THE EFFECT OF INFORMATION TECHNOLOGY ON SUPPLY CHAIN MANAGEMENT PERFORMANCE OF HUAWEI TECHNOLOGIES ETHIOPIA PLC

By

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A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY, SCHOOL OF COMMERCE FOR THE PARTIAL FULFILMENT OF THE DEGREE OF MASTERS OF ARTS IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT PROGRAM

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June 2024

Addis Ababa, Ethiopia

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External examiner	Signature	Date

DECLARATION

I, the undersigned, hereby declare that this thesis, titled "**The effect of information technology on supply chain management performance of Huawei technologies Ethiopia PLC**" is my original work and has not presented in any other university or collage for the award of a degree, and that all sources of materials used for the thesis have been properly acknowledged.

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CERTIFICATION

This is to certify that Samrawit Gebreselassie worked under my supervision on the thesis entitled "**The effect of information technology on supply chain management performance of Huawei technologies Ethiopia PLC**". This work is original and can be submitted in partial fulfillment of the requirements for the award of the Masters of Arts in Logistics and Supply Chain Management.

Advisor Name: Shiferaw Mitiku (Ph.D.)

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Date: _____

ACKNOWLEDGEMENTS

First and for most, I would like to thank God for giving me the strength and will to withstand the Challenges and obstacles I faced to complete this study. Next, I would like to express my gratitude for my advisor Dr. Shiferaw Mitiku for his great advice, prompt responses and for directing and helping me finalize this thesis. I would also like to express my heartfelt appreciation to all study participants and Huawei Technologies Ethiopia Plc for their cooperation during data collection. Finally, my acknowledgement and gratitude extend to my family who supported me and encouraged me to embark on this journey.

The Researcher

(Samrawit Gebreselassie).

LIST OF ABBREVIATIONS AND ACRONYMS

CRM- Customer Relationship Management.

RFID - Radio Frequency Identification

IT - Information Technology

ERP - Enterprise Resource Planning

RFQ - Request for Quotation

SCM - Supply Chain Management

WMS - Warehouse Management System

TMS - Transportation Management System

AfCFTA - African Continental Free Trade Area

EDI - Electronic Data Interchange

GDP - Gross Domestic Product

C&C - Command and Control

R&D - Research and Development

IBM - International Business Machines Corporation

ICT - Information and Communications Technology

ESLSE - Ethiopian Shipping and Logistics Services Enterprise

IOT - Internet of Things

XML - Extensible Markup Language

RBV - Resource-Based View

GPS - Global Positioning System

GDPR - General Data Protection Regulation

CAD/CAE - Computer-Aided Design/Computer-Aided Engineering

FMS - Flexible Manufacturing System

JIT - Just in Time

CAM/CIM - Computer-Aided Manufacturing/Computer-Integrated Manufacturing

MRP - Material Requirements Planning

SCOR - Supply Chain Operations Reference

GEF - Global Environment Facility

PTC - Parametric Technology Corporation

PRTM - Pittiglio Rabin Todd & McGrath

MR - Market Research

PLM - Product Lifecycle Management

MES - Manufacturing Execution System

CFPR - Call for Papers and Reviews

ASP - Application Service Provider

APS - Advanced Planning and Scheduling

SRM - Supplier Relationship Management

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ABSTRACT

The goal of this study was to evaluate how IT affects supply chain management performance. In order to explore and provide answers to the subject matter and goals, the study used the commonly utilized facets of supply chain practices: Planning, Sourcing, Making, Delivery, and Return as an independent variable and Cost Efficiency, Delivery Speed and Customer Satisfaction as a dependent variable. The research also explored the Challenges of supply chain management practices. The research was based on 77 questionnaires distributed to Huawei Technologies Ethiopia in which 72 responses were collected which resulted in 93.5% response rate. The research shows that Huawei has a high overall adoption of IT on the supply chain practices i.e., Planning, Sourcing, Making and Delivery had high ranking means and Return with mean slightly above the midpoint. The organization also has a high overall logistics performance. The supply chain performance measurements i.e., Cost Efficiency, Delivery Speed and Customer Satisfaction has almost similar mean. The regression analysis reveals a robust positive correlation between supply chain practices and performance. These statistical results affirm the model's strength and reliability in predicting performance based on the specified supply chain practices.

***Key Words**: Supply Chain Management Performance, Information Technology, Supply Chain management, supply chain practice, supply chain challenge*

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CHAPTER ONE

1. INTRODUCTION

This chapter presents background of the study, background of the study area, statement of the problem, research questions, research objectives, scope of the study, significance of the study organization of the paper, definition of key terminologies.

1.1 Background of the Study

Information technology (IT) plays a crucial role in enhancing the performance of logistics and supply chain operations by facilitating the use of inter-organizational systems for information sharing and processing across organizational boundaries. The increasing complexity and speed of the modern business environment highlight the necessity for efficient and effective supply chain management solutions. Businesses are now seen as integral parts of multi-echelon, multi-company networks, underscoring the importance of IT in managing supply chain activities (Karkkainen & Sartpola, 2007).

In Kenya, where the supply chain field is still emerging and many firms engage in international trade, the demand for robust supply chain practices is pronounced. Companies continuously procure materials for manufacturing and strive to deliver products to customers at optimal locations and costs. Enhancing flexibility and responsiveness in operations, procedures, and technology is essential for improving overall efficiency. Integrating IT into the supply chain paradigm is crucial for achieving this goal, enabling enhanced information flows and operational agility.

The advent of the internet and related technologies has significantly transformed business practices, allowing companies to conduct external business as efficiently as internal operations. (Boone and Ganeshan, 2007) highlight how the use of internet technologies enables seamless business interactions across firms, extending business capabilities beyond traditional boundaries.

In summary, IT integration in supply chain management is pivotal for modern businesses aiming to streamline operations, enhance responsiveness, and maintain competitiveness in a rapidly

evolving global marketplace. As firms continue to navigate complex supply chain dynamics, leveraging IT solutions becomes indispensable for achieving strategic supply chain goals.

Companies leverage Information Technology (IT) in diverse ways to enhance operational efficiency and reduce costs. IT is widely recognized as one of the most effective tools for improving overall firm performance. Large firms, in particular, utilize IT to synchronize processes across their supply chains, encompassing upstream procurement, internal production, downstream sales, customer service, and information sharing throughout the supply chain network.

Various supply chain activities benefit from IT integration. For instance, businesses utilize the internet to facilitate purchasing and sourcing of materials, thereby streamlining procurement processes and expanding supplier networks. (Chopra and Meindl, 2001) exemplify this with Intel's implementation of an online ordering application that led to significant workforce reductions in clerical roles. E-business technologies enable companies to conduct transactions online, facilitating the seamless transfer of documents such as orders, invoices, and payments.

Moreover, enterprises deploy robust IT systems like Customer Relationship Management (CRM), Radio Frequency Identification (RFID), and Inventory Management Systems to integrate and optimize activities within the supply chain. These systems enhance visibility, improve inventory accuracy, and automate processes, thereby enhancing overall supply chain efficiency and responsiveness.

In summary, IT plays a crucial role in modern supply chain management by enabling streamlined operations, enhanced communication, and efficient resource utilization. Companies that effectively leverage IT solutions are better positioned to navigate competitive landscapes and achieve sustainable business growth.

Da Silveira and Cagliano (2006) highlight that the advent of internet business and associated applications has introduced innovative opportunities for supply chain management. Organizations within the supply chain utilize Information Technology (IT) extensively for various activities. They employ Enterprise Resource Planning (ERP) systems such as Tally and Pastel to integrate functions such as finance, manufacturing, inventory control, and purchasing.

Additionally, electronic data interchange is used to electronically exchange documents like invoices, requests for quotations (RFQs), purchase orders, and waybills. The utilization of extranets and the internet further facilitates information sharing among employees, management, suppliers, and customers, as documented by (Muriuki ,2013).

The integration of IT in Supply Chain Management (SCM) has revolutionized global business operations. IT enables seamless coordination and real-time data exchange, which enhances the management of the supply chain from suppliers to end consumers. Technologies such as Enterprise Resource Planning (ERP) systems, Transportation Management Systems (TMS), Warehouse Management Systems (WMS), and advanced analytics tools have become indispensable for enhancing supply chain visibility, reducing costs, and improving customer satisfaction (Chopra and Meindl, 2016). Global trends indicate that companies that leverage IT in their supply chains can gain significant competitive advantages. For example, the use of Radio Frequency Identification (RFID) and Internet of Things (IoT) technologies enables real-time tracking of goods, ensuring punctual deliveries and minimizing losses (Christopher, 2016). Furthermore, big data analytics provide predictive insights that enable better demand forecasting and more effective inventory management (Ivanov et al., 2019).

Although the adoption of Information Technology (IT) in supply chain management varies across Africa, there is a noticeable upward trend. The primary drivers for increasing IT use include enhancing trade efficiency and overcoming infrastructure challenges. Countries like South Africa and Kenya are leading in this regard, making significant investments in IT infrastructure to support Supply Chain Management (SCM) practices (Mwangi, 2018). The African Continental Free Trade Area (AfCFTA) aims to boost intra-African trade, and IT plays a crucial role in achieving this goal. Technologies such as digital platforms and Electronic Data Interchange (EDI) are instrumental in streamlining customs procedures and reducing border delays (UNECA, 2019). However, challenges such as low internet penetration, a shortage of skilled labor, and inadequate IT investments continue to hinder progress in many African nations (World Bank, 2020).

In Ethiopia, there is a growing recognition of the pivotal role IT plays in supply chain management and industrial development. The government has initiated several digitalization

projects aimed at enhancing IT infrastructure and boosting productivity across key sectors like manufacturing, agriculture, and healthcare (Ministry of Innovation and Technology, 2020). Despite these efforts, Ethiopia faces challenges in fully harnessing the potential of IT in SCM. Issues such as poor internet connectivity, limited access to advanced technologies, and a shortage of qualified personnel constrain the effective integration of IT in supply chains (Gebrehiwot and Berhe, 2019). Nonetheless, industries that have embraced IT solutions, particularly in manufacturing, are beginning to see improvements in operational efficiency and supply chain performance.

The study area focuses on exploring the role of IT in SCM performance within Ethiopia's industrial sector. Given the sector's significant contribution to GDP and employment, enhancing supply chain competitiveness and efficiency through IT adoption is critical for Ethiopia's economic advancement (Gebremariam, 2021). This research aims to provide insights into how IT solutions are currently utilized in the manufacturing supply chain, evaluate their impact on operational performance, and identify the challenges faced by businesses in implementing these technologies. Ultimately, the findings seek to inform policy and strategic decisions that promote greater IT integration in Ethiopian manufacturing supply chains, ensuring they remain competitive in an increasingly globalized market.

While Ethiopia's adoption of new supply chain technologies may lag behind developed nations, the country's economic growth and intensifying competition underscore the necessity of embracing technological advancements to thrive in the global marketplace.

1.2 Background of the Company

Huawei Technologies Co. Ltd., a leading global brand headquartered in Shenzhen, Guangdong, China, is a multinational company specializing in networking and telecommunications equipment. Founded in 1987 by Ren Zhengfei, a former military officer, Huawei started as a private enterprise with a mission to provide consulting and operational services to enterprises within China and internationally. Today, Huawei employs around 140,000 people globally, with a significant 46% engaged in research and development (R&D) activities distributed across

countries like the UK, Pakistan, Canada, Turkey, Ireland, Sweden, and Russia. The company's products and services are utilized in approximately 140 countries worldwide.

Initially beginning as a sales agent for private branch exchange switches, Huawei swiftly progressed into establishing its own research and development capabilities. A pivotal breakthrough came with the launch of its C&C08 digital telephone switch. Huawei's international expansion gained momentum in 1997 when it started supplying fixed-line network products to companies in Hong Kong. In 1999, Huawei established its first R&D center in Bangalore, India, and initiated a five-year contract with IBM, extending until 2003. The company continued to grow internationally, marking notable achievements such as delivering the first LTE/EPC commercial network for Telia Sonera in Norway in 2009 and opening new offices, including one in Canada in 2013.

Huawei has been dedicated to advancing mobile technology and fostering partnerships, including joint ventures like 3Com-Huawei, focusing on R&D and networking product production. By 2010, Huawei had secured partnerships with 80% of the top 50 global telecom companies, collaborating with prominent names such as Motorola, Vodafone, Talk Talk, T-Mobile, Clearwire, and Bell Canada. Notably, Huawei's contract with Everything Everywhere in the UK was a significant milestone, enhancing 2G network services and marking its first major network deal in the United Kingdom.

Organized into three core business units—Telecom Carrier Networks, Enterprise Business, and Devices (manufacturing communication devices)—Huawei is the largest telecom equipment manufacturer globally and holds a dominant position in China's telephone network equipment market. It leads the soft switches market and is recognized as a global leader in providing ICT solutions. Huawei's extensive portfolio includes telecom network equipment, IT products, cloud computing solutions, and smart devices, deployed across 170 countries and regions worldwide, serving over one-third of the global population.

In 2014, Huawei ranked 228th on the Global Fortune 500 list based on revenue, which reached approximately USD 46.5 billion that year. The company invests over 10% of its annual revenue into R&D, amounting to US$6.6 billion globally in 2014, with more than 45% of its workforce

engaged in R&D efforts. Huawei is committed to bridging the digital divide and promoting high-quality broadband connectivity through customer-centric innovation and partnerships. It advocates for socioeconomic sustainability by supporting secure network operations, enhancing industry efficiency, and driving low-carbon economic growth.

With a vision to build a better-connected world, Huawei focuses on future-oriented technologies including information pipes, cloud services, Big Data, IoT (Internet of Things), and premium quality handsets and devices. By localizing operations and fostering a global value chain, Huawei enables local innovators to maximize global opportunities and achieve mutual success. Dedicated to creating maximum value for telecom operators, enterprises, and consumers worldwide, Huawei continues to innovate and shape the future of global connectivity.

1.3 Statement of the Problem

Huawei Technologies Ethiopia, a key player in the region's telecommunications industry, stands at the forefront of technological innovation. The company has strategically incorporated various IT solutions into its supply chain management practices. While such initiatives are often celebrated for their potential to revolutionize operational efficiency, the question of how these IT interventions specifically contribute to improved supply chain performance remains inadequately explored.

The primary objective of this article is to investigate how the adoption of Information Technology (IT) enhances supply chain management performance within the operational framework of Huawei, focusing specifically on supply chain practices.

Cheruiyot (2013) conducted a study on the impact of integrated supply chain on performance at Kenya Tea Development Agency. The findings indicated that the supply chain integration was positively associated with supply chain performance.

Ann c.w. muriuki (2013), who has done a research entitled “Information Technology and Performance of Supply Chain Management: A Case Study of International Energy Technik Ltd” shows that IT has improved the processes of transactions across the various functions and also it is integrated in such a way that information flows along the various functions between

procurement and planning; logistics and warehouse. The various technologies used have reduced costs of operations in the supply chain and many savings has achieved.

Rajiv Bhandari(2020), who conducted a journal of entitled" Impact of Technology on Logistics and Supply Chain Management" draws conclusion that Technology is a vehicle to enhance supply chain competitiveness and performance by enhancing the overall effectiveness and efficiency of supply chain performance.

Yalew (2015) studied on the impact of Information and Communication Technology on performance of Ethiopian Private Banks using Dashen Bank S.C. and United Bank S.C. as a case study and the finding showed that Information and Communication Technology has positively impacted performance of Ethiopian private banks

Yafet (2018), who has done a research entitled "The Role of Information Technology in Logistics and Supply Chain Management Performance: The Case of Ethiopian Shipping and Logistics Services Enterprise (ESLSE)" finds that there is a strong and positive relationship between IT practice and role of IT with logistics and SCM performance. His findings show that role of IT has a strong influence on logistics and SCM performance.

Ermias (2019), who also has done a research entitled "The role of information communication technology adoption on supply chain performance of the Ethiopian shipping and logistics services enterprises" The results indicate significant positive relationships between ICT capability and supply chain performance and research findings also indicate that ICT capability influence the supply chain performance of ESLSE.

1.4 Research Questions

- What is the role of Information Technology on the supply chain performance of Huawei Technologies Ethiopia (in terms of cost efficiency, delivery speed, and customer satisfaction)?
- How supply chain management is being practiced with the help of integrated Information Technology at Huawei Technologies Ethiopia
- What are the major challenges of supply chain management practices at Huawei Technologies Ethiopia?

This study aims to bridge the existing gap in empirical knowledge by providing a comprehensive understanding of the role of Information Technology in enhancing logistics and supply chain management performance, with Huawei Technologies Ethiopia serving as a pertinent case study.

1.5 Objective of the Study

1.5.1 General Objective

The main objective of this study is to assess the supply chain management practices and identify its challenge, and examine the effect of Information Technology on the supply chain management performance of Huawei Technologies Ethiopia in enhancing its cost effectiveness, delivery speed, and customer satisfaction.

1.5.2 Specific Objectives

- To determine role of Information Technology on the supply chain performance of Huawei Technologies Ethiopia (in terms of cost effectiveness, delivery speed, and customer satisfaction)
- To assess the supply chain management practices with the help of integrated Information Technology at Huawei Technologies Ethiopia
- To identify the major challenges of supply chain management practices at Huawei Technologies Ethiopia

1.6 Significance of the Study

The first domain to gain from this research would be the logistics and supply chain management departments, since it would aid in their efforts to create more effective IT systems. The various IT systems developed about consumer behavior, service quality, and other activities are beneficial for Huawei Technologies Ethiopia's planning and decision-making procedures. Additional research contributions may come from academicians or scholars in the future who wish to examine on the effect that information technology plays in linked enterprises may also use researchers who wish to pursue related fields of study as a reference.

1.7 Scope of the Study

This study examines how IT affects SCM performance at Huawei Technology Ethiopia. It thus encompasses the cumulative SCM actions of the employees of Huawei Technology Ethiopia in conjunction with the company's IT system. Even though the supply chain management, and IT

divisions of Huawei Technology Ethiopia employees are the study's intended audience, some customers will also be included. The conceptual scope of the study explores dimensions of information technology (IT) adoption and their effect on supply chain management (SCM) performance at Huawei Technologies Ethiopia. It focuses on various IT solutions such as Enterprise Resource Planning (ERP) systems, Transportation Management Systems (TMS), Warehouse Management Systems (WMS), RFID, and big data analytics. The Geographical scope of study is conducted specifically at Huawei Technologies Ethiopia, located in Addis Ababa, Ethiopia. The research will concentrate on this geographical area to examine the IT adoption practices and SCM performance within the Ethiopian context. The study utilizes a Quantitative-methods approach, such as multiple linear regression and statistical analysis, will be employed to measure and analyze the actual SCM performance metrics influenced by IT adoption. This method approach aims to provide a comprehensive understanding of how IT adoption affects SCM performance.

1.8 Organization of the Paper

This study will be made of Five Chapters that are grouped as Chapter One, which covers the general introduction of the work that includes the background to the study, statement of the problem, objectives of the study, research questions and research hypotheses, scope of the study and significance of the study. Chapter Two shall be concerned with the review of existing literature. Chapter Three will deal with the methodology adopted for the study. Issues to be covered include research design, population and sample size, sample techniques, instrumentation, mode of data collection and method of data analysis, Chapter Four that is the main Chapter of the study will present findings and discussions based on the analysis made. The final chapter, Chapter Five will summarize the findings, a general conclusion of the research, recommendations and indications for further research.

1.9 Definition of Key Terminologies

Logistics: (Council of Logistics management,1991) defined that logistics is ‘part of the supply chain process that plans, implements and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers’ requirements.

Supply Chain: - (Martin Christopher, 2011) defined "Supply Chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer"

Supply Chain Management: (Michael Hugos, 2011) defined "Supply Chain Management (SCM) refers to the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served"

Supply Chain Performance: refers to the extended supply chain's activities in meeting end customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner.

Logistics Performance: According to (Chowet al.,1994) conceptualized that logistics performance is a subset of a larger organizational performance. According to (Fugate et al., 2010) the concept by highlighting that logistics performance positively affects organizational performance. According to (Green et al., 2008) logistics performance as the "ability to deliver goods and services in the precise quantity and at the precise times as required by the customers".

Differentiation or relevancy manifests itself in the ability of logistics to create value for the customer through the uniqueness and distinctiveness of logistical services (Langley and Holcomb, 1992; Bowersox et al., 2000).

Efficiency: Organizational efficiency is defined as an internal standard of performance (Pfeffer and Salancik, 1978) and is approximately a construct "for doing the things right". From resource 7 dependence perspective efficiency is an independent measure for evaluating organizational productivity. Efficiency is seen as a "value free" quantifiable measure – highly valued as a rationale for activities such as improvement programs or as a base for rewards. This is problematic for social systems (Pfeffer and Salancik ,1978) as efficiency is two dimensional (input and output) and social systems usually have several dimensions in their output. An example of this is the interdependencies within as well as among supply chains that cause efficiency in one supply chain and inefficiency in overlapping supply chains (Dubois et al. 2003). This means that efficiency within a supply-chain system is difficult to optimize due to

limited knowledge of interdependencies within the supply chain as well as towards other supply chains. This is evident in the ramp-up phase of Volvo's S80 model.

Effectiveness: organizational effectiveness is defined as an external standard "of how well an organization is meeting the demands of the various groups and organizations that are concerned with its activities" (Pfeffer and Salancik, 1978) which approximately is a construct "for doing the right things" or having validity of outcome (Hines et al., 2000). A conceptualization of effectiveness as use value is interesting to highlight that how well as well as demands in the above definition is vague. (Håkansson and Prenkert,2004) seem to refer use value to evaluation of the network's utilization of resources. In resource dependence, perspective is effectiveness seen as an independent measure for evaluating organizations. Meeting demands of various evaluators means that conflicting as well as compatible demands are prevalent.

CHAPTER TWO

2 REVIEW OF RELATED LITERATURE

2.1 Introduction

This study investigates the Effect of IT in supply-chain management performance of HUAWEI Technology Ethiopia plc. The chapter provides a review of the literature related to the study area. The literature included studies conducted by other researchers on the effect of IT in SCM performance. More importantly, the chapter provided a review on the effect of IT intervention to the improvement of supply chain performance, the specific IT solutions to address supply chain challenges and the effect of IT adoption on supply-chain management practice.

2.2 Theoretical Literature Review

A theoretical framework consists of concepts and, together with their definitions and reference to relevant scholarly literature, existing theory that used for a particular study. The theoretical framework must demonstrate an understanding of theories and concepts that are relevant to the topic of the research paper.

2.2.1 Supply Chain Management Practices

The Plan category involves all the necessary activities to organize and manage the operations in the other three categories. This includes a detailed examination of three critical operations: demand forecasting, product pricing, and inventory management. The Source category covers activities required to obtain inputs for creating products or services. This encompasses procurement, which involves acquiring materials and services, and credit and collections, which, although not traditionally considered a sourcing activity, can be viewed as the acquisition of cash. Both procurement and credit and collections significantly impact supply chain efficiency (Michel H. Hugos, 2011).

The Make category includes the operations essential for developing and producing the products and services a supply chain offers. This involves product design, production management, and facility management. While the SCOR model does not explicitly cover product design and

development, they are included here due to their crucial role in the production process. The Deliver category consists of activities related to receiving customer orders and delivering products. Key operations in this category include order management, product delivery, and return processing, which are essential for connecting companies within a supply chain (Michel H. Hugos, 2011).

The return process, also known as "reverse logistics," is a challenging and often inefficient aspect of all supply chains, warranting a dedicated category in the Supply-Chain Council's SCOR model. Returns can occur due to various issues: incorrect products delivered, products damaged in transit or defective from the factory, or excess product delivered to the customer. These problems arise from supply chain inefficiencies. Companies need to track the types, frequency, and trends of returns. While return processing should be efficient, minimizing the need for returns through effective supply chain management is crucial. Optimizing the return process often involves addressing the root causes of returns. A beneficial aspect of returns is product recycling, where end-users send products back at the end of their lifecycle for reuse or safe disposal. As environmental awareness grows and green policies adopted, recycling will increase, with companies emerging to handle it as a sourcing activity to acquire raw materials (Michel H. Hugos, 2011).

2.2.2. Supply Chain Performance

Supply chains serve two primary functions: the physical function, which includes transformation, storage, and transportation, and the market mediation function, which involves matching supply with demand. Efficiency is measured internally, whereas effectiveness is gauged externally to meet the demands of various stakeholders (Pfeffer & Salancik, 1978). Companies achieve their objectives through performance measurements (Ackermann, 2003). Performance in a supply chain is evaluated based on efficiency, effectiveness, and flexibility (Hald, 2007). Supply chain efficiency focuses on cost reduction, reduced inventory levels, shorter lead times, and streamlined processes.

Many organizations prioritize cost reduction in their supply chains while also aiming to improve lead times. Supply chain effectiveness seeks to enhance customer service, increase market share

and sales, and facilitate the development of new products. According to (Ann C.W. Muriuki ,2013), reduced inventory means maintaining appropriate inventory levels, ensuring timely market entry, and achieving break-even points. Order fulfillment should reflect the impact of supply chain partners on order processing time and shipment accuracy (Ann C.W. Muriuki, 2013).

The supply chain field has evolved significantly, linking suppliers and customers from raw material delivery through various value-adding activities to the end customer. (Spekman et al. ,1994) suggest that competition is assessed as a network of cooperating companies competing with other firms along the supply chain. Companies are increasingly aligning processes and information flows across the value-added network to meet market demands (Quinn, 1993). Success measured by cost, speed, innovation, and customer satisfaction. The coordination of complex global networks is the primary source of competitive advantage (Ann C.W. Muriuki, 2013).

Brewer and Speh (2000) argue that a successful supply chain effectively coordinates processes, focuses on delivering customer value, eliminates unnecessary costs in key areas, and establishes performance measurement systems to assess whether the supply chain meets expectations. To gain a competitive edge globally, firms must provide high-quality products at low costs with short lead times (De Meyer et al., 1999; Goonatilake, 1990; Hugh, 2011).

In terms of cost reduction, firms aim to minimize waste by reducing duplication, harmonizing operations and systems, and enhancing quality (Brewer & Speh, 2000). Inventory maintenance is centralized to avoid duplication, with organizations planning inventory levels based on customer demand analysis. Analyzing customer order patterns and integrating systems helps reduce waste. Cost reduction enables firms to sell products at lower prices, which is beneficial for price-sensitive goods (Fisher, 1997). Improved lead times and reduced uncertainty are also key efficiency measures, leading to reduced inventory and improved cash flow as customers pay for goods promptly. This results in smooth information and product flows along the supply chain, enabling quick responses to customer demands (Brewer & Speh, 2000).

Stewart (1995) emphasizes that customer satisfaction driven by the supply chain link responsible for delivering goods and services. Effective customer service involves delivering the right products at the right time and place. Developing and maintaining partnerships with customers can enhance customer service. Supply chain metrics linked to customer satisfaction to ensure effective performance. Meeting individual customer demands through product and service availability is crucial for achieving customer satisfaction.

2.2.3. Information Technology

Supply chains fulfill two primary roles: the physical function, which involves transformation, storage, and transportation, and the market mediation function, which aligns supply with demand. Efficiency is an internal performance metric, while effectiveness measures the ability to meet various group demands externally (Pfeffer & Salancik, 1978). Achieving organizational goals aided by performance measurements (Ackermann, 2003). In supply chains, performance assessed through efficiency, effectiveness, and flexibility (Hald, 2007). Efficiency focuses on cost reduction, inventory minimization, shorter lead times, and streamlined processes.

Organizations often prioritize cost reduction while improving lead times in their supply chains. Effectiveness in the supply chain aims to enhance customer service, increase market share and sales, and support new product development. As noted by (Ann C.W. Muriuki,2013), reducing inventory involves maintaining suitable inventory levels, timely market entry, and reaching break-even points. Order fulfillment should consider how supply chain partners influence order processing time and shipment accuracy (Ann C.W. Muriuki, 2013).

The supply chain field has evolved considerably, linking suppliers and customers from raw material delivery through various value-adding activities to the end customer. (Spekman et al. ,1994) highlight that competition now involves networks of cooperating companies competing with other supply chain firms. Companies increasingly align processes and information flows across the value-added network to meet market demands (Quinn, 1993). Success measured by cost, speed, innovation, and customer satisfaction, with coordinated complex global networks providing competitive advantage (Ann C.W. Muriuki, 2013).

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In supply chain management (SCM), proper alignment and integration between key supply chain actors, along with increased visibility and transparency, ensure accurate forecasting of resources (people, materials, and equipment), enhancing resource and process optimization, market alignment, and employment growth. Over the past decade, technology adoption and evolution in SCM have become essential for increasing organizational efficiency and competitiveness (Heuser et al., 2008). Technologies such as Enterprise Resource Planning (ERP), Warehouse Management Systems (WMS), Transportation Management Systems (TMS), and Intelligent Transportation Systems (ITS) have significantly affected SCM (Hasan et al., 2013).

Advanced technologies in SCM demand transparency (supply chain visibility) and integrity checks (ensuring the right products are delivered at the right time, in the correct quantity, and at the right cost) (Macaulay et al., 2015). The need for dynamic "re-configurability" of supply networks, particularly through service level agreements with upstream suppliers, is growing (Carvalho et al., 2011). The demand for highly personalized products and services is continuously increasing.

Inbound and outbound logistics must adapt to this changing environment. Warehouses are crucial in the flow of goods within a supply chain and should be a source of competitive advantage for logistics providers. Implementing "smart" management during the adoption of Warehouse Management Systems (WMS) will transform warehouse activities to meet future inbound logistics requirements (Schrauf et al., 2016). Integration among SCM actors ensures complete coordination and alignment. Intelligent warehouse management systems will optimize just in time and just-in-sequence delivery by communicating shipment positions and expected arrival times and preparing docking slots accordingly. RFID sensors will track deliveries and provide real-time data throughout the SCM, enhancing customer service levels. The WMS will automatically allocate storage space and demand appropriate equipment for transferring goods to precise locations autonomously. Real-time visibility into inventory points, facilitated by labels sending signals to the WMS, will avoid overstocking and improve management decision-making.

A Transport Management System (TMS) is a crucial part of SCM, focusing on transport logistics. TMS integrates with order management systems and distribution centers or warehouses to help firms control rising transport costs, manage electronic communications with customers and carriers, and provide end-to-end supply chain visibility. Major software companies are moving their TMS solutions to the cloud, reducing the need for on-site installations (Cunnane, 2017). TMS systems offer better visibility, integration with mobile devices, and real-time tracking of vehicles and goods.

As items that are more physical are equipped with barcodes, RFID tags, or sensors, transportation and logistics companies can monitor the movement of goods in real time from the source to the destination. The Internet of Things (IoT) provides promising solutions to transform

transportation systems and automotive services (Qin et al., 2013). IoT technologies enable tracking the location of vehicles, monitoring their movements, and predicting future locations.

The Intelligent Transport System (ITS) integrates various transport management aspects, such as operations, policies, and control methods, using advanced technologies like computing hardware, positioning systems, sensor technologies, telecommunications, data processing, and virtual planning techniques. ITS aims to increase safety, reliability, speed, and traffic flow while reducing risks, accident rates, carbon emissions, and air pollution.

SCM must develop market strategies that leverage technological advancements while maintaining flexibility to adapt as needed. However, switching technologies once implemented can be challenging. Modern SCM is a complex network connecting organizations, industries, and economies, operating within interconnected business networks. Increased IT use, SCM globalization, and integrating company networks into "smart businesses" have helped reduce SCM exposure to disasters. The challenge for SCM is to understand the full scope of technology and manage the barriers, which requires the necessary skills, processes, and contingencies within the supply chain network. Technological innovation and customer demands for advanced technology and services continue to introduce new challenges, necessitating transparency and integrity control within supply chains. This transformation will significantly impact SCM management, aligning with new incentives and environmental configurations.

2.3 Empirical Literature Review

Empirical literature review deals with original research (such as scientific experiments, surveys and research studies). They are researches based on experience and observation, rather than on Systematic logic Malang (2012).

2.3.1 IT Adoption in the Supply Chain Process

In today's dynamic and competitive business landscape, efficient and optimized supply chains are critical for organizational success (Christopher, 2016). Information technology (IT) adoption plays a transformative role in enhancing supply chain processes across all stages plan, source, make, deliver, and return (Gunasekaran et al., 2013). This review examines the empirical

literature on how IT adoption impacts each stage, highlighting the benefits, challenges, and key factors influencing successful implementation.

2.3.1.1 IT Adoption in Supply Chain Process: Plan

Demand Forecasting and Inventory Management: IT facilitates improved demand forecasting through sophisticated algorithms and historical data analysis. Studies by (Kouvelis et al., 2012 and Li et al., 2014) demonstrate how Enterprise Resource Planning (ERP) systems contribute to more accurate demand forecasts, leading to optimized inventory levels and reduced stockouts. Advanced Planning and Scheduling (APS) systems further enhance planning by simulating production scenarios and optimizing resource allocation (Stadtler et al., 2005). However, (Büyüközkan and Gülbay, 2018) highlight the challenge of integrating forecasting models with real-time data to ensure their effectiveness.

2.3.1.2 IT Adoption in Supply Chain Process: Source

IT empowers organizations to improve supplier selection, streamline procurement processes, and facilitate collaborative forecasting, planning, and replenishment (CFPR). Electronic marketplaces and supplier relationship management (SRM) systems enable efficient supplier selection based on cost, quality, and performance metrics (Ahuja & Büyüközkan, 2017). E-procurement platforms automate purchase orders and streamline communication, leading to cost savings and faster procurement cycles (Carter et al., 2012). CFPR allows for collaborative demand forecasting with key suppliers, ensuring synchronized inventory levels throughout the supply chain (Vachon & Leite, 2010). However, challenges in data sharing and aligning incentives can hinder the effectiveness of CFPR initiatives (Min et al., 2015).

2.3.1.3 IT Adoption in Supply Chain Process: Make

IT empowers manufacturing operations through production monitoring, quality control systems, and real-time data visibility. Manufacturing Execution Systems (MES) provide real-time production data, enabling process optimization and predictive maintenance (Lee & Bagheri, 2016). Industrial Internet of Things (IIoT) applications, with sensors embedded in machines and tools, further enhance data collection and automate tasks (Xu et al., 2018). These technologies can lead to increased production efficiency, improved product quality, and reduced waste.

However, security concerns and the need for skilled personnel to manage complex IIoT systems pose challenges (Dutta et al., 2015).

2.3.1.4 IT Adoption in Supply Chain Process: Deliver

IT optimizes warehousing, transportation management systems (TMS), and last-mile delivery solutions, leading to faster and more cost-effective order fulfillment. Warehouse Management Systems (WMS) optimize storage space allocation, picking and packing processes, and inventory tracking (Akyol et al., 2018). TMS software optimizes transportation routes, carrier selection, and real-time shipment tracking, reducing delivery times and costs (Crain et al., 2018). The rise of e-commerce has driven the adoption of last-mile delivery solutions, such as route optimization apps and delivery tracking platforms, to ensure efficient final product delivery to customers (Wang et al., 2019). However, integrating these various systems and ensuring data compatibility across the supply chain network can be a challenge (Sodhi et al., 2014).

2.3.1.5 IT Adoption in Supply Chain Process: Return

IT plays a crucial role in managing reverse logistics, returns processing, and product lifecycle management. Reverse logistics software streamlines the process of receiving and processing returned goods, facilitates product refurbishment or recycling, and ensures proper waste disposal (Meacham et al., 2018). Product lifecycle management (PLM) systems track product information throughout its lifecycle, enabling efficient returns processing and facilitating product end-of-life management (Griehammer & Voss, 2020). However, effectively integrating these functionalities with existing supply chain systems and establishing clear return policies are key considerations (Jahre & Moeller, 2013)

2.3.1.6 Success Factors for IT Adoption

Several factors influence the success of IT adoption in supply chain management. (Topal et al., 2018) highlight the importance of top management commitment, user training, and change management strategies. (Eaton et al., 2015) emphasize the need for data quality and integration across different IT systems. Furthermore, cultural change within the organization is crucial for employees to embrace new technologies and processes (Gunasekaran et al., 2013).

2.3.2 Supply Chain Performance

The study of (Mishra, 2012) focused on the role of Information technology (IT) in supply chain Management. It also highlights the contribution of IT in helping to restructure the entire Distribution set up to achieve higher service levels, lower inventory, and lower supply chain Costs. The broad strategic directions that needs to be supported by the IT strategy are increasing of frequency of receipts/dispatch, holding materials further up the supply chain and crashing the various lead times. Critical IT contributions and implementations are discussed. Fundamental changes have occurred in today's economy. These changes alter the relationship we have with our customers, our suppliers, our business partners and our colleagues. It also describes how IT developments have presented companies with unprecedented opportunities to gain competitive advantage. So IT investment is the pre-requisite thing for each firm in order to sustain in the market.

The Study of (Dong, 2009) aimed to better understand the value of information technology (IT) in supply chain contexts. Grounded in the resource-based theory in conjunction with transaction cost economics, they developed a conceptual model that links three IT-related resources (back end integration, managerial skills, and partner support) to firm performance improvement. The model differs from previous studies by proposing a moderating effect of competition on the resource-performance relationships. Using data of 743 manufacturing firms, their analysis indicates significant contribution of IT to supply chains, which is generated through development of the digitally enabled integration capability and manifested at the process level along the supply chain. The technological resource alone, however, does not hold the answer to IT value creation. In fact, managerial skills, which enable adaptations on supply chain processes and corporate strategy to accommodate the use of IT, are shown to play the strongest role in IT value creation.

A number of beneficial changes were made, including the implementation of a major new business system replacing the old accounting system. In all these developments, the work of a teaching company associate, now known as knowledge transfer partnerships associate supported the analysis, but the full participation and support of all key personnel within the company was essential. Although there were problems during the implementation, these have being resolved and Beale and Cole now has a fully supported and integrated IT system which will maintain their

competitive advantage and facilitate their continued growth and profitability. The study of (David, 2004) indicated that the supply chain management is critical since firms always confront the competition on their supply chain efficiency.

Specialized tools address the critical issues in food production management including product tracing, quality management, product identification and specification, expiration dates, production lots, date codes and hold management. Lead time being the time between order and placement of materials and the actual delivery, he shorter the lead time the better the supplier.

Every logistics company is comfortable when the lead time is shortest possible. Long lead time has time has the impression that the specific supplier is less efficient or he just has some more customers than he can serve thus delaying deliveries (Beamon, 2005). Organization technologies have led to a host of innovations which seem to be radically changing the nature of manufacturing industry.

The increasing replacement of mass production, specialized single –purpose, fixed equipment by computer aided design and engineering capabilities (CAD/CAE). robots, automatic handling and transporting devices, flexible manufacturing systems (FMS), computer aided/ integrated manufacturing(CAM/CIM),cellular manufacturing, just in time (JIT) techniques, materials resource planning(MRP), and telematics has allowed firms to produce a larger variety of outputs efficiently in smaller batches and less time(Kaplisky, 2006). State-of –the art supply chain management systems can be obtained from the supply chain operations Reference Model for business applications, advancement and practices.

Problematic management processes in standard process reference model form improves competitive advantage, communication, dimensions, management, control and alter to a specific purpose among the supply chain management processes. SCOR (Supply Chain Operations Reference) is a reference framework that models supply chains, developed by the Supply Chain Council, set in 1996 by Pittiglio. Rabin,Todd McGrath (PRTM) and MR Research. SCOR models supply chain by these complementary perspectives, approach, functional domains and levels of analysis Stewart (1997). SCOR has been developed for applying and advancing state-of-the art supply chain management systems and practices through its structured framework and approach. It provides a comprehensive methodology to improve the overall supply chain

operations. SCOR, is a flexible framework and has common language that can help companies improve their SC internally and externally, were developed by real-world supply chain Experiences. SCOR evaluates the objective, effectiveness of reengineering, performance, quantification, testing and future planning as well as specific process operations in SC. It is not possible to have a perfect SCM model but a closely adapted model is being applied at PTC, which is a first in the history of SCOR at the factory level (Gulledge, Cavusoglu & Kessler, 2010). Complex management processes can be transformed in standard process reference model form to achieve competitive advantage, communication, measurement, management, control systems and alterations for a specific purpose. Since SCM systems can be represented in the form of a model which represents the real world situation .It is necessary to study modeling approaches for the integration of each function through SCM concepts.

According to (Archie & Kevin, 2004) SCOR includes main functional domains, with a concept similar to GEF and porter's value chain planning processes, Plan the supply chain: operations planning (similar to GEF), Execution Processes, Source: equivalent to Porter's Inbound Logistics; Make: equivalent to Porter's Operations ,includes the realization of products via blending, separation, mechanical work, chemical transformation; Deliver, equivalent to porter's outbound Logistics +Porter's Sales; and Return: return of materials by the customer to the supplier, e.g. because they have not been positively tested. SCOR includes also a wide class of "enabling processes", that are intended to prepare, file, handle information needed to planning and execution processes.

Gulledge (2010) argues that SCOR process elements are described by a thick Manual, that contains diagrams and cards that list their properties in terms of Text description; Metrics by which business performances of a process, element are measured in terms of reliability, responsiveness, flexibility, cost, asset; Best practices, that mentioned reference solutions to perform or computerize the process element considered, and also, mention excellence criteria, e.g. planning is excellent if balances supply and demand. The SCOR method is a customization of the reference framework processes, problematic management processes, lead time being the time between order and placement of material and the actual delivery, the shorter the lead time, the better the supplier. Every logistics company is comfortable when the lead-time is shortest possible. Long lead-time has the impression that the specific supplier is less efficient or he just

has more customers than he can serve thus delaying deliveries (Beamon, 2005). Organization technologies have led to a host of innovations, which seem to be radically changing the nature of manufacturing industry.

The increasing replacement of mass production, specialized, single-purpose, fixed equipment by computer aided design and engineering capabilities (CAD/CAE), robots, automatic handling and transporting devices, flexible manufacturing systems (FMS), computer aided/integrated manufacturing (CAM/CIM), cellular manufacturing, just-in-time (JIT) techniques, materials resource planning (MRP) and telematics has allowed firms to produce a larger variety of outputs efficiently in smaller batches and less time (Kaplinsky, 2006). The implementation of ICT affects supply chain performance in various ways as outlined in the following section.

2.3.3 Challenges of IT Adoption in Supply Chain Processes

The transformative potential of information technology (IT) in supply chain management is undeniable. However, adopting and implementing IT solutions across various stages (plan, source, make, deliver, return) presents a complex set of challenges (Gunasekaran et al., 2013). This review explores three key challenges organizations face when integrating IT into their supply chains: logistical complexities, foreign currency fluctuations, and legal and regulatory hurdles.

2.3.3.1 Logistical Challenges Affecting IT Adoption in Supply Chain Processes

IT adoption often necessitates significant changes in an organization's existing logistics infrastructure. Integrating new systems with legacy ones can be a daunting task (Sodhi et al., 2014). Data incompatibility across different platforms and the need for data cleansing to ensure accuracy pose significant hurdles (Eaton et al., 2015). Furthermore, implementing real-time data visibility solutions like Warehouse Management Systems (WMS) or Transportation Management Systems (TMS) may require upgrades to warehouse automation or transportation routing systems, leading to additional investment and potential disruptions (Akyol et al., 2018; Crain et al., 2018).

2.3.3.2 Challenges of Foreign Currency Fluctuations Affecting IT Adoption in Supply Chain Processes

Global supply chains inherently involve transactions across different currencies. IT systems need to account for these fluctuations to ensure accurate financial reporting and cost optimization. Managing foreign exchange risk within IT systems can be complex, especially with volatile markets (Jahre & Moeller, 2013). ERP systems play a crucial role in managing international trade transactions, but ensuring real-time currency conversion rates and accurate cost calculations within the system requires ongoing monitoring and adjustments (Christopher, 2016).

2.3.3.3 Legal and Regulatory Challenges Affecting IT Adoption in Supply Chain Processes

Data privacy regulations like the General Data Protection Regulation (GDPR) in Europe and similar regulations emerging worldwide create new complexities for supply chain data management (Gunasekaran et al., 2013). IT systems need to be compliant with these regulations to ensure data security and privacy for all stakeholders involved in the supply chain. Additionally, IT adoption may raise concerns regarding intellectual property rights, especially when collaborating with international partners. Organizations need to have robust legal frameworks in place to address these concerns and ensure smooth cross-border data flow (Meacham et al., 2018).

Several strategies can help organizations overcome these challenges and successfully implement IT solutions for their supply chains. (Topal et al.,2018) emphasize the importance of thorough planning and change management. This involves conducting detailed feasibility studies, involving key stakeholders in the implementation process, and providing proper training to adapt to new workflows. Additionally, investing in data quality and system integration is crucial (Eaton et al., 2015). Organizations should ensure their IT infrastructure supports seamless data flow across various systems to avoid disruptions and ensure accurate information for decision-making. Furthermore, collaborating with experienced IT consultants and solution providers can offer valuable expertise in navigating the complexities of IT adoption within the supply chain domain.

2.3.4 Role of IT on Supply Chain Performance

The subject of IT in supply chain and logistics has attracted many researchers who have conducted studies on different areas of the subject. In its report on transport and logistics, the European Commission noted that the use of IT software positively drives organizational changes European Commission (2008). The study tested the hypothesis that IT usage positively correlates to organizational changes and it was noted that IT skills and software have different implications on the conduct and performance of organizations. In the same study, it was again noted that whereas IT hardware is necessary for an organization, it does not automatically guarantee business transformation. Positive change comes from IT skills coupled with the use of innovative software to manipulate operations. The success derived from IT investment from a logistics companies therefore largely hinges on innovation, skills and software used.

In a feasibility study of an integrated IT-based logistics system for the Friuli Venezia Giulia region in Italy, (Danielis,2008) finds that intermodal transport needs can be enhanced by connecting the regional stakeholders with an IT system. By interviewing 20 stakeholders, the researchers noted that a generic ICT system might not be applicable to the region. It was realized that a successful IT system must be implemented in phases beginning with the sharing of information on the benefits of the system. From the findings, it emerged that an IT-based system in logistics operations greatly reduces transportation costs, energy usage and carbon emission. Transportation management System (TMS) helps in planning and executing external flows thereby optimizing transportation while taking account of multimodal transport, and international trade.

In the East African Logistics Performance Survey (2012), the Shippers Council of Eastern Africa did a field assessment of the challenges faced by logistics companies in the region. 54.4% of the respondents indicated that they always experienced delays arising from insufficient IT infrastructure. In addition, it was seen that the security of cargo is a major challenge to the shippers as it is not always guaranteed in the supply chain. In this regard, the ability of the companies to track and trace their shipments becomes an important issue. The respondents were also asked how easily they could always track their shipments while intransit. 31.25% said they use electronic means of cargo tracking while the rest rely on telephone as the main way of tracking.

Zhelyazkoz (2008) studied the impact of IT systems on road logistics for companies in Australia. The research identified the major reasons and inhibitors to the adoption of IT by logistic companies. Considering the cost implications and technical features of ideal IT systems, it was realized that it was not always certain that IT investment fulfils the needs of companies. Technology constraints identified as major barriers due to the lack of standard communication platforms between different suppliers and buyers. It is realized that different

IT applications adopted in the market meant that companies always invest heavily in order to communicate to all parties. It is therefore seen that IT only influences an organization's supply chain system when used appropriately and in the presence of supporting infrastructure. This study focuses on effects of ERP, RFID, Bar coding and GPS on supply chain performance.

Several studies have been conducted to examine the effect of information technology on SCM. One of such is an empirical study by (Auramo, Kauremaa and Tanskanen,2005), in which responses from 16 Finnish industrial and service companies were obtained. The study revealed that the primary drivers (reduction of cost operational expenses, speed, volume of transaction, unpredictable and logistically demanding environment, in-transit delivery consolidation, project-orientation of the business) that necessitated the use of IT in SCM were transaction processing, supply chain planning and collaboration and order tracking and delivery coordination. The study concluded by proposing a relationship between the drivers and the use of IT and its benefits in enhancing information sharing. Another study conducted by (Mishra, 2012), highlights the contribution of IT in helping to restructure the entire distribution system to achieve higher service levels and lower inventory and supply chain costs. The broad strategic directions that need to be supported by the IT strategy are increasing of frequency of receipts/dispatch, holding materials further up the supply chain and crashing the various lead times.

The other streams focus on a specific technology and the second stream studies the applications and benefits of IT in general. Authors such as cited in (Ann c.w. muriuki, 2013), (Mukhopadhyay et al.,1995), (Tuunainen,1998) focus on adoption factors and impact of Electronic Data Interchange (EDI). (Mukho padhy et al.,1995) has identified cost reduction as an objective of EDI links while (Tuunainen,1998) links EDI with the volume of transactions between supply chain partners. as cited in (Ann c.w. muriuki,2013), studied the use of Extended

Markup Language (XML) for supply chain intergration. Research focusing on application areas such as the tracking systems and their efficient coordination on the logistics flows have been widely conducted by authors such as (Harris,1999), as cited in (Ann c.w. muriuki,2013), among others. As much as these tracking systems have not been empirically founded, there is a wide use of tracking systems and tracking information in many logistics companies. (Zhu and Kraemer,2005) developed a resource-based view (RBV) framework to assess IT enabled resources at both the front end and the back end. The RBV was drawn primarily from 17 the value of IT in digitally enabled supply chains. (Barney, 1991 & Peteraf , 1993) attribute RBV to improvement in the performance of the firm to valuable resources or resource bundles. The IT value creation was looked from one lens where IT value creation has a direct role for IT in firm performance. The main reason is that IT affects other resources that lead to competitive advantage. IT was seen as an independent variable while the other variables like revenue generation and cost reduction are viewed from the other lens as dependent variables. According to (Mukhopadhyay and Kekre,2002), revenue and cost reduction are the two major dimensions of process performance improvements through supply chain integration. (Gunasekaran and Ngai,2004), state that a comprehensive study of IT in supply chain will be useful to identify critical success factors of IT for an integrated supply chain. There has not been adequate attention from researchers and practitioners in the design and implementation of the supply chain management especially in the business to business ecommerce and the supply chain (Gunasekaran and Ngai, 2004)

2.4 Theoretical Frame Work

The theoretical framework for the effect of information technology (IT) in supply chain management (SCM) performance encompasses various dimensions that influence the integration and impact of IT solutions on SCM practices. It comprises the following components: IT adoption on supply chain management practice i.e., Planning, Sourcing, Making, Delivery and Return as an Independent variable and supply chain performance i.e., Cost Efficiency, Delivery Speed and Customer satisfaction as Dependent variable and the challenges like Legal and regulator , Logistical Challenges and Access to foreign Currency challenge also affects the Independent Variable Directly.

2.5 Conceptual Frame Work

Conceptual framework is researcher's map that explains graphically or in narrative form, the main areas to be studied the key factors or variables by establishing relationship among them. As cited in (Ermias Girma,2019) In this study the relationship between dependent and independent variables demonstrated conceptually in the below diagram.

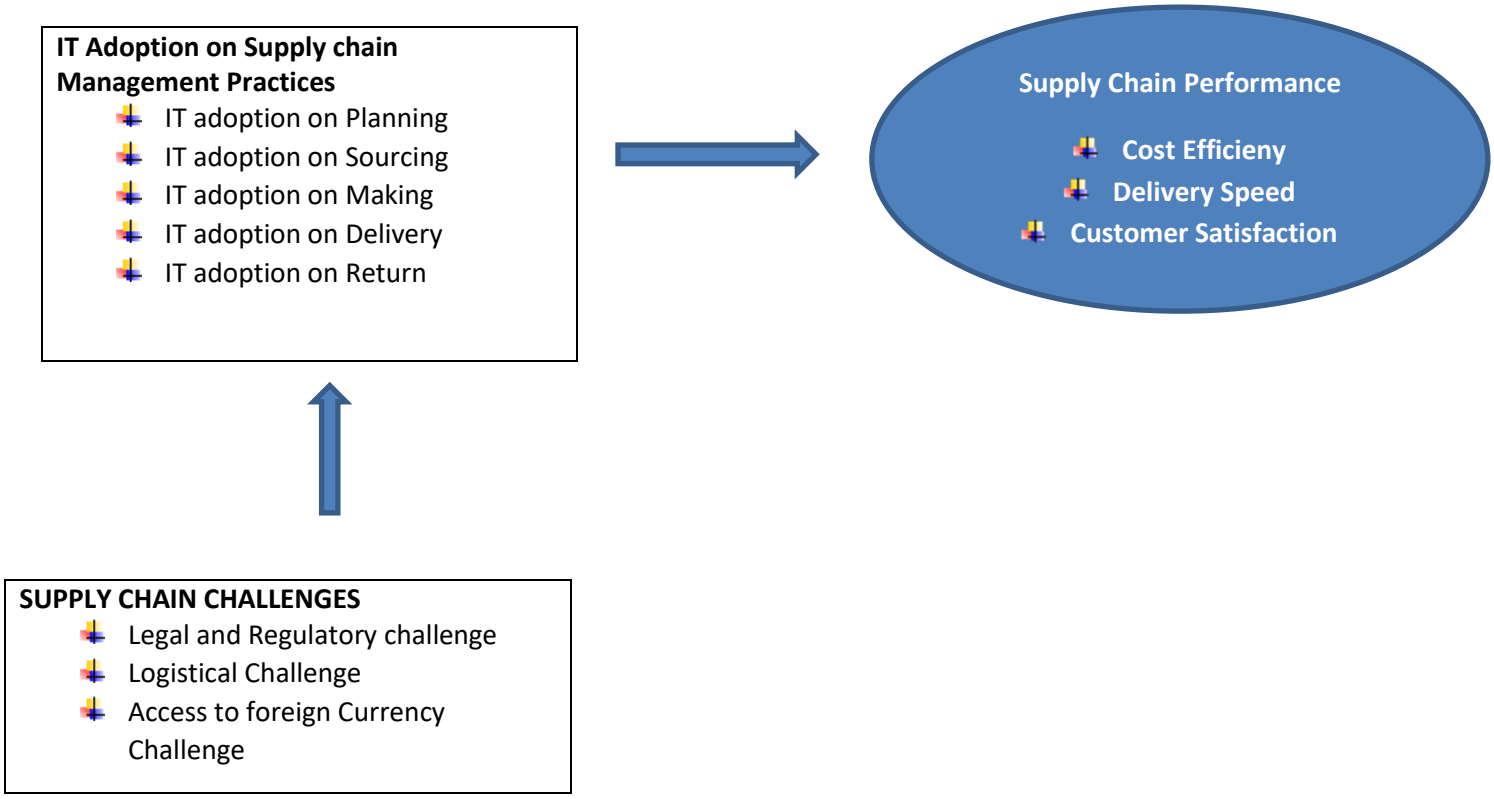

Figure 2.1: Conceptual Framework of IT adoption

CHAPTER THREE

3. METHODOLOGY OF THE STUDY

3.1 Introduction

This chapter focused on the research methodology that employed in the study. The researcher addresses the following: research design, target population, sample size and sampling procedures, data collection instrument, data collection procedure, validity and reliability of the instrument, data analysis, and ethical consideration.

3.2. Description of the Study Area

Huawei was established by Ren Zhengfei in 1987 in Shenzhen, China, and has since become a prominent figure in the information and communications technology (ICT) industry. The company is renowned for its pivotal role in advancing telecommunications infrastructure and cutting-edge technologies. Operating in more than 170 countries and regions worldwide, Huawei has solidified its position as a global technology leader. The company's expansive global footprint enables it to cater to a diverse and extensive clientele.

Employing approximately 207,000 individuals globally, Huawei's workforce engages in various facets of the business, including research and development, manufacturing, and customer support. As a major provider of ICT infrastructure, Huawei delivers a comprehensive array of solutions and services encompassing telecommunications equipment, networking solutions, cloud computing, and other technology-related products. Additionally, Huawei is recognized for its innovative smart devices, comprising smartphones, tablets, wearables, and consumer electronics.

Central to its mission is Huawei's dedication to expanding digital connectivity across individuals, households, and organizations, aimed at fostering a fully connected and intelligent world. The company's commitment to technological advancement is underscored by substantial investments in research and development. Huawei has been pivotal in the evolution of 5G technology, artificial intelligence, and other emerging tech domains, shaping the future of global connectivity.

Despite its achievements, Huawei has encountered challenges and controversies, particularly regarding security concerns related to its telecommunications equipment raised by some governments. These issues have sparked international scrutiny and discussions. Beyond commercial success, Huawei's impact extends to significant contributions in advancing the ICT sector, influencing global connectivity and communication norms.

3.3 Design of the Study

Research design encompasses the overall strategy and methodology employed in research, encompassing decisions ranging from broad assumptions to specific methods of data collection and analysis. It serves as the framework that guides a researcher's approach and the techniques chosen for conducting the study. According to (MacMillan and Schumacher, 2001), research design is a structured plan that outlines the selection of subjects, research sites, and procedures for data collection to address the research questions. Similarly, (Creswell, 2003) defines research design as a specific inquiry framework within a research approach that provides clear direction for conducting the study.

In this particular study, the research is structured around a quantitative survey design. The primary objective is to evaluate how information technology influences the performance of supply chain management at Huawei Technologies Ethiopia plc. Therefore, the chosen methodological approach is a quantitative survey, deemed appropriate for systematically gathering and analyzing data to achieve this research objective.

3.4 Research Approach

The methodology of any research is key part of the scientific research. Most researchers argued that the best method to use for a study depends on the purpose of the research, research data, and the accompanying research questions (Kothari, 2004). The study will primarily adopt a quantitative approach, with the main objective being to analyze the relationship between the independent and dependent variables through quantitative methods.

3.5 Sources of Data

Both primary and secondary sources are used for this study. The primary data is collected from Huawei technologies Ethiopia Employees. On the other hand, the secondary data is obtained from relevant documents and literatures.

3.6 Data Collection Instruments

The techniques applied to collect the data for this study is questionnaire. The researcher will use primary data which is collected from the respondents. The data has been analyzed to get the respondents opinion on The Role of Information Technology in Supply Chain Management Performance at Huawei Technologies Ethiopia. The study will use self-administered questionnaires as the instrument to collect data where the respondents remained anonymous. The researcher will give the respondents adequate time to complete the questionnaires after which they are submitted.

3.6.1 *Questionnaire*

The principal way of collecting information for the study will be through questionnaire. This is because of the nature of the problem under investigation.

Questionnaire is widely used in educational research to obtain information about certain conditions and practices and to enquire into opinion and attitude of an individual or group. In this study, closed ended questions are included to collect information from the respondents. This is the reason that questionnaires are used as an important tool when examining people's opinions, feelings, and behaviors on issues that concern them directly or indirectly (Punch, 2004)

The questionnaires are primarily submitted to the advisor for comments. Then the questionnaires are tested. Pilot study has been undertaken to maintain reliability and to evaluate the appropriateness before they will be administered.

3.7 Sampling Design

As to sampling procedure, ideally one wants to study is the entire population. However, usually it is impossible or unfeasible to do this and therefore one must settle for a sample. Sample is a portion of elements taken from a population, which is considered to be representative of the

population. This is because no study can include everything: you cannot study everyone': sampling in quantitative research usually means people sampling (Punch, 2004).

After stratification, the researcher applied appropriate method in order to obtain a sample size sampling the target population

3.7.1 Target Population

The target population is defined as the entire aggregation of respondents that meet the designated set of criteria (Kothari, 2004). Sample populations are often used in this research because of the near impossibility of studying the whole group. The target population of this study is Supply chain department and related to supply chain at Huawei technologies Ethiopia.

3.7.2 Sampling Technique

Since it is difficult to include all population in the study, because of time, budget and labor constraints the researcher will use Purposive sampling technique because of the objective and nature of the study. To address the respondents of this research purposive sampling technique is implemented.

3.7.3 Sample Size

The sample size is a statistical concept that involves determining the number of observations or replicates that should be included in a statistical sample. Determining sample size varies for various types of research designs and there are several approaches in practice (Cochran W.G., 1977 cited in Kothari, 2004). As a rule, one can say that the sample must be of optimum size, it should be neither excessively large nor too small. Therefore, while doing the study the sample size will be calculated using the Cochran formula.

i.e $n= Z^2pq/e^2$

n= stands for the sample size which will be drawn

e = level of precision or sometimes called sampling error (range in which the true Value of the population would be estimated.)

P= population proportion

Z = level of confidence (in a Z table)

q= 1-p

The sample has been drawn from the maximum variability of the population (P=0.5) with 95% level of confidence with a 5% precision level.

$$n_0 = \frac{Z^2 pq}{e^2}$$

$$= \frac{(1.96)2*0.5*0.5}{(0.05)2}$$

n_o =384.16

Therefore, $n=\frac{no}{1+\frac{no-1}{N}}$

$$=\frac{384.16}{1+\frac{384.16-1}{96}}$$

=77

3.8 Data Analysis Methods

After the needed data is collected, the researcher summarizes and analyzes the quantitative data based on Descriptive statistics and particularly percentages, frequency distribution, and mean. Descriptive statistics used to present the data of the findings in the questionnaires; before processing the responses, the completed questionnaires are checked for completeness and comprehensibility to ensure consistency. The data shall be summarized, coded, and entered into the Statistical Package for Social Sciences (SPSS).

3.9 Reliability and Validity of Instrument

3.9.1 Reliability

Reliability refers to the consistency and stability of a measurement instrument or scale over time and across different conditions. One commonly used method to assess reliability is Cronbach's alpha coefficient. A high Cronbach's alpha value suggests that the items within the scale are highly correlated and measure the same underlying construct consistently and it indicates that the scale has good internal consistency, enhancing the reliability of our findings.

Reliability is the measure of internal consistency in the study. A construct is reliable if alpha (α) value is greater than 0.7 (Hair et al., 2013). Construct is reliable was assessed using Cronbach's Alpha.

Number	***Measures/ variables***	***No items***	***Alpha (α)***
1	Practice of IT	*15*	*α =.808*
2	Challenges	*11*	*α = .922*
3	Supply chain performance	*15*	*α = .944*
Total	Overall reliability	*41*	*α = .957*

Table 3.1 Cronbach's Alpha Determination

The results demonstrate the reliability of the study's measures based on Cronbach's alpha (α) values, which range from 0 to 1, with higher values indicating greater reliability. The **Practice of IT** category, with 15 items, has a Cronbach's alpha of .808, indicating good reliability. The **Challenges** category, consisting of 11 items, has an alpha of .922, indicating excellent reliability. The **Supply Chain Performance** category, with 15 items, has an alpha of .944, also indicating excellent reliability. Overall, the study's measures are highly reliable, especially for challenges and supply chain performance, with the practice of IT showing good reliability.

3.9.2 Validity

According to Kothari (2004), the validity of a research instrument refers to its ability to measure what it is intended to measure. Punch (2004) explains that measurement validity pertains to the

extent an instrument accurately measures its intended variables based on score interpretation. Validity focuses on minimizing measurement error or bias. To ensure a solid foundation for analysis, the questionnaire is designed based on a thorough literature review. Additionally, questions are formulated in simple language to enhance clarity and ease of understanding. Moreover, a pilot study is conducted to test the validity and reliability of the research instruments.

3.9.3 Pre-Test

According to (Freund and Wilson, 1997), the research instrument is pre-tested on individuals who are related to the study but are not included in the final study sample. The pre-test involves administering the same questionnaire that will be used in the study. This helps the researcher identify any items that are unclear to respondents.

3.9.4 Data Analysis

Quantitative data analysis conducted using SPSS version 26 software. The data was analyzed and interpreted using appropriate tools including frequency distribution, percentages, mean, standard deviation, and multiple regressions. The analyzed data were compiled and organized in a manner conducive to interpreting the results in relation to the research questions.

3.10 Ethical Considerations

Ethical considerations are addressed from the start to the completion of the research. The researcher treats respondents with a high level of respect and notifies them that the data obtained will only be used for research purposes. Confidentiality issues are also respected, ensuring that respondent information remains private and secure.

CHAPTER FOUR

4. RESULTS, INTERPRETATION, AND DISCUSSION

4.1 Introduction

In this chapter, an attempt has been made to address the general objective of the study, which is to assess incorporating technology into supply chain management in the context of Huawei Technologies Ethiopia to enhance efficiency and effectiveness and streamline the process.

4.2. Questionnaire Return Rate

The 77 Questionnaires distributed by using Google sheet and 72 has been returned successfully. Therefore, the return rate was 93.5%.

77 questionnaires by using Google sheet were distributed to the Employees of Huawei Technologies Ethiopia. Out of those distributed questionnaires 72 (93.5%) were filled correctly and returned. Thus, the total return rate of the questionnaires was 93.5% out of the sample population.

4.3. Demographic of the Respondent

This part of the study provides demographic descriptions of the respondents, including gender, work position, work experience, educational level and working period. Understanding about the overview of the respondent's characteristics was important for further analysis of their responses. Hence, attempts were made to describe the background of the respondents, which directly or indirectly related to the objective of the study. Description of the Sample demography presented below.

The gender distribution of the respondents is presented in Table 4.1. Out of a total population of 72 individuals, 44 respondents, accounting for 61.1%, are male, while 28 respondents, representing 38.9%, are female. This indicates a higher proportion of male respondents compared to female respondents in the surveyed population. As it is indicated in the table the highest percent of the respondents 52 (72.2%) of the respondent are under graduate (Bachelors). on the other hand, 20 (27.8 %) were Masters Holders,

The respondents' distribution by work position reveals a diverse representation within the organization. Out of a total of 72 individuals, 10 respondents (13.9%) are Supply Chain

Managers or Officers, while 8 respondents (11.1%) hold the position of Warehouse Manager or Officer. The largest group comprises 21 respondents (29.2%) who are Logistics Managers or Officers. Additionally, 5 respondents (6.9%) are Finance Managers, and 3 respondents (4.2%) are Production Managers. Procurement Managers account for 7 respondents (9.7%). Furthermore, 18 respondents (25%) are in other unspecified positions. This variety in roles highlights a comprehensive representation across different functional areas within the organization.

Out of the total respondents, 69.4% (50 individuals) reported having less than 5 years of work experience. Additionally, 20.6% (15 individuals) have between 5-10 years of work experience, while 9.7% (7 individuals) have More than 10 years of work experience.

The respondents' distribution based on their tenure with the company demonstrates a significant range of experience levels. Out of the total participants, 47 respondents (65.3%) have been with the company for less than 5 years, indicating a substantial proportion of relatively newer employees. A further 22 respondents (30.6%) have been employed for a period between 5 to 10 years, showing a solid group of mid-term employees. Only 3 respondents (4.1%) have been with the company for more than 10 years, representing a small group of long-term employees. This distribution highlights a predominantly newer workforce with a moderate segment of more experienced staff.

Table 4.1 Summary of Demographic Respondents

Category	Item No	Cluster	Frequency	Percent
Gender	1	Male	44	61.1
	2	Female	28	38.9
		Total	**72**	**100.0**
Education level of the respondents	3	Bachelor Degree	52	72.2
	4	Masters	20	27.8
		Total	**72**	**100.0**
	5	Supply Chain Manager/ Officer	10	13.9
	6	Warehouse	8	11.1

		Manager/Officer		
Work position	7	Logistics Manager/Officer	21	29.2
	8	Finance Manager	5	6.9
	9	Production Manager	3	4.2
	10	Procurement Manager	7	9.7
	11	Other	18	25
		Total	**72**	**100**
Work Experience	12	Less than 5 years	50	69.4
	13	5-10 years	15	20.6
	14	More than 10 years	7	9.7
		Total	**72**	**100**
Stay in company	15	Less than 5 years	47	65.3
	16	5-10 years	22	30.6
	17	More than 10 years	3	4.1
		Total	**72**	**100.0**

Source: own SPSS survey result (2023)

4.4 Findings

4.4.1 Descriptive Statistics for Supply Chain Practices

Data collection, summarization, and simplification are all topics covered by descriptive statistics. A 5-point Likert scale was employed to collect data from respondents, with 5 highly agreeing, 4 agreeing, 3 neutral, 2 disagreeing, and 1 strongly disagreeing. Because of the nature of the study and the dimensions involved, a total of 41 questions were in the questionnaire. Items and responses were computed accordingly using Statistical Package SPSS version 26. In general, the study used descriptive statistics and multiple regression to answer the questions presented in the specific objectives. The following assumptions are used to display the means statistical values of the variables according to the 5-point Likert scale (Salingay & Tan 2018): If the mean (M) score is less than 3, the respondents are presumed to disagree with the statement, neutral if the mean (M) score is equal to 3, and agree with the statement if the mean (M) score is greater than 3. For

a 5-point Likert scale the interval is 0.8 which means the intervals to analyze the means found from the Likert scales will be shown in the table below.

Likert scale	**Scale**	**Interpretation**
Strongly Disagree	1.00 - 1.80	Very low
Disagree	1.81 - 2.60	Low
Neutral	2.61 – 3.40	Average/Moderate
Agree	3.41 – 4.20	High
Strongly Agree	4.21 – 5.00	Very High

Table 4. 2 Likert Scale Points: Source (Best, 2005)

In table 4.3, it is sought to see what Supply Chain Practice of the company looks like. In order to do that, the respondents were requested to respond to the statements on a 5 point Likert scale and indicate the extent they agree with the statements that is: 5-Strongly agree, 4-Agree, 3-Nutral, 2-Disagree, 1-Strongly disagree.

Descriptive Statistics	Mean	Std. Deviation
A. IT adoption on Planning practices		
Huawei utilizes ISC and IBP systems when planning	4.00	0.993
Huawei utilizes advanced demand forecasting and planning tools which used to optimize inventory levels	3.83	0.964
Huawei utilizes advanced demand forecasting and planning tools, which used to align production schedules.	3.74	0.904
GRAND MEAN	3.86	
B. IT adoption on Sourcing practices		
Huawei ensures that sourcing practices align with customer demand and preferences	4.11	0.640
Huawei uses technology supporting sourcing strategy.	4.14	0.737
Huawei's supply sourcing processes are identified and addressed proactively.	3.81	0.882

GRAND MEAN	4.02	
C. IT adoption on Making practices		
Huawei utilizes production scheduling tools to optimize resource utilization and minimize lead times.	4.06	0.918
Huawei utilizes production schedules that are flexible to accommodate changes in demand or supply constraints.	3.83	0.964
Huawei utilizes WMS software to manage warehouse operations in-order to improve order fulfillment rates.	3.74	0.904
GRAND MEAN	3.88	
D. IT adoption on Delivery practices		
TMS is in practice to manage its delivery in supply chain system	4.11	0.640
WMS is in place at Huawei to manage its delivery	4.14	0.737
ECRM is in practice in Huawei to manage its deliver system of the supply chain management	3.64	1.052
GRAND MEAN	3.96	
E. IT adoption on Return practices		
Huawei provides convenient return practice	3.50	1.061
Huawei uses technologically supported return process	3.67	1.048
Huawei's return process is efficient and time saving	3.54	0.963
GRAND MEAN	3.57	

Table 4.3 Descriptive Statistics of Supply Chain Practices

According to the provided descriptive statistics, respondents have varying perceptions of Huawei's supply chain practices across different categories. Planning practices were generally viewed positively, slightly above the midpoint with a grand mean of 3.86. The moderate standard deviation of 0.86 indicates some variability in how these practices are perceived, ranging from somewhat favorable to moderately favorable.

In contrast, sourcing practices received the highest rating with a grand mean of 4.02 and a low standard deviation of 0.53, indicating strong consensus and very positive perception among

respondents. This suggests that Huawei's sourcing strategies effectively meet customer demands and integrate well with technology.

Making practices were also positively perceived overall with a grand mean of 3.88, although slightly lower than sourcing practices. The standard deviation of 0.68 suggests moderate variability in perceptions, indicating potential areas for improvement in communication or execution.

Delivery practices received positive feedback as well, with a grand mean of 3.96 and a standard deviation of 0.63, similar to sourcing practices. This indicates effective management of delivery processes, despite some variability in perception among respondents.

On the other hand, return practices received a mixed perception with a grand mean of 3.57, slightly above the midpoint. The standard deviation of 0.60 reflects variability in how these practices are viewed, suggesting room for improvement in efficiency and satisfaction.

In summary, Huawei's strengths are particularly evident in sourcing and delivery practices, which are perceived very positively and consistently among respondents. While planning and making practices also received positive feedback, there is more variability in perception, and improvements could enhance overall effectiveness and stakeholder satisfaction. Using these insights can assist Huawei in improving its supply chain strategies to uphold its strengths and effectively address any weaknesses.

Table 4.4. Summary of Mean Scores of Supply Chain Practices

Supply Chain Practice	Grand-Mean Value	Rank
IT adoption on Planning	3.86	4th
IT adoption on Sourcing	4.02	1st
IT adoption on Making	3.88	3rd
IT adoption on Delivery	3.96	2nd
IT adoption on Return	3.57	5th
Overall Mean	3.86	

Source: own SPSS survey result (2023)

4.4.2 Supply Chain Performance measurement

Regarding the Cost efficiency, Delivery speed and customer satisfaction the respondents gives answer as following.

Cost Efficiency		
Huawei adopts cost effective planning strategy	3.82	0.909
Huawei adopts cost effective sourcing strategy	4.11	0.640
Huawei adopts cost effective delivery approach	3.60	0.959
Huawei adopts cost effective manufacturing process	3.65	0.995
Huawei adopts cost effective return practice for returnable, guarantee and warrantee items	4.13	0.855
Grand Mean	3.86	
Delivery Speed		
Huawei has responsive planning	4.13	0.855
Huawei has responsive sourcing strategy	4.04	0.813
Huawei has responsive delivery practice	4.03	0.949
Huawei's manufacturing process is highly responsive.	3.69	0.959
Huawei promises quick processing times for returned items.	3.90	0.754
Grand Mean	3.96	
Customer Satisfaction		
Customers are satisfied with the variety of items being sourced.	3.64	0.969
Customers are satisfied with the availability of products/services	4.01	0.911

based on their demand expectations.		
Customers are satisfied with the overall quality and performance of our products.	3.75	0.818
Customers are satisfied by the overall experience with our organization and its delivery processes.	3.94	0.820
Customers are satisfied with the speed and efficiency of our return processes.	4.07	0.811
Grand Mean	3.88	
Valid N (list wise)	72	

Table 4.5 Descriptive Statistics of Supply Chain Performance measurement

Table 4.6 Summary of Mean Scores of Supply Chain Performance measurement

Supply Chain Performance	Grand-Mean Value	Rank
Cost Efficiency	3.86	3rd
Delivery Speed	3.96	1st
Customer Satisfaction	3.88	2nd
Overall Mean	3.9	

Huawei's supply chain performance receives positive evaluations across various dimensions, as indicated by the grand means for cost efficiency, delivery speed, and customer satisfaction. With a grand mean of 3.86 for cost efficiency, Huawei's strategies are generally perceived favorably, slightly above the midpoint of the scale. The sourcing strategy stands out with a high mean of 4.11, reflecting effective cost management strategies, while the manufacturing process, rated lowest at 3.65, suggests areas for improvement despite overall positive feedback.

In terms of delivery speed, Huawei demonstrates strong performance with a grand mean of 3.96. The high ratings for responsive planning (mean = 4.13) and efficient returns processing (mean =

3.90) underscore effective responsiveness across the supply chain, despite variability in perceptions, particularly regarding manufacturing process responsiveness (mean = 3.69).

Customer satisfaction also reflects positively with a grand mean of 3.88. Customers express high satisfaction with product availability aligned with demand expectations (mean = 4.01) and the efficiency of return processes (mean = 4.07). However, satisfaction with product variety (mean = 3.64) shows room for improvement compared to other aspects.

Overall, Huawei's supply chain performance exhibit strengths in cost efficiency, delivery speed, and customer satisfaction, as indicated by the grand means. Addressing areas of variability can further enhance Huawei's performance and competitiveness, ensuring continued satisfaction and efficiency in meeting customer needs.

Table 4.7 Descriptive Statistics of Challenges of Supply Chain Practices

Descriptive Statistics	Mean	Std. Deviation
Leagal_and_Regulatory_Challenge1	3.61	0.943
Leagal_and_Regulatory_Challenge2	3.56	0.837
Leagal_and_Regulatory_Challenge3	3.69	0.816
Leagal_and_Regulatory_Challenge4	3.64	1.052
GRAND MEAN	**3.625**	**0.912**
Logistical_Challenge1	3.50	1.061
Logistical_Challenge2	3.21	1.006
Logistical_Challenge3	3.49	1.035
GRAND MEAN	**3.4**	**1.034**
Foreign_Currency1	4.32	0.709
Foreign_Currency2	3.64	0.997
Foreign_Currency3	3.43	1.032
Foreign_Currency4	3.92	0.946
GRAND MEAN	**3.83**	**0.921**
Valid N (list wise)	72	

The descriptive statistics offer insights into the respondents' perceptions of four legal and regulatory aspects. Each aspect has a sample size of 72, with mean scores ranging from 3.61 to 3.69. This narrow range suggests a moderate level of agreement or satisfaction across these

dimensions. The standard deviations, which fall between 0.943 and 1.052, indicate moderate variability in responses, with the highest variability observed in the "Legal_and_regulatory_4" aspect. This variability suggests differing perceptions among respondents for this particular item. The Grand Mean, calculated as 3.625 with a standard deviation of 0.912, provides an overall summary measure that underscores a generally neutral to slightly positive view of the legal and regulatory measures being assessed. The consistency in the mean scores across the variables highlights similar perceptions among respondents, though the increased spread in responses for "Legal_and_regulatory_4" suggests a need for further exploration. Overall, these results reflect a moderately positive and consistent view of the legal and regulatory aspects, with some variation warranting additional attention.

The descriptive statistics for logistical challenges provide a clear picture of the respondents' perceptions across three different aspects. With a sample size of 72 for each item, the mean scores range from 3.21 to 3.50, indicating a generally neutral stance towards logistical challenges, with a slight lean towards agreement or acknowledging the challenges. The first and third aspects of logistical challenges have similar mean scores of 3.50 and 3.49, respectively, suggesting that respondents perceive these two dimensions similarly. The second aspect has a slightly lower mean score of 3.21, indicating a relatively less significant perception of challenge in this area. The standard deviations, which range from 1.006 to 1.061, indicate a moderate level of variability in the responses. This suggests that while there is some consensus among respondents, individual perceptions vary to a certain extent. The Grand Mean of 3.4 with a standard deviation of 1.034 serves as an overall summary measure, reflecting a generally neutral view of logistical challenges, with responses neither highly positive nor highly negative.

Overall, these results suggest that respondents recognize logistical challenges to a moderate degree, with some variability in their perceptions. The consistency in the mean scores, despite the slight dip in the second aspect, highlights a generally uniform perception of logistical challenges among the respondents. This indicates areas where logistical issues are perceived as challenges and may benefit from targeted interventions to improve logistical processes or address specific concerns raised by the respondents.

The descriptive statistics for foreign currency challenges provide insight into respondents' perceptions of this issue across four different aspects. The mean scores range from 3.43 to 4.32,

indicating that respondents generally acknowledge significant challenges related to foreign currency.

The Foreign Currency Challenge aspect has the highest mean score (3.83), suggesting that respondents strongly agree or perceive this as a significant challenge. The relatively low standard deviation (0.709) indicates a high level of agreement among respondents. The mean score of 3.64 indicates a more neutral to moderately agreeing perception of this challenge. The higher standard deviation (1.032) shows more variability in respondents' views. This aspect has the lowest mean score (3.43), suggesting that respondents are more neutral or slightly agreeing about this challenge. The standard deviation (1.032) is the highest among the four, indicating the greatest variability in responses for this aspect. The mean score of 3.92 shows that respondents moderately agree about this being a challenge. The standard deviation (0.946) indicates a moderate level of variability in responses. The overall mean score of 3.83 suggests that respondents generally perceive foreign currency challenges as significant. The standard deviation of 0.921 reflects a moderate level of agreement across all aspects. The overall mean score of 3.83 suggests that respondents generally perceive foreign currency challenges as significant. The standard deviation of 0.921 reflects a moderate level of agreement across all aspects.

The results indicate that foreign currency challenges are perceived as significant issues by the respondents, with the highest concern indicated by the first aspect (Mean: 4.32). While there is some variability in perceptions, particularly for the second and third aspects, the overall trend points towards recognizing foreign currency challenges as a considerable concern. The variability in responses suggests that different respondents might have diverse experiences or perspectives on the severity of these challenges. This highlights the importance of addressing specific foreign currency issues to mitigate their impact on respondents effectively.

Table 4.8. Summary of mean scores of Challenges of Supply Chain Practices

Supply Chain Challenge	Grand-Mean Value	Rank
Legal and Regulatory challenge	3.625	2nd
Logistical Challenge	3.4	3rd
Access to foreign Currency challenge	3.83	1st
Overall Mean	3.9	

4.4.3 Inferential Statistics

4.4.3.1 Regression Analysis

Multiple linear regression analysis was employed to assess how well the explanatory variables account for the variation in the dependent variable. This statistical method allows for the exploration of the relationship between a dependent or criterion variable and a set of independent or predictor variables. Unlike correlation, whose main focus is to measure the strength and direction of a relationship, the primary objective of regression is prediction (Marczyk, 2017).

Multiple regression is a frequently used statistical tool designed to determine the best predictive relationship between a set of dependent and independent variables. Its goal is to assess the impact of specific variables, identify structural connections, and explain multiple relationships (Robert, 2017). Consequently, this study employed the multiple linear regression method to ascertain the distinct contributions of each independent variable factor to the dependent variable.

4.4.4 Assumption Tests

Different assumption tests were conducted before the regression analysis and the results are listed.

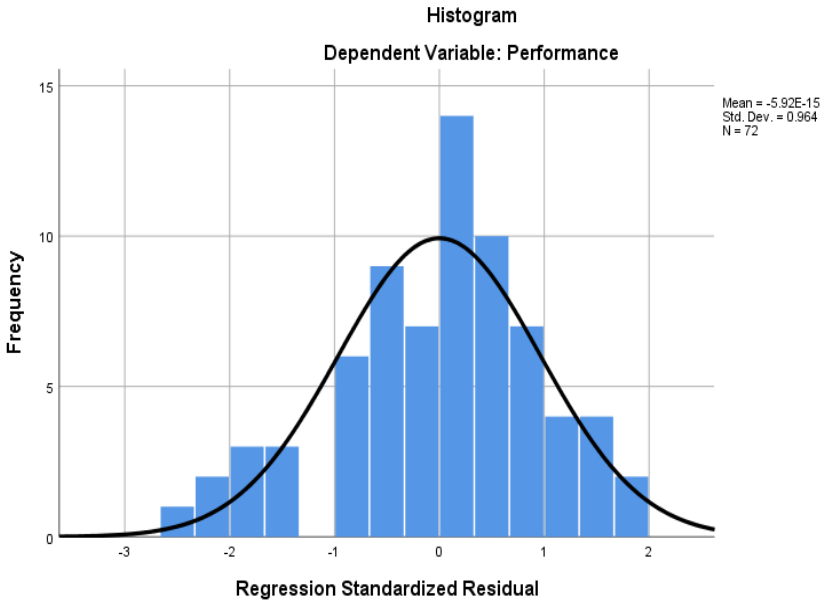

Figure 4.1 Histogram for objective 3

Normally Distributed Test:

The residuals are considered random variables with a normal distribution. This implies that there are very few instances of significant deviations greater than zero, and the differences between the model and the actual data are typically zero or very close to zero (Creswell, 2018). To verify the normal distribution of the residuals, examine the histogram and the normal probability plot. Based on the histogram in Figure 4.2 and the normal probability plot in Figure 4.3, the distribution pattern generally appears to be normal.

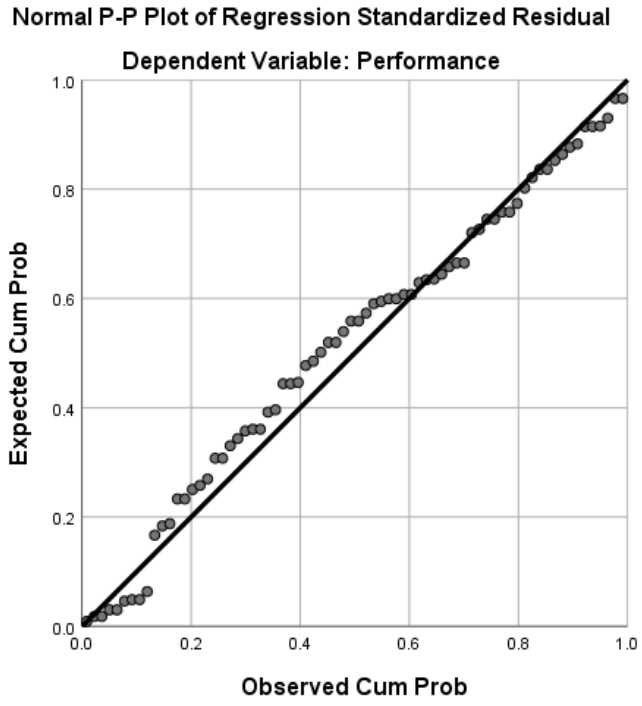

Fig 4.2 P-P Plots for objective 3

The normal probability plot in Figure 4.3 illustrates the deviation from normalcy. In this plot, the closer the dots are to the diagonal line, the more uniformly distributed the residuals are. The P-P plots demonstrate that the points are almost on the diagonal line or follow its slope closely, indicating that the residuals meet the normality assumption.

Homoscedasticity refers to the assumption that the variance of residuals (or the degree of errors in the model) is consistent across all points in the model. In other words, the distribution of

residuals should remain largely uniform across all predicted values. To verify this assumption, we examine the final graph, which compares the standardized residuals with the standardized predicted values from our model. Ideally, as the predicted values increase (along the x-axis), the variation in the residuals should remain consistent, appearing as a random scatter of dots. If the graph exhibits a funnel shape, this assumption is violated. However, our plot of standardized residuals versus standardized predicted values, shown in Figure 4.4, does not display any signs of funneling; with values, ranging from -2 to 2.This indicates that the homoscedasticity assumption has been satisfied.

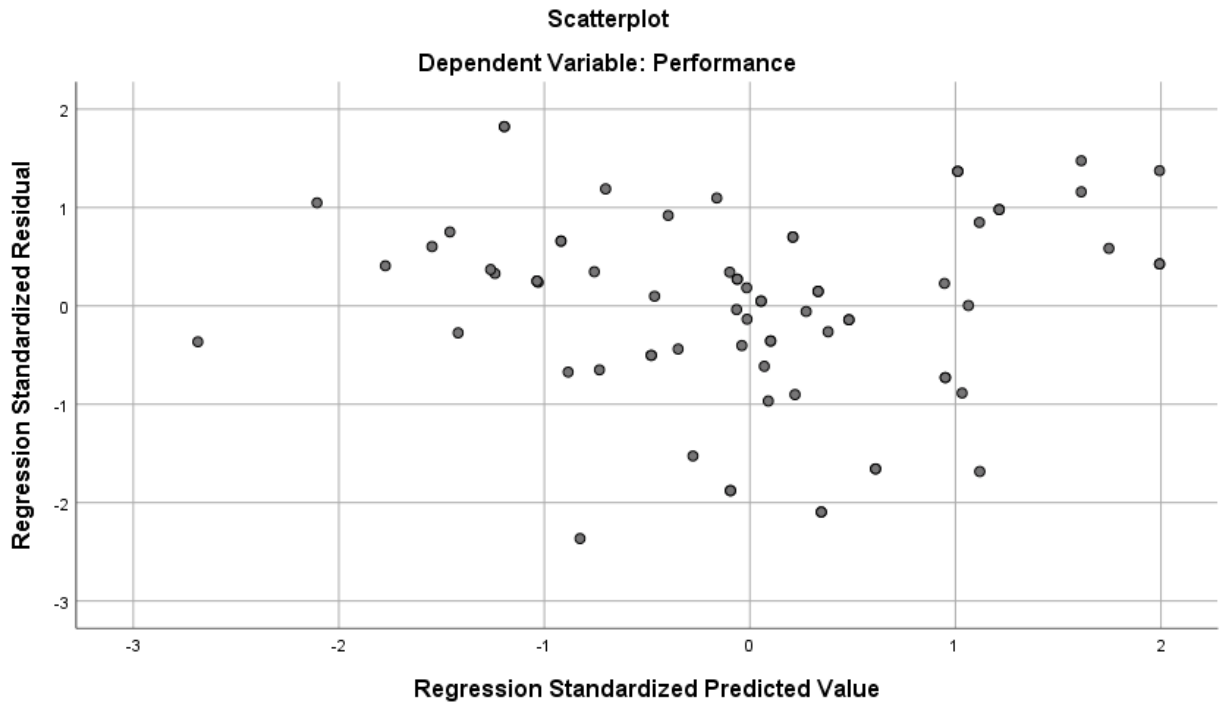

Fig 4.3 Scatterplot for Objective 3

The table below shows the model summary and it indicates how much the variance in IT adoption of Supply Chain Management (Planning, Sourcing, making, Delivery and return) is explained by supply chain performance (Cost Efficiency, Delivery Speed and Customer Satisfaction) in the model.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.894[a]	.800	.784	.21082	1.675

a. Practice: (Constant), RETURN, DELIVERY, PLANNING, SOURCING, MAKING

b. Dependent Variable: Performance

Table 4.9 Model Summary of regression
Source: own SPSS result

The Model Summary table presents key statistics from the regression analysis assessing the impact of various supply chain practices (RETURN, DELIVERY, PLANNING, SOURCING, and MAKING) on performance. The correlation coefficient (R) is 0.894, signifying a strong positive relationship between these supply chain practices and performance. The R Square value of 0.800 indicates that 80% of the variance in performance is explained by these practices. The Adjusted R Square, which accounts for the number of predictors, is 0.784, further confirming the model's robustness. The standard error of the estimate is 0.21082, indicating the average distance of the observed values from the regression line. The Durbin-Watson statistic is 1.675, suggesting no significant autocorrelation in the residuals. Overall, these statistics demonstrate that the model is strong and reliable for predicting performance based on the specified supply chain practices.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.707	5	2.341	52.681	.000[b]
	Residual	2.933	66	.044		
	Total	14.640	71			

a. Dependent Variable: Performance

b. Practices: (Constant), RETURN, DELIVERY, PLANNING, SOURCING, MAKING

Table 4.10 ANOVA Table

The ANOVA table summarizes the regression analysis examining the relationship between various supply chain practices (RETURN, DELIVERY, PLANNING, SOURCING, and MAKING) and performance. The model explains a significant portion of the variance in performance, with a Regression Sum of Squares of 11.707, indicating the variation explained by

the model, and a Residual Sum of Squares of 2.933, indicating the unexplained variation. The Total Sum of Squares is 14.640. With 5 degrees of freedom for regression and 66 for residual, the Mean Square values are 2.341 for regression and 0.044 for residual. The high F-statistic of 52.681 and a significance level of .000 ($p < 0.001$) demonstrate that the model is statistically significant. Therefore, the combined effects of these supply chain practices significantly predict performance, indicating that they have a meaningful impact on the organization's performance.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.869	.206		4.221	.000
	IT adoption on PLANNING	.248	.074	.419	3.336	.001
	IT adoption on SOURCING	.062	.066	.088	.938	.352
	IT adoption on MAKING	-.127	.077	-.230	-1.663	.101
	IT adoption on DELIVERY	.464	.043	.625	10.727	.000
	IT adoption on RETURN	.122	.036	.255	3.374	.001

a. Dependent Variable: Performance

Table 4.11 Coefficients table

The Coefficients table provides detailed insights into the relationship between specific supply chain practices and Performance. The constant term ($B = 0.869$, $p < 0.001$) represents the baseline level of Performance when all practices are at zero. Among the practices, PLANNING ($B = 0.248$, $p = 0.001$) and RETURN ($B = 0.122$, $p = 0.001$) have significant positive impacts on Performance, indicating that improvements in these areas are strongly associated with better performance. DELIVERY has the most substantial positive effect ($B = 0.464$, $p < 0.001$), suggesting it is a crucial driver of performance. In contrast, SOURCING ($B = 0.062$, $p = 0.352$) and MAKING ($B = -0.127$, $p = 0.101$) do not significantly impact Performance, with MAKING even showing a negative, though not statistically significant, relationship. The standardized coefficients (Beta) further highlight DELIVERY as the most influential factor (Beta = 0.625), followed by PLANNING (Beta = 0.419) and RETURN (Beta = 0.255). Overall, the analysis

indicates that while all practices contribute to performance, improving delivery, planning, and return processes yields the most significant positive outcomes.

Finally, the model will be,

Y=0.869+0.248x1+0.062x2-0.127x3+0.464x4+0.122x5

Whereas, x1= IT adoption on Planning

X2= IT adoption on Sourcing

X3= IT adoption on Making

X3= IT adoption on Delivery

X3= IT adoption on Return

4.5. Discussion

The first objective of this study was to assess supply chain management practices at Huawei Technologies Ethiopia, particularly through the integration of Information Technology (IT), focusing on Planning, Sourcing, Making, Delivery, and Return. The findings show that Huawei's supply chain practices have the following grand mean values: Sourcing (4.02), Delivery (3.96), Making (3.88), Planning (3.86), and Return (3.57). Sourcing is identified as the most critical and challenging practice, followed by Delivery, Making, and Planning, with Return ranking last but still important.

Research consistently indicates that effective IT adoption significantly enhances these supply chain practices. IT systems facilitate efficient sourcing through real-time supplier collaboration, automated procurement, and accurate demand forecasting with advanced analytics (Chopra & Meindl, 2020; Gunasekaran et al., 2017). Enhanced delivery performance is achieved through IT-enabled logistics optimization, route planning, and real-time tracking, improving delivery speed and reliability (Simchi-Levi et al., 2019). In manufacturing, IT supports Making practices by optimizing production schedules, ensuring quality control with IoT sensors, and efficiently managing inventory levels (Jacobs, 2019; Stevenson & Hojati, 2007). Planning benefits from IT tools for demand planning, supply chain visibility, and inventory optimization, enhancing responsiveness and resource allocation (Chopra & Meindl, 2020; Simchi-Levi et al., 2019). IT

also streamlines Return processes by managing reverse logistics, customer returns, and inventory disposition effectively (Chopra & Meindl, 2020; Simchi-Levi et al., 2019).

Empirical studies highlight the positive impacts of IT adoption on supply chain practices. Organizations using advanced IT systems exhibit greater supply chain agility, responsiveness, and cost-effectiveness (Gunasekaran et al., 2017; Jacobs, 2019). IT enhances decision-making through data analytics, predictive modeling, and scenario planning, improving performance metrics such as service levels, cycle times, and inventory turnover (Stevenson & Hojati, 2007; Simchi-Levi et al., 2019). Moreover, IT fosters collaboration across supply chain partners, enhancing coordination, information sharing, and joint problem-solving capabilities (Chopra & Meindl, 2020; Gunasekaran et al., 2017).

In conclusion, effectively integrating IT into supply chain practices is essential for improving operational efficiency, responsiveness, and overall performance. Organizations should prioritize IT investments that align with these practices, leveraging technological advancements fully. Continuous adaptation and integration of emerging IT solutions, guided by empirical insights, will optimize supply chain practices, allowing organizations to thrive in competitive and dynamic business environments while efficiently meeting customer demands (Stevenson & Hojati, 2007; Simchi-Levi et al., 2019).

The second goal of this study was to identify the major challenges in supply chain management practices at Huawei Technologies Ethiopia. Based on the grand mean values, the primary challenges identified are Access to Foreign Currency (3.83), Legal and Regulatory Compliance (3.625), and Logistical Optimization (3.4). Managing access to foreign currency is the most critical challenge, followed closely by legal and regulatory issues, with logistical challenges ranking third. Effective management of currency fluctuations requires robust hedging strategies and financial risk management practices (Apte & Sonsino, 2017; Chopra & Meindl, 2020). Addressing legal and regulatory complexities necessitates automated compliance systems and proactive regulatory intelligence to ensure operational efficiency and mitigate legal risks (Jacobs, 2019; Monczka et al., 2019). Meanwhile, optimizing logistics involves leveraging advanced technologies such as real-time tracking and predictive analytics to enhance efficiency and reduce costs in supply chain operations (Simchi-Levi et al., 2019; Chopra & Meindl, 2020). However,

there is a research gap in understanding the interplay between these challenges and their combined impact on overall supply chain resilience and performance. Future studies could explore integrated frameworks that simultaneously address currency management, regulatory compliance, and logistical optimization to provide comprehensive strategies for sustainable supply chain management in dynamic global environments.

The third objective of this study was to determine the role of Information Technology (IT) in enhancing the supply chain performance of Huawei Technologies Ethiopia in terms of cost-effectiveness, delivery speed, and customer satisfaction. The model summary (R = 0.894, R Square = 0.800, Adjusted R Square = 0.784, standard error = 0.21082, Durbin-Watson = 1.675) demonstrates a strong relationship between SCM practices and performance metrics, underscoring the significant impact of IT adoption on SCM performance. Research by Gunasekaran et al. (2017) and Chen et al. (2019) highlights how IT improves operational efficiency through automation and resource optimization. Advanced analytics and decision support systems, as noted by (Choi & Krause, 2006) and (Zhao et al., 2019), enhance decision-making in inventory management and supplier selection, improving service levels. IT also enhances supply chain visibility and coordination (Christopher & Peck, 2004; Lee & Kao, 2019), supports risk management through predictive analytics (Chopra & Sodhi, 2004; Tang & Musa, 2011), and improves customer satisfaction and competitiveness by optimizing customer relationship management (Riggins & Mukhopadhyay, 1994; Jüttner et al., 2003). Overall, integrating IT into SCM practices fosters operational efficiency, risk mitigation, and customer-centricity, which are crucial for sustaining a competitive advantage in dynamic business environments.

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CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Based on the findings related to supply chain management challenges legal and regulatory challenges present a moderate level of difficulty with slight variability among dimensions. Logistical challenges show lower overall difficulty but significant variability in perceptions. Foreign currency challenges indicate a moderate to high level of difficulty with moderate variability. Addressing these challenges requires tailored strategies for mitigation, optimization, and risk management in supply chain management. By implementing targeted approaches that account for these nuances, organizations can enhance their resilience and performance in navigating legal complexities, optimizing logistical operations, and managing financial risks effectively across their supply chains

The findings of this study indicated that the statistics from the regression model (R = 0.894, R Square = 0.800, Adjusted R Square = 0.784, standard error = 0.21082, Durbin-Watson = 1.675) affirm the strong relationship between SCM practices and performance metrics. When integrated with IT adoption, these SCM practices become more efficient, responsive, and adaptable to market dynamics. Organizations should prioritize IT investments that align with SCM objectives to capitalize on these positive relationships. Continuous monitoring, evaluation, and adaptation of IT strategies are essential to sustain competitiveness and achieve sustainable growth in today's dynamic business environment.

In summary, leveraging IT in SCM enhances operational capabilities, improves decision-making processes, mitigates risks, and ultimately contributes to enhanced organizational performance and customer satisfaction. The synergy between SCM practices and IT adoption forms a robust foundation for organizations aiming to achieve efficiency, agility, and resilience in their supply chain operations.

5.2 RECOMMENDATIONS

The researcher suggests that Huawei Ethiopia concentrate on the following areas to enhance their operations and optimise performance, based on the study's findings. Even if the company performed well in the majority of the supply chain procedures, there are still certain areas that need to be improved in order to raise the organization's overall performance.

Huawei Ethiopia performs admirably in terms of supply chain procedures. By increasing the impression of return practices and pointing out areas where efficiency and satisfaction could be increased.

To enhance overall performance, it is recommended that the supply chain and logistics departments prioritize the adoption of IT, given its favorable and significant impact on logistics performance in supply chain practices. This strategic focus will help streamline operations, improve efficiency, and foster competitiveness in the marketplace.

To further enhance Huawei Ethiopia's supply chain performance and competitiveness, it is recommended to address areas of variability, particularly in improving efficiency and consistency across all supply chain functions. By focusing on these improvements, Huawei can ensure sustained customer satisfaction, operational efficiency, and agility in meeting evolving customer demands.

Further studies and implications can be explored to deepen understanding and optimize the impact of IT adoption on supply chain performance within supply chain practices. Conducting additional research could uncover new insights into technological advancements and strategies that further enhance operational efficiency and competitiveness in the industry.

5.3 SUGGESTIONS FOR FUTURE RESEARCH

The study focused on how Huawei Technologies Ethiopia's supply chain management performance was impacted by information technology. It examines the degree of IT adoption in supply chain operations, the effectiveness of supply chain management, and the obstacles that impact supply chain operations. The researcher suggests that different performance measurements for supply chain management indicators that are not covered here be used in future studies in order to offer thorough insights for maximizing supply chain effectiveness and strategic decision-making.

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Dear Respondents,

My name is Samrawit G/selassie and I am currently conducting my Master of Arts in Logistics and Supply Chain Management at Addis Ababa University, School of Commerce. I am working on my research titled “The Effect of Information Technology on Supply Chain Management Performance of Huawei Technologies Ethiopia.” As a requirement in partial fulfillment for the degree of Master of Arts in Logistics and Supply Chain program. This questionnaire is prepared only for academic purposes and because you have the necessary knowledge and expertise in the area of study. The study follows confidentiality and your answers to the following questions will only be used for this research only. I kindly ask you to take a few minutes out of your time and fill the questionnaire on current situations.

Thanks in advance for your kind cooperation.

Sincerely,

Samrawit Gebreselassie,

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samrigebre9@gmail.com

Section One: Demography of respondents

General direction after carefully reading each question, indicate your response by ticking (√) the box that is appropriate for you.

1. Gender

□ Male □ Female

2. Highest Level of education Attained

□ Certificate □ Diploma □ Bachelor's Degree □ Master's degree □ PhD

3. Current position in the company

□Logistics Manager / Officer □Supply chain Manager/Officer

□Warehouse Manager/ Officer □ Inventory Manger/ Officer □ Production Manger

□ Finance Manager □ Procurement Manager/Officer □ Other

4. How long did you serve in your current position?

□ Less than 5 year's □ 5-10 years □ More than 10 years

5. How long did you work in this organization?

□ Less than 5 year's □ 5-10 years □ More than 10 years

Section Two: Objective 1 - How supply chain management practices with the help of integrated Information Technology at Huawei Technologies Ethiopia. Hence, based on your opinion of the statement, please rank your best response for the following questions using a five-point Likert scale where.**1= "strongly disagree"2 = "Disagree" 3 = "Neutral" 4 = "Agree" 5 = "strongly agree"**

No	IT adoption on Supply chain management practices	Likert Scale				
A.	**IT adoption on Planning practices**	**1**	**2**	**3**	**4**	**5**
1	Huawei utilizes ISC and IBP systems when panning					
2	Huawei utilizes advanced demand forecasting and planning tools which used to optimize inventory levels					
3	Huawei utilizes advanced demand forecasting and planning tools which used to align production schedules.					
B.	**IT adoption on Sourcing practices**					
4	Huawei ensures that sourcing practices align with customer demand and preferences					
5	Huawei uses technology supporting sourcing strategy.					
6	Huawei's supply sourcing processes are identified and addressed proactively.					
C.	**IT adoption on Making practices**					
7	Huawei utilizes production scheduling tools to optimize resource utilization and minimize lead times.					
8	Huawei utilizes production schedules that are flexible to accommodate changes in demand or supply constraints.					
9	Huawei utilizes WMS software to manage warehouse operations in-order to improve order fulfillment rates.					
E.	**IT adoption on Delivery practices**					
10	TMS is in practice to manage its delivery in supply chain system					
11	WMS is in place at Huawei to manage its delivery					
12	ECRM is in practice in Huawei to manage its					

	deliver system of the supply chain management					
F.	**IT adoption on Return practices**					
13	Huawei provides convenient return practice					
14	Huawei uses technologically supported return process					
15	Huawei's return process is efficient and time saving					

	Supply chain management performance					
No	**Cost Efficiency**	**1**	**2**	**3**	**4**	**5**
16	Huawei adopts cost effective planning strategy					
17	Huawei adopts cost effective sourcing strategy					
18	Huawei adopts cost effective delivery approach					
19	Huawei adopts cost effective manufacturing process					
20	Huawei adopts cost effective return practice for returnable, guarantee and warrantee items					

No	**Delivery Speed**	**1**	**2**	**3**	**4**	**5**
21	Huawei has responsive planning					
22	Huawei has responsive sourcing strategy					
23	Huawei has responsive delivery practice					
24	Huawei's manufacturing process is highly responsive.					
25	Huawei promises quick processing times for returned items.					

No	**Customer Satisfaction**	**1**	**2**	**3**	**4**	**5**
26	Customers are satisfied with the variety of items being					

	sourced.					
27	Customers are satisfied with the availability of products/services based on their demand expectations.					
28	Customers are satisfied with the overall quality and performance of our products.					
29	Customers are satisfied by the overall experience with our organization and its delivery processes.					
30	Customers are satisfied with the speed and efficiency of our return processes.					

Objective 2: What are the major challenges of supply chain management practices at Huawei Technologies Ethiopia?

No	**Legal and Regulatory Challenge**	1	2	3	4	5
31	Regulatory requirements in Ethiopia, related to trade regulations affects effective supply chain management practice					
32	Regulatory requirements in Ethiopia, related to customs procedures negatively affects the smooth supply chain management practice					
33	Regulatory requirements in Ethiopia, related to taxation policies negatively affects the smooth supply chain management practice.					
34	Supply side risks such as political instability, security concerns negatively affects the smooth supply chain management practice					

No	**Logistical Challenges**	**1**	**2**	**3**	**4**	**5**
35	Inadequate transportation infrastructure affects supply chain practice					

36	Unreliable power supply affects supply chain practice					
37	Limited access to technological infrastructure affects the supply chain practice					
No	**Access to foreign Currency Challenge**	**1**	**2**	**3**	**4**	**5**
38	Lack of access to foreign currency affects the smooth supply chain practice of Huawei					
39	Fluctuation of exchange rate affects the smooth supply chain practice of Huawei					
40	High Inflation affects the smooth supply chain practice of Huawei					
41	Unstable economic condition affects the smooth supply chain practice of Huawei					

Annex I -Time Schedule

Actions	Sep/2023	Oct-Feb	Mar	Apr	April -May	May	June
Choosing of title							
Submission of the proposal							
Acceptance of the proposal							
Start the actual research work							
Collecting data by Giving out questionnaire and interviews							
Analyzing the data collected							
Writing							
Presentation							

Annex II-Budget breakdown

Budget Breakdown			
Item	**Amount needed**	**Unit price**	**Total price**
A4 paper	2 Packs	250	500
Writing Pad	2 pieces	200	400
Pen	10 pieces	20	200
Paper fluid	1	50	50
Stapler	1	300	300
Staples	5 Packs	20	100
Internet	Unlimited	6000	6000
Transport Service	2000	–	2000
SSD	1	3000	3000
		Total price	12,550