal of Industrial Engineering and Management*, 10(1), pp. 373-387.
- Bush, A. A., Tiwana, A., & Rai, A. (2010). Complementarities Between Product Design Modularity and IT Infrastructure Flexibility in IT-Enabled Supply Chains. *IEEE Transactions on Engineering Management*, pp. 240-254.
- Cai, J., Liu, X., Xiao, Z., & Liu, J. (2009). Improving supply chain performance management: A systematic approach to analyzing iterative KPI accomplishment. *Decision Support Systems*, 46(2), pp. 512-521.

- Camarinha-Matos, L. M., & Afsarmanesh, H. (2005). Collaborative Networks: A New Scientific Discipline. *Journal of Intelligent Manufacturing*, 16, pp. 439-452.
- Camarinha-Matos, L. M., & Afsarmanesh, H. (2006). Collaborative Networks' Value Creation in a Knowledge Society. *Proceedings of PROLAMAT 2006 IFIP International Conference on Knowledge Enterprise- New Challenges*. Shanghai, China: Springer.
- Carr, A. S. (2016). Relationships among Information Technology, Organizational Cooperation and Supply Chain Performance. *Journal of Managerial Issues*, 28(3/4), pp. 171-190.
- Chae, B., Yen, H. R., & Sheu, C. (2005). Information Technology and Supply Chain Collaboration: Moderating Effects of Existing Relationships Between Partners. *IEEE Transactions on Engineering Management*, 52(4).
- Chanopas, A., Krairit, D., & Khang, D. B. (2006). Managing information technology infrastructure: a new flexibility framework. *Management Research News*, 29(10), pp. 632-651.
- Chege, J., Ngui, D., & Kimuyu, P. (2016). Retrieved from Brookings Web site: [https://www.brookings.edu/wp-content/uploads/2016/07/L2C\\_WP25-1.pdf](https://www.brookings.edu/wp-content/uploads/2016/07/L2C_WP25-1.pdf)
- Chelimo, S. C. (2019). Information Systems and Supply Chain Integration in Manufacturing Industry in Kenya.
- Chen, J.-h., & Zhao, M.-h. (2009). Study on the Analysis of Information Technology Capability of Third-Party Logistics Firms and its Constructing. *International Conference on Information Management, Innovation Management and Industrial Engineering*. Xi'an, China: IEEE.
- Chimhamhiwa, D., Molen, V. P., Mutanga, O., & Rugege, D. (2009). Towards a framework for measuring end to end performance of land administration business processes – A case study. *Computers, Environment and Urban Systems*, 33(4), pp. 293-301.
- Chintan, H. B. (2018, September 23). Retrieved from LinkedIn: <https://www.linkedin.com/pulse/management-information-systemmis-dr-chintan-bhavsar>

- Chituc, C.-M., & Azevedo, A. L. (2005). Multiperspective Challenges on Collaborative Networks Business Environments. *Working Conference on Virtual Enterprises PRO-VE 2005*, (pp. 25-32).
- Chiu, C.-Y., Chen, S., & Chen, C.-L. (2017). An Integrated Perspective of TOE Framework and Innovation Diffusion in Broadband Mobile Applications Adoption by Enterprises. *International Journal of Management, Economics and Social Sciences*, 6(1), pp. 14-39.
- Christofides, E., Stroud, K., Tullis, D. E., & O'Doherty, K. C. (2019). Improving dissemination of study results: perspectives of individuals with cystic fibrosis. *Research Ethics*, 15(3-4).
- Cooper, D. R., & Schindler, P. S. (2014). *Business Research Methods*. New York: McGraw-Hill Education.
- Crawford, L. M. (2020). *Conceptual and Theoretical Frameworks in Research*. Retrieved from Sage Pub: [https://us.sagepub.com/sites/default/files/upm-assets/105274\\_book\\_item\\_105274.pdf](https://us.sagepub.com/sites/default/files/upm-assets/105274_book_item_105274.pdf)
- Creswell, J. W., & Clark, V. L. (2011). *Designing and Conducting Mixed Methods Research*. Thousand Oaks: Sage.
- De Toni, A., & Tonchia, S. (2001). Performance Measurement Systems: Models, Characteristics and Measures. *International Journal of Operations & Production Management*, 21(1/2), pp. 46-70.
- Dean, K., Joseph, J. M., Roberts, J., & Wight, C. (2006). *Realism, Philosophy and Social Science*. 175-Fifth Avenue, New York: Palgrave Macmillan.
- Drost, E. A. (2011). Validity and Reliability in Social Science Research. *Education Research and Perspectives*, 38(1).
- Dunakin, C. (2021, February 10). Retrieved from 6 River Systems: <https://6river.com/biggest-challenges-of-supply-chain-management/>
- Durugbo, C. (2019). Collaborative Networks: A Systematic Review and Multi-level Framework. *International Journal of Production Research*, 54(12), pp. 3749-3776.

- Elrod, C., Muray, S., & Bande, S. (2013). A Review of Performance Metrics for Supply Chain Management. *Engineering Management Journal*, 25(3), pp. 39-50.
- Essex, A., Gunasekaran, A., & Subramanian, N. (2015). The Relationship between Supply Chain Manager Capabilities and Performance: Empirical Evidence. *Production Planning and Control*, 27(3), pp. 198-211.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), pp. 1-4.
- Fahad, B. (2011). Factors Affecting Supply Chain Management by Oil Companies in Kenya.
- Fasanghari, M. (2008). Assessing the Impact of Information Technology on Supply Chain Management. *International Symposium on Electronic Commerce and Security*. IEEE.
- Fayezi, S., & Zomorodi, M. (2015). The role of relationship integration in supply chain agility and flexibility development: An Australian perspective. *Journal of Manufacturing Technology Management*, 26(8).
- Fincham, J. E. (2008). Response Rates and Responsiveness for Surveys, Standards and the Journal. *American Journal of Pharmaceutical Education*, 72(2), pp. 43.
- Gakuubi, D. K. (2018). The Impact Impact Of Information Communication Technology On Organizational Performance: A Case of Nairobi Bottlers Logistics Operation's.
- Ganbold, O., Matsui, Y., & Rotaru, K. (2020). Effect of information technology-enabled supply chain integration on firm's operational performance. *Journal of Enterprise Information Management*, 34(3), pp. 948-983.
- Ghobakhloo, M., Tang, S. H., Sabouri, M. S., & Zulkifli, N. (2014). The Impact of Information System-Enabled Supply Chain Process Integration on Business Performance: A Resource-Based Analysis. *International Journal of Information Technology & Decision Making*, 13(5), pp. 1075-1113.
- Glazer, R. (1991). Marketing in an Information Intensive Environment: Strategic Implications of Knowledge as an Asset. *Journal of Marketing*, 55(4), pp. 1-19.

- Global, B. (2021). *What Are the Main Supply Chain Challenges?* Retrieved from <https://www.blumeglobal.com/learning/supply-chain-challenges/>
- Grover, V., & Bhatt, G. D. (2005). Types of Information Technology Capabilities and Their Role in Competitive Advantage: An Empirical Study. *Journal of Management Information Systems*, 22(2), pp. 253-277.
- Guerrini, F. M., & Yamanari, J. S. (2019). A Systematic Review of Collaborative Networks: Implications for Sensing, Smart and Sustainable Enterprises. *20th Working Conference on Virtual Enterprises (PRO-VE), Sept 2019*, (pp. 69-80). Turin, Italy.
- Gunasekaran, A., & Ngai, E. W. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2), pp. 269-295.
- Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance Measures and Metrics in a Supply Chain Environment. *International Journal of Operations and Production Management*, 21(1/2), pp. 71-87.
- Haradhan, M. K. (2017). Two Criteria for Good Measurements in Research: Validity and Reliability. *Annals of Spiru Haret University Economic Series*, 17(4), pp. 59-82.
- Harnowo, A. S. (2015). Roles of Information Technology in Supply Chain.
- Hausman, W. H. (2002). Supply Chain Performance Metrics.
- Hausman, W. H. (2004). Supply Chain Performance Metrics. In T. P. Harrison, H. L. Lee, & J. J. Neale, *The Practice of Supply Chain Management: Where Theory and Application Converge* (pp. 61-73). Boston, MA: Springer.
- Huang, Y., & Han, W. (2020). The Complexity of Collaboration in Supply Chain Networks. *Supply Chain Management: An International Journal*, 25(3), pp. 393-410.
- Hwang, B.-N., Huang, C.-Y., & Wu, C.-H. (2016). A TOE Approach to Establish a Green Supply Chain Adoption Decision Model in the Semi-Conductor Industry. *Sustainability*, 8(168).

- Irfan, M., Wang, M., & Akhtar, N. (2019). Impact of IT capabilities on supply chain capabilities and organizational agility: a dynamic capability view. *Operations Management Research*, 12, pp. 113-128.
- Isal, Y., Pikarti, G., Hidayarto, A., & Putra, E. (2016). Analysis of IT Infrastructure Flexibility Impacts on IT-Business Strategic Alignment. *Journal of Industrial Engineering and Management*, 9(3), pp. 657-683.
- Ismail, W. S., & Ali, A. (2013). Conceptual Model for Examining the Factors that Influence the Likelihood of Computerised Accounting Information Systems (CAIS) Adoption among Malaysian SMEs. *International Journal of Information Technology and Business Management*, 15(1), pp. 122-151.
- Jacob, A., & Teuteberg, F. (2018). Organisational Adoption of Social Media in Ethical Fashion. *PACIS 2018*.
- Jayaram, J., Vickery, S. K., & Cornelia, D. (2000). The effects of information system infrastructure and process improvements on supply-chain time performance. *International Journal of Physical Distribution & Logistics Management*, 30(3/4), pp. 314-330.
- Jean, R.-J. B., Sinkovics, R. R., & Kim, D. (2008). Information technology and organizational performance within international business to business relationships: A review and an integrated conceptual framework. *International Marketing Review*, 25(5), pp. 563-583.
- Jere, J. N., & Ngidi, N. (2020). A Technology, Organisation and Environment Framework Analysis of Information Communication Technology Adoption by Small and Medium Enterprises in Pietermaritzburg. *South African Journal of Information Management*, 22(1).
- Jesus, F. C., Pinheiro, A., & Oliveira, T. (2019). Understanding CRM Adoption Stages: Empirical Analysis Building on the TOE Framework. *Computers in Industry*, 109, pp. 1-13.

- Jirma, H. D., & Guyo, W. (2017). Factors Influencing Performance of Supply Chain Management Strategies in the National Government Ministries in Kenya. *Strategic Journal of Business & Change Management*, 4(4).
- Ju-hong, C., & Meng-hua, Z. (n.d.). Study on the Analysis of Information Technology Capability of Third-Party Logistics Firms and its Constructing. In *2009 International Conference on Information Management, Innovation Management and Industrial Engineering*.
- Kaaria, H. N., & Mwangangi, P. (2017). Role of Information Technology on Supply Chain Performance in Public Institutions in Kenya: A Case of the Judiciary of Kenya. *International Journal of Logistics and Procurement Management*, 1(1), pp. 1-17.
- Kakhi, M. D., & Gargeya, V. B. (2019). Information systems for supply chain management: a systematic literature analysis. *International Journal of Production Research*, 57(15-16), pp. 5318-5339.
- Karahan, O. (2016). The Impact of ICT-Producing and ICT-Using Industries on Economic Growth in OECD Countries. *ICTBEL 2016 Conference Proceedings*. Oxford, England.
- Karim, A. J. (2011). The significance of management information systems for enhancing strategic and tactical planning. *JISTEM - Journal of Information Systems and Technology Management*, 8(2), ISSN 1807-1775.
- Kariuki, M., & Nzuki, D. (2019). Management information systems capabilities and organizational performance of supermarkets in Nairobi City County, Kenya. *International Journal of Education and Research*, 7(6).
- Katua, P. A. (2014). The impact of supply integration on the supply chain performance in the manufacturing firms in Kenya.
- Kaur, P., Stoltzfus, J., & Yellapu, V. (2018). Descriptive Statistics. *International Journal of Academic Medicine*, 4(1), pp. 60-63.
- Kimitei, E., Chepkwony, J., & Charles, L. (2019). Influence of Valence of Logistic Information Integration Capability on Firm Performance in Kenya. *Journal of Logistics Management*, 8(3), pp. 51-60.

- Kuan, K. K., & Chau, P. (2001). A Perception-Based Model for EDI Adoption in Small Businesses Using a Technology-Organisation-Environment Framework. *Information & Management*, 38(8), pp. 507-521.
- Kumar, A., Singh, R. K., & Modgil, S. (2020). Exploring the relationship between ICT, SCM practices and organizational performance in agri-food supply chain. *Benchmarking: An International Journal*.
- Lans, D. (2019). *7 Main Challenges in Supply Chain Management And How You Can Workaround It*. Retrieved from My Story: <https://yourstory.com/mystory/7-main-challenges-in-supply-chain-management-and-h-rdq2oy6mh9>
- Lau, H. C., & Lee, W. B. (2000). On a responsive supply chain information system. *International Journal of Physical Distribution & Logistics*, 30(7/8), pp. 598-610.
- Laudon, K. C., & Laudon, J. P. (2020). *Management Information Systems: Management the Digital Firm, 16th Edition*. New York: Pearson.
- Lee, C. W., Kwon, I.-W. G., & Severance, D. (2007). Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Supply Chain Management: An International Journal*, 12(6), pp. 444-452.
- Lee, D. M., Trauth, E. M., & Farwell, D. (1995). Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation. *MIS Quarterly*, 19(3), pp. 313-340.
- Lee, S., Havelka, D., Koh, S., & Yen, D. (2001). Evolution of IS Professionals' Competency: An Exploratory Study. *Journal of Computer Information Systems*, 41(4), pp. 21-28.
- Lee, S., Havelka, D., Koh, S., & Yen, D. (2004). The Relationship Between Information Technology Professionals' Skill Requirements and Career Stage in the E-Commerce Era: An Empirical Study. *Journal of Global Information Management*, 12(1), pp. 68-82.
- Lejano, R. P., & Ingram, H. (2009). Collaborative Networks and New Ways of Knowing. *Environmental Science & Policy*, 12(6), pp. 653-662.

- Lihniash, S., Egdair, I., & Ahmed, S. (2019). The Proposed Conceptual Framework to Understand the Effect of the Technology-Organisation-Environment (TOE) Model on Internet Financial Reporting (IFR) in Libyan Finance Institutions. *Open Journal of Business and Management*, 7(2), pp. 339-347.
- Lin, H.-F., & Lin, S.-M. (2008). Determinants of E-business Diffusion: A Test of the Technology Diffusion Perspective. *Technovation*, 28, pp. 135-145.
- Lippert, S. K., & Govindarajulu, C. (2006). Technological, Organisation and Environmental Antecedents to Web Services Adoption. *Communications of the IIMA*, 6(1).
- Liu, H., Ke, W., Wei, K. K., Chen, H., & Gu, J. (2009). From IT Capabilities to Supply Chain Performance: The Mediating Effects of Supply Chain Agility and Absorptive Capacity. *AMCIS 2009 Proceedings*.
- Majchrzak, A., & Markus, L. M. (2014). Technology Affordances and Constraints Theory (of MIS). In A. Majchrzak, & L. M. Markus, *Encyclopedia of Management Theory* (pp. pp. 832-836). Thousand Oaks: SAGE Publications, Inc. <http://dx.doi.org/10.4135/9781452276090.n256>.
- Manufacturers, K. A. (2018). *Manufacturing in Kenya Under the 'Big 4 Agenda'*. Retrieved from Kam.co.ke: <https://kam.co.ke/kam/wp-content/uploads/2018/10/KAM-Manufacturing-Deep-Dive-Report-2018.pdf>
- Manufacturers, K. A. (2020). *Manufacturing Priority Agenda 2020: Establishing a Competitive Manufacturing-led Economy for Job and Wealth Creation*. Retrieved from <https://kam.co.ke/kam/wp-content/uploads/2020/02/Manufacturing-Priority-Agenda-2020-Full-version.pdf>
- Marinagi, C., & Reklitis, T. P. (2015). Information Quality and Supply Chain Performance: The Mediating Role of Information Sharing. *Proceedings of the 3rd International Conference on Strategic Innovative Marketing (IC-SIM 2014)*, 175 (pp. pp. 473-479). Procedia - Social and Behavioral Sciences.

- Marinagi, C., Trivellas, P., & Sakas, D. P. (2014). The impact of information technology on the development of supply chain competitive advantage. *Procedia-Social and Behavioral Sciences, 147*, pp. 586-591.
- Matay, A. P. (2019). Effects of Information Communications Technology on Supply Chain Management Practices in Tanzania: A Case of Tanzania Electricity Supply Company (TANESCO).
- McCarthy, T. M., & Golicic, S. L. (2002). Implementing collaborative forecasting to improve supply chain performance. *International Journal of Physical Distribution & Logistics Management, 32(6)*, pp. 431-454.
- McCarthy-Bryne, T. M., & Mentzer, J. T. (2011). Integrating supply chain infrastructure and process to create joint value. *International Journal of Physical Distribution & Logistics Management, 41(2)*, pp. 135-161.
- Mehmeti, G., Musabelliu, B., & Xhoxhi, O. (2016). The Review of Factors that Influence the Supply Chain Performance. *Academic Journal of Interdisciplinary Studies, 5(2)*.
- Metaxiotis, K. S. (2009). Exploring the Rationales for ERP and Knowledge Management Integration in SMEs. *Journal of Enterprise Information Management, 22(1/2)*, pp. 51-62.
- Mezgar, I. (2004). Novel Networking Technologies for Collaborative Networked Organizations. *Working Conference on Virtual Enterprises PRO-VE 2004: Virtual Enterprises and Collaborative Networks*, (pp. 397-406).
- Ministry of Industrialization, T. a. (2020). *Inside Kenya's 10-year Manufacturing Dream*. Retrieved from <https://www.industrialization.go.ke/index.php/media-center/blog/292-inside-kenya-s-10-year-manufacturing-dream>
- Ministry Of Industrialization, T. a. (2020). *Vision 2030 Manufacturing Sector*. Retrieved from <https://www.industrialization.go.ke/index.php/vision-2030-manufacturing-sector>
- Mithas, S., Ramasubbu, N., & Sambamurthy, V. (2011). How Information Management Capability Influences Firm Performance. *MIS Quarterly, 35(1)*, pp. 237-256.

- Modgil, S., & Sharma, S. (2017). Information Systems, Supply Chain Management and Operational Performance: Tri-linkage—An Exploratory Study on Pharmaceutical Industry of India. *Global Business Review, 18*(3), pp. 652-677.
- Mohamed, N., Mahadi, B., Miskon, S., Haghshenas, H., & Adnan, H. M. (2013). *Information System Integration: A Review of Literature and a Case Analysis*. World Scientific and Engineering Academy and Society (WSEAS).
- Mohammed, A.-N. N., & Hu, W. (2015). Using Management Information Systems (MIS) to Boost Corporate Performance. *International Journal of Management Science and Business Administration, 1*(11), pp. 55-61.
- Morssi, M.-A. H., Elhusseiny, H. M., & Hammad, D. A. (2020). The Impact of Internet of Things on Supply Chain Performance. *Proceedings of the 2nd African International Conference on Industrial Engineering and Operations Management*, (pp. 7-10). Harare, Zimbabwe.
- Mugenda, O. M., & Mugenda, A. G. (2009). *Research Methods: Quantitative & Qualitative Approaches*. Nairobi, Kenya: African Center for Technology Studies (ACTS) Press.
- Muneer, S. (2020). The Information System Management and Its Infrastructure for Supply Chain Management as Antecedents of Financial Performance. *Journal of Asian Finance, Economics and Business, 7*(1), pp. 229-238.
- Namusonge, E., Mukulu, E., & Iravo, M. (2017). Influence of Procurement Capabilities on Firm Performance of Manufacturing Entities in Kenya. *International Journal of Academic Research in Business and Social Sciences, 7*(2), pp. 507-520.
- Ngumi, P. M. (2013). Effect of Bank Innovations on Financial Performance of Commercial Banks in Kenya.
- Njagi, J. M., & Muli, S. (2020). Influence of supply chain integration practices on the performance of manufacturing firms in kenya A case of kenya breweries limited. *International journal of business and social research, 10*(1), pp. 35-57.
- Nulty, D. D. (2008). The Adequacy of Response Rates to Online and Paper Surveys: What can be Done? *Assessment and Evaluation in Higher Education, 33*(3), pp. 301-314.

- Nyambura, M. T. (2018). Moderating Effect of Information Communications Technology on Supply Chain Risks and Firm Performance among Manufacturing Firms in Kenya.
- Oláh, J., Zoltan, Z., Balogh, I., & Popp, J. (2018). Future challenges and areas of development for supply chain management. *LogForum*, 14(1), pp. 127-138.
- Otwori, N. (2017). An assessment of the effect of ICT practices on procurement efficiency on beverage companies in Kenya. A Case study of Kenya Breweries Limited.
- Panayides, P., Borch, O. J., & Henk, A. (2018). Measurement challenges of supply chain performance in complex shipping environments. *Maritime Business Review*, 3(4), pp. 431-448.
- Park, Y. S., Konge, L., & Artino, A. R. (2020). The Postivism Paradigm of Research. *Journal of the Association of American Medical Colleges*, 95(5), pp. 690-694.
- Parung, J., & Bititci, U. S. (2008). A Metric for Collaborative Networks. *Business Process Management Journal*, 14(5).
- Peppard, J., Lambert, R., & Edwards, C. (2000). Whose job is it anyway?: organizational information competencies for value creation. *Information Systems Journal*, 10(4), pp. 291-322.
- Pius, A. K. (2014). The impact of supply integration on the supply chain performance in the manufacturing firms in Kenya .
- Prajogo, D., & Sohal, A. (2014). Supply chain professionals: A study of competencies, use of technologies, and future challenges. *International Journal of Operations & Production Management*, 33(11/12), pp. 1532-1554.
- Qrunfleh, S., & Tarafdar, M. (2014). Supply Chain Information Systems Strategy: Impacts on Supply Chain Performance and Firm Performance. *International Journal of Production Economics*, 147(B), pp. 340-350.
- Rai, A., Patnayakuni , R., & Seth, N. (2006). Firm Performance Impacts of Digitally Enabled Supply Chain Integration Capabilities. *MIS Quarterly*, 30(2), pp. 225-246.

- Rajaguru, R., & Matanda, M. J. (2011). Role of inter-organisational compatibility and IOIS integration in large firms and SMEs retailing chains. *Asia Pacific Journal of Marketing and Logistics*, 23(2), pp. 177-199.
- Ramayah, T., Sang, T. Y., Omar, R., & Dahlan, N. M. (2008). Impact of Information Technology (IT) Tools, Partner Relationship and Supply Chain Performance. *Asian Academy of Management Journal*, 13(2), pp. 33-55.
- Rusticus, S. (2014). Content Validity. *Encyclopedia of Quality of Life and Well Being Research* .
- Ryan, G. (2018). Introduction to Postivism, Intepretivism, and Critical Theory. *Nurse Researcher*, 25(4), pp. 14-20.
- Salleh, K. A., Janczewski, L., & Beltran, F. (2015). SEC-TOE Framework: Exploring Security Determinants in Big Data Solutions Adoption. *PACIS 2015 Proceedings*. 203.
- Sambamurthy, V., & Zmud, R. W. (1999). Arrangements for Information Technology Governance: A Theory of Multiple Contingencies. *MIS Quarterly*, 23(2), pp. 261-290.
- Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. *MIS Quarterly*, 27(2), pp. 237-263.
- Saraf, N., Langdon, C. S., & Gosain, S. (2007). IS Application Capabilities and Relational Value in Interfirm Partnerships. *Information Systems Research*, 18(3), pp. 320-339.
- Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students*. Harlow (Munich) : Pearson.
- Saunders, M., Lewis, P., Thornhill, A., & Thill, J. V. (2006). *Research Methods for Business Students*. Pearson Education, Limited.
- Schmidt, A., Otto, B., & Österle, H. (2010). Integrating information systems: case studies on current challenges. *Electron Markets*, 20, pp. 161-174.
- Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation Coefficients: Appropriate Use and Interpretation . *Anesthesia and Analgesia*, 126(5): 1.

- Sezen, B. (2008). Relative effects of design, integration and information sharing on supply chain performance. *Supply Chain Management: An International Journal*, 13(3), pp. 233-240.
- Shepherd, C., & Gunter, H. (2006). Measuring Supply Chain Performance: Current Research and Future Directions. *International Journal of Productivity and Performance Management*, 55(3/4), pp. 242-258.
- Sigilai, M. J. (2017). Impact of Information Technology on the Output Growth of Manufacturing Firms in Kenya.
- Silva, M. A., & Lima, C. d. (2018). The Role of Information Systems in Human Resource Management.
- Sundram, V. P., Bahrin, A. S., Munir, Z. B., & Zolait, A. H. (2018). The effect of supply chain information management and information system infrastructure: The mediating role of supply chain integration towards manufacturing performance in Malaysia. *Journal of Enterprise Information Management*, 31(5), pp. 751-770.
- Taherdoost, H. (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/ Survey in a Research. *International Journal of Academic Research in Management*, 5(3), pp. 28-36.
- Tarigan, Z. J., Siagian, H., & Bua, R. R. (2019). The Impact of Information System Implementation to the Integrated System for Increasing the Supply Chain Performance of Manufacturing Companies . *IOP Conf. Series: Materials Science and Engineering* 473. IOP Publishing Ltd.
- Tavani, N. S., Tavani, N. Z., Oghazi, P., Naude, P., & Zeynaloo, E. (2018). How Collaborative Innovation Networks Affect New Product Performance: Product Innovation Capability, Process Innovation Capability and Absorptive Capacity. *Industrial Marketing Management*, 73, pp. 193-205.
- Teixeira, R., Koufteros, X., Xiaosong, D., & Peng, X. D. (2012). Organizational Structure, Integration and Manufacturing Performance: A Conceptual Model and Propositions. *Journal of Operations and Supply Chain Management*, 5(1), pp. 69-81.

- Themistocleous, M., Irani, Z., & Love, P. E. (2004). Evaluating the integration of supply chain information systems: A case study. *European Journal of Operational Research*, 159, pp. 393-405.
- Tornatzky, L. G., & Fleischer, M. (1990). *The Processes of Technological Innovation*. Lexington, Mass: Lexington Books.
- Transformation, S. S. (2016). *Manufacturing in Kenya: Features, Challenges and Opportunities*. Retrieved from <https://set.odi.org/wp-content/uploads/2016/09/Manufacturing-in-Kenya-Anzetse-Were.pdf>
- Tripathy, S., Aich, S., Chakraborty, A., & Lee, G. M. (2016). Information technology is an enabling factor affecting supply chain performance in Indian SMEs: A structural equation modelling approach. *Journal of Modelling in Management*, 11(1), pp. 209-287.
- Trochim, W. M. (2006). *The Qualitative Debate. Research Methods Knowledge Base*. Retrieved from <https://conjointly.com/kb/qualitative-debate/>
- Tseng, M.-L., Wu, K.-J., & Nguyen, T. T. (2011). Information technology in supply chain management: a case study. *Procedia - Social and Behavioral Sciences*, 25, pp. 257-272.
- Udomleartprasert, P., & Jungthirapanich, C. (2004). *The Supportive Infrastructures Enhancing the Supply Chain Performance*. Singapore: IEEE.
- Ursachi, G., Horodnic, I. A., & Zait, A. (2015). How reliable are measurement scales? External factors with indirect influence on reliability estimators. *Procedia Economics and Finance*, 20, pp. 679-686.
- Valverde, R., & Saadé, R. G. (2015). The Effect of E-Supply Chain Management Systems in the North American Electronic Manufacturing Services Industry. *Journal of Theoretical and Applied Commerce Research*, 10(1). <https://doi.org/10.4067/S0718-18762015000100007>, pp. 79-98.
- Varma, T. N., & Khan, D. A. (2014). Information Technology in Supply Chain Management. *Journal of Supply Chain Management*, 3(3), pp. 35-46.

- Wang, E. T., Chou, F. K., Lee, N. C., & Lai, S. Z. (2014). Can intrafirm IT skills benefit interfirm integration and performance? *Information & Management*, 51(2014), pp. 924-938.
- Wang, X., & Cheng, Z. (2020). Cross-sectional Studies: Strengths, Weaknesses and Recommendations. *Chest Journal*, 158(1), pp. 65-71.
- White, W. J., O'Connor, A. C., & Rowe, B. R. (2004). *Inadequate Infrastructure for Supply Chain Integration*. Retrieved from <https://www.nist.gov/system/files/documents/director/planning/report04-2.pdf>
- Wu, Y., Cegielski, C. G., Hazen, B. T., & Hall, D. J. (2013). Cloud Computing in Support of Supply Chain Information System Infrastructure: Understanding When to go to the Cloud. *Journal of Supply Chain Management Volume 49, Issue 3*, pp. 25-41.
- Yeh, C.-H., Pai, J.-C., & Lee, G.-G. (2014). Using a Technology-Organisation-Environment Framework to Investigate the Factors Influencing E-business Information Technology Capabilities. *Information Development*, 31(5).
- Yuan, N. (2010). The Impact of Information Technology on Supply Chain Performance: A Knowledge Management Perspective.
- Zhang, X., Van Donk, D. P., & Vaart, T. V. (2016). The Different Impact of Inter-organizational and Intra-organizational ICT on Supply Chain Performance. *International Journal of Operations & Production Management*, 36(7), pp. 803-824.
- Zhiying, Z., Kai, K., & Yunfeng, W. (2009). The Investigation of Inter-organizational Information Systems Capabilities in Hebei Province, China. *WRI World Congress on Computer Science and Information Engineering*. 10.1109/CSIE.2009.1013. Los Angeles, CA, USA: IEEE.

## APPENDICES

### Appendix I: Letter of Introduction

To the respondent

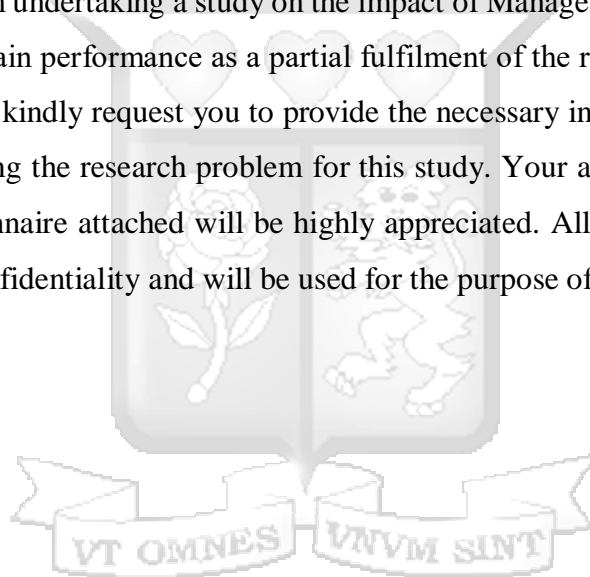
Dear Sir/Madam

#### RE: REQUEST TO COLLECT DATA

Greetings,

My name is Modestar Wandili, a student at Strathmore university and currently pursuing a master's degree in commerce. I am undertaking a study on the impact of Management information systems capabilities on supply chain performance as a partial fulfilment of the requirement for a master's degree. For this reason, I kindly request you to provide the necessary information that is required for the purposes of solving the research problem for this study. Your assistance and cooperation in filling out the questionnaire attached will be highly appreciated. All the data received will be regarded with utmost confidentiality and will be used for the purpose of this study only.

Kind regards,



**Appendix II: Questionnaire**

**INSTRUCTION:** *Please fill out the questionnaire by ticking the appropriate box that closely matches your view or alternatively writing in the spaces provided where necessary.*

**NOTE:** *All the information provided will be regarded with utmost confidentiality and will be used for the purpose of this study only.*

**PART A: Background Information**

1. What is your job position in the company?

Top-level manager  Middle-level manager  Lower-level manager

2. How long have you been working for this organization?

Less than 5 years  5-10 years  10-15 years  15-20 years

Over 20 years

3. What is your highest level of education?

Diploma  Undergraduate Degree  Post-Graduate Degree

**PART B: Information Systems Infrastructure Capabilities**

Please indicate the extent to which you agree with the following statements. This is a scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Somewhat Agree, 4= Agree, 5= Strongly Agree

	<b>IS Infrastructure Capabilities</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>1</b>	Our organization has integrated the necessary IS Infrastructure to support manufacturing operations					
<b>2</b>	Our organization continuously upgrades and replaces key IS applications and systems to suit the changing environment					
<b>3</b>	The IS Infrastructure employed by our organization is easy to use and maintain by any kind of user					

<b>4</b>	The IS infrastructure is flexible in the sense that it is easy to make the necessary changes in the software					
<b>5</b>	Our organization ensures that there is alignment between IS infrastructure and manufacturing operations to ensure that they work in synergy					
<b>6</b>	Our organization has automated most of the manufacturing processes					

**PART C: Information Systems Human Resource Capabilities**

Please indicate the extent to which you agree with the following statements. This is a scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Somewhat Agree, 4= Agree, 5= Strongly Agree

	<b>IS Human Resource Capabilities</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>1</b>	Our organization has employed IS professionals with the highest proficiency in IT skills.					
<b>2</b>	Our organization has ensured that there is training and development for IS professionals for further upskilling					
<b>3</b>	IT managers have the necessary balance of technological and interpersonal skills					
<b>4</b>	Our organization encourages employees to share their innovative ideas.					

### **PART D: Information Systems Integration Capabilities**

Please indicate the extent to which you agree with the following statements. This is a scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Somewhat Agree, 4= Agree, 5= Strongly Agree

	<b>IS Integration Capabilities</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>1</b>	Our organization has ensured that there is maximum connectivity and interoperability of systems across several organizational participants in the supply chain					
<b>2</b>	Our organization has employed IS systems that retain the expected level of functionality in a dynamic environment					
<b>3</b>	The IS systems allow for optimal decision-making collaboration both within and outside our organizational boundaries					
<b>4</b>	The IS meets the needs of users while performing assigned manufacturing operations effectively					
<b>5</b>	Our organization has employed IS systems that are repairable and can be easily corrected without disrupting their functionality					

### **PART E: Supply Chain Performance**

Please indicate the extent to which you agree with the following statements. This is a scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Somewhat Agree, 4= Agree, 5= Strongly Agree

	<b>Supply Chain Performance</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>1</b>	There is significant improvement in the quality of products delivered to the customers					
<b>2</b>	Our organization has experienced an increase in customer retention and an improvement in customer satisfaction					

3	Our organization has achieved efficiency in manufacturing operations					
4	There is an improvement in the competitiveness of our organization's products relative to those of other manufacturing companies					
5	Our organization can respond effectively to short-term changes in customer demand and supply					



## Appendix III: Ethics Research Approval



6<sup>th</sup> September 2021

Ms Wandili Modestar,  
modestar.wandili@strathmore.edu

Dear Ms Wandili,

**RE: The Influence of Management Information Systems Capabilities on the Supply Chain Performance of Listed Manufacturing Firms in Kenya**


This is to inform you that SU-IERC has reviewed and **approved** your above **SU-master's** research proposal. Your application reference number is **SU-IERC1127/21**. The approval period is **6<sup>th</sup> September 2021 to 5<sup>th</sup> September 2022**.

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-IERC.
- 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-IERC 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-IERC 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-IERC.

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 also obtain other clearances needed.

Yours sincerely,

  
for: Dr Virginia Gichuru,  
**Secretary; SU-IERC**

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



Ole Sangale Rd, Madaraka Estate. PO Box 59857-00200, Nairobi, Kenya. Tel +254 (0)703 034000  
Email admissions@strathmore.edu www.strathmore.edu



## Appendix V: List of Manufacturing firms that are listed in the Nairobi Securities Exchange

1. Athi River Mining
2. Bamburi Cement Ltd.
3. B.O.C Kenya Ltd
4. British American Tobacco Kenya Ltd.
5. Car and General Ltd.
6. Carbacid Investments
7. Crown Paints Kenya PLC
8. Eaagads Ltd
9. E.A Cables Ltd.
10. E.A Portland Cement Ltd.
11. East African Breweries Ltd.
12. Eveready East Africa Ltd.
13. Flame Tree Group Holdings Ltd.
14. Kakuzi
15. Kapchorua Tea Co. Ltd.
16. KenGen Ltd.
17. Kenya Orchards Ltd.
18. Kenya Power & Lightning Co. Ltd.
19. Limuru Tea Co. Ltd
20. Mumias Sugar Co. Ltd
21. Rea Vipingo Plantations Ltd.
22. Sasini Ltd.
23. Total Kenya Ltd.
24. Umeme Ltd.
25. Unga Group Ltd.
26. Williamson Tea Kenya Ltd.

