EFFECT OF SUPPLY CHAIN ENHANCEMENT PRACTICES ON OPERATIONAL EFFICIENCY OF BUNKERING FIRMS OF EAST AFRICA SEAPORTS ALONG INDIAN OCEAN

BY

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A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION, FACULTY OF BUSINESS AND MANAGEMENT SCIENCES, UNIVERSITY OF NAIROBI

2022

DECLARATION

I hereby pronounce that this research project report is absolutely, my genuine and true work and it has never been submitted in any University including The University of Nairobi for the award of a degree.

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D61/11593/2018

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DEDICATION

To my family; kindly accept my candid appreciation, especially my parents Mr. & Mrs. Mwakavi for continuous push for academic excellence all through since lower levels. My dear lovely wife, Deborah Mwakavi for unwavering love and support, tireless effort and being available at the time of need in pursuance of MBA award. My son whom together spent lengthy time in study room as he pursues his own goals not forgetting my two lovely daughters who have remained pillars in my study achievements. I dedicate the achievement to you all.

ACKNOWLEDGEMENT

The might God is the enabler of everything and indeed I gratefully thank him whole heartedly for graciously guiding me to this far in academics more so in every single stage of my MBA Study. My secret academic mentor, Doctor Stephen Odock my supervisor, kindly accept my deepest gratitude for tireless guidance, being available even in odd hours, many times of indispensable assistance, positive criticism which in my view, sharpened and elevated me towards completion of the project. God almighty will reward you. I would also like to use this opportunity to thank all the University of Nairobi dons who helped me complete my MBA studies in any way. The University of Nairobi librarian, thank you.

Additionally, I offer my heartfelt gratitude to the entire management of Kenya Ports Authority, Bandari College for all time access to your Library, Kenya Maritime Authority, Kenya Shipping Agents Association for their support and uncontrolled access to their magazines and publications throughout the study.

I must acknowledge the challenges experienced in the course of the study but appreciate the knowledge realized in the entire period.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

AEL	Alfoss Energy Limited
APL	Alba Petroleum Limited
DEA	Data Envelopment Analysis
CEF	Customer Effort Score
DRC	Democratic Republic of Congo
EDI	Electronic Data Interchange
EFA	Exploratory Factor Analysis
GDP	Gross Domestic Product
IBIA	International Bunker Industry Association
ICS	Institute of Chartered Shipbrokers
IT	Information Technology
JIT	Just in Time
LNG	Liquefied Natural Gas
NPS	Net Promoter Service
RBV	Knowledge –Based View
PLC	Public Limited Company
RV	Retention View
RFID	Radio Frequency Identification

SABT	South Africa Banker Terminals
SC	Supply Chain
SCE	Supply Chain Efficiency
SCM	Supply Chain Management
SCI	Supply Chain Indicators
SCP	Supply Chain Performance
SCO	Supply Chain Orientation
SMCS	Supply Chain Management Systems
SPSS:	Statistical Product for Social Sciences
TOC	Theory of Constraint
UNICTAD	United Nations Conference on Trade and Development
VIF	Variance Inflation Factor

ABSTRACT

This research aimed to demonstrate that bunkering companies in East African Indian Ocean ports benefited from supply chain efficiency measures. The study's foundations were the Theory of Constraints (TOC) and the theory of interested parties. The study used a descriptive cross-sectional survey with a sample size of 168 bunkering businesses. It was determined by use of a questionnaire. Participants were managers in the workplace. There was use of both descriptive and inferential statistics. SPSS was used to analyze the data collected in this way. Using regression analysis, the researcher was able to determine the connection between the variables. The research managed a 70.2% response rate which was excellent and deemed fit for the study. Reliability and validity tests found out that the constructs were reliable and the data collection instrument was valid. The data was submitted to a variety of diagnostic tests prior to the analysis with the purpose of enabling subsequent analyses. Test for normality were carried out using Skewness and Kurtosis, while Durbin-Watson Statistic was employed to assist in evaluating Autocorrelation and Test for Variance Inflation Factors were used to evaluate multicollinearity (VIFs). The data was found to be normally distributed. There was also no autocorrelation for the study variables. Furthermore, the study variables were not multicollinear. Strategic information exchange, information technology, effective inventory management, and a competent supply chain were all found to have major effects on operational efficiency. Specifically, the correlation was positive, with more supply chain enhancement techniques (such strategic information exchange, supply chain competency, IT, and inventory management) leading to higher operational efficiency. 89.5% of the variation in operational efficiency may be attributed to supply chain management strategies. As much as the model tried, it just couldn't account for 10.5% of the entire variance in operational efficiency. Policymakers in the marine industry, and the bunkering industry in particular, are urged to take the study's conclusions into consideration. The characteristics analyzed in this research account for 89.5% of the operational efficiency. A total of 10.5% of the variation in productivity in operations could not be explained by the factors. This study suggests conducting additional research to determine the other elements.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Even high yielding supply chains degenerate over time in the twenty-first century, whether as a result of new postponements or the development of better replenished strategies in the digital markets, as businesses add more supplies, products, distribution centers, or even their own customer and product mix. Due to the current unstable state of the economy and markets, this forces firms to implement methods to create a flexible and agile supply chain (Hove & Pooe, 2018). If a supply chain can outperform in the business market and maintain superior performance over time, it is considered competent (Derwick & Hellstrom, 2017). The operational effectiveness of a firm in changing the inputs into the outputs is an essential constituent of its precise resources that helps it create and secure value by reducing expenses and increasing income (Peteraf, 1993; Barney, 2002). Due to growing rivalry, changes in company practices, and the modern technology revolution, the concept of operational efficiency has become a source of worry (Bhagavath, 2009). Operational effectiveness improves working capital minimization, which boosts a company's financial performance (Owolabi & Obida, 2012).

The stakeholders' theory and the theory of constraints (TOC) served as the study's foundations. TOC follow scientific development process, assuming that each comprehensive approach entails a number of related activities, each of which acts as a barrier to the effectiveness of the entire approach (Gupta & Boyd, 2008). The stakeholder's theory recognizes the synergistic link among the stakeholders and describes the stakeholders of every corporation as a crucial component in achieving organizational performance as started by Fassin (2008). By combining TOC and stakeholder theory, it may be possible to emphasize the factors that encourage the adoption of efficient practices.

Like other bunkering corporations along Indian Ocean countries, the bunkering businesses have been around since colonial times in the East African seaports of Mombasa and Dar es Salaam. Due to unpredictable price swings that are excessive and hinder smaller bunker operators, bunker suppliers in both circumstances fail to maintain a significant supply (International Bunker Industry Association, 2016). Bunkering activities have been hindered by a number of problems,

including the cost of fuel, expensive marine port fees, the quality of the fuel, the wait time for bunker supplies, the strictness of customs, and the lack of sufficient clear and accurate information about the services (Acosta, Coronado & Del Mar, 2011). Currently, the precarious position need a workable strategy that would increase profits. By streamlining the operations that can boost shipping optimization, improve collaboration, reduce overhead costs, and improve quality controls, keeping up with demand and facilitating higher efficiency rate, supply chain enhancement practices can overcome the significant challenges connected with bunkering. Additionally, supply chain improvement techniques can help with visibility in tracking information flow and other advantages including efficient cost control, implementing the best supply chain, and utilizing cutting-edge supply chain technologies (Gomez, 2019).

1.1.1 Supply Chain Enhancement Practices

Supply chain enhancement (SCE) methods include a broad range of actions taken to enhance the current supply chain management (SCM) procedures while also lowering costs. It entails adopting a strategy of making small, persistent efforts to address present supply chain issues impeding the intended objectives (Zhu, & Lai, 2019). SCE practices are a collection of actions taken by a company to promote efficiency in the management of its supply chains (Mayaka, 2015). SCE procedures can also be seen as methods that simultaneously reduce expenses and increase the effectiveness of supply chains. Businesses functioning in the present day should recognize that the supply chain is still a crucial component of competitiveness since it is increasingly recognized that at all levels, the true competition is not happening between individuals or enterprises, but rather between supply chains (Botes, Niemann & Kotze, 2017).

In order to manage both internal and external operations, businesses functioning in today's commercial markets are implementing supply chain integration. To do this, they develop strategic partnerships with their SC partners (Huo, 2012; Van der et al., 2008). Because of this, increased supply chain performance has played a significant role in increasing total business efficiency (Alexiev, Volberda & Van den Bosch, 2016). Companies across a variety of industries worldwide have been forced to utilize and apply various sorts of SCE practices in their efforts to improve the performance of their SC. With a view of enhancing SC performance, businesses have expanded into a variety of industries throughout the globe by utilizing and implementing a

variety of enhanced supply chain management (SCM) methods (Li, 2014). According to Vermeulen, Nieman, and Kotze (2016), the effectiveness of supply chains, in which the participating enterprises work as partners, is crucial to organizational success.

According to Ibrahim, Ahmad, and Asif (2015), information technology, trade management, uncertainties and customer satisfaction are some of the variables that affect SCM. SCE procedures can be applied both intra- and inter-firm. Delivery procedures, just-in-time (JIT) production, SC planning and inventory management are among the intra-firm SCE practices implemented by businesses. Inter-firm SCE practices include SC e-collaboration, SC competency, and strategic information exchange (Sibanda & Pooe, 2018). The following supply chain improvement practices will be taken into account in the study: strategic information exchange, supply chain expertise, improved information technology, and inventory management. The researcher chose these practices as SCE indicators in order to highlight the advantages associated with them, including facilitating the smooth flow of real-time information, implementing a competent supply chain that is adaptable to any economic or environmental uncertainties, utilizing modern, cutting-edge technologies, and keeping the appropriate inventories in response to demand changes.

1.1.2 Operational Efficiency

Operational efficiency is the relationship created between a firm's output and input, in that when healthful, enable firms cut down on discretionary costs while maximizing revenue. It can also be explained as what firms endeavor to work on in an effort to produce products of high quality with few resources possible (Bhagavath, 2009). The main goal driving producers here is specifically to avert waste (Kumbhakar & Lovell, 2003). Operational efficiency is an essential element in profitability (Sadiq, Mushtaq & Hussain, 2015). It indicates in general the extent to which the processes of the firm are efficient. An organization can be efficient at handling customer grievances, service delivery, and marketing as well as in the production process (Somjai & Jermsittiparsert, 2019). Additionally, inefficiencies transpire at various levels in any organization such as in production lines, customer service, and finance departments or in shipping and receiving (Lin & Orvis, 2016). Operational efficiency come about when suitable as well as right people, technology and processes are integrated to provide its customers products as

well as services, by coordinating the fundamental procedures with the current shifts in the economic forces (Apruebo, 2010).

Several factors as deduced by Osazefua (2019) have been employed as measures of operational efficiency; accounts receivables, inventory turnover, operating expenses, asset turnover and employee growth. Operational efficiency points up the level of competence as well as effectiveness in relation to management and utilization of asset (Dhillon, 2013). This is reflected in the firm's net profit margin. Operational efficiency can be measured by output maximization, cost minimization and maximization of profit. A firm is considered efficient if it has the ability to attain maximum outputs from minimum allocated inputs employed in producing outputs. The main objective derived by producers, is evasion of waste (Kumbhakar & Lovell, 2003). According to Mpogolo (2013), customer satisfaction, productivity and efficiency are regarded as measures of operational efficiency.

Efficiency as opined by Drucker (1963) is performing things precisely. In many studies it has been emphasized as a factor that influences both profit as well as sustainability concurrently (Eskandari, 2007). Operational efficiency is also termed as a key element for cost leadership strategy (Osazefua, 2019). Efficiency focuses on internal perceptive by adopting standards such as cutting expense and productivity optimization or performing better at whatever they do (Barua, 1995). Delivering high-quality goods and/or services in accordance with consumers' needs ensures their satisfaction. Revenue is enhanced as a result of lower operating costs and reduced losses. It also results in less waste. The methods of allocating tasks or operations to the appropriate machinery and personnel resources are a part of efficient operation scheduling. This study measured operational efficiency using customer satisfaction, efficient operations scheduling and curbing losses (Li & Lo, 2014; Yeung, Cheng, & Chan, 2004; Akkerman & van Donk, 2008)

1.1.3 Supply Chain Enhancement Practices and Operational Efficiency

Improvement in SC has been linked to general improvement of business efficiencies (Volberda & Van den Bosch, 2016). Better SC value can be achieved and dispersed among the intended SC entities if the highest value can be delivered at the lowest cost. End-users and consumers are the perfect source of value for supply chains since they are predisposed to pay for the value they

experience (Feller, Shunk, and Callarman, 2006). A key merit associated with SCE practices is that its systems approach coordinates activities together with upstream and downstream activities (Simchi & Kaminsky, 2000). Suppliers with excellent operational efficiency provide more returns from a particular group of inputs than their own competitors hence minimizing operational costs while earning higher profit margin (Walker, 2018). Operational efficiency entails the proficiency of a business to avoid the unacceptable and optimize resources capabilities in order to supply products and services of quality to all buyers (Kalluru & Bhat, 2009).

Suppliers with high operational efficiency have the capability to utilize the finger grained information as well as peculiar knowledge they acquire from main customers during transaction process (Kim & Swink, 2021). Supply chain has the lowest attainable cost as well as meets customers' standards on operations including; accurate delivery and shorter lead-time especially for short shelf-life products (Nakandala & Lau, 2019). Efficient supply chain strategies should consider the interconnections at various supply chain levels so as to cut costs and improve service quality. In order to reduce expense and enhance service quality, SCE procedures must also take into consideration the connections at the various SC nodes (Simchilevy, 2000). SCE places a significant emphasis on competing supply chains whereby all participants of the supply chain prosper to optimize value delivered to its customers (Handfield, 2006). Improvement in operational efficiency directly impacts firms' profit margins as well as enhancing cost-effectiveness.

1.1.4 Bunkering Firms Along Indian Ocean Ports

Bunkering is simply dispensing fuel via horse pipe from the bunker vessel, bunker barge or shore pipeline at berth to foreign going or foreign registered vessel doing international cargo transportation. The East Africa territory consists of states of Kenya, Tanzania, Uganda, Rwanda and Burundi (Molland, 2019). Other adjacent seaports within EA includes seaports n Djibouti, Somalia, Malawi, Madagascar, Mozambique, Seychelles and Mauritius. The seaports of Mombasa and Dar-Es-Salaam are vital as well as a lifeline to all development in relation to economies in the EA territory. The seaports benefit Kenya and Tanzania, and other neighboring landlocked developing nations of Uganda, Burundi, Democratic Republic of Congo (DRC), Rwanda, Zambia, South Sudan and Malawi. The Mombasa Port in Kenya stands the topmost

ports in EA though with its challenges; it retains its eminence and surpasses among EA ports year after year. The Dar Es Salaam Port has been the biggest port in Tanzania and is a real competitor to the Mombasa Port (Daoui, 2017). The port being the main port not only benefits Kenya but also plays an essential being the leading principal gateway for the Eastern Africa hinterland nations of Uganda, Burundi, Ethiopia, Southern Sudan, Zambia, Rwanda and Democratic Republic of Congo (Nyamwange, 2001).

Other EA ports with visibility in the area are the Port of Djibouti and the Port of Somalia. As they facilitate and guarantee marine access on the East-West commercial route lateral to the Horn of Africa, northern sections of Africa, and parts of Europe, the bunkering enterprises in these ports play a crucial role in bunkering activities. The ports' companies are strategically located at the intersection of one of the busiest maritime arteries in the world, guarding the Horn of Africa, the Arabian Peninsula, and Europe. The Port of Djibouti's enterprises, according to South Africa Bunker Terminals (SABT, 2015), quoted by Mdlalose, enabling essential and secure trade with Ethiopia but have long been plagued by piracy in the Horn of Africa and in East Africa (2019).

In late 1980's and early 1990's and over the years bunkering operations dwindled as the time went by. Firms in both Mombasa as well as Dar-Es-Salaam and just like other firms in the region have struggled to meet the overhead costs due to declining bunkering opportunities. Ever since bunkering firms have continuously exited bunkering industry as a result of similar economic turbulences previously mentioned (KPA, 2009). In consideration of the effort, the researcher finds it strange for reduction of bunkering firms and therefore seeks to establish the gap contributing to fall of bunkering activities at the East African sea ports.

Despite all the attributes associated with the seaports, the celebrated sea ports are currently plagued with challenging bottlenecks such as services poor pricing, lack of proper training and education of agents, delays in clearing and forwarding processes, chronic vessel congestion, hefty taxes and lack of automation. These rank the seaport performance inefficient and significantly below global standards. Ports in poorly developed or rather developing economies however are frequently constrained by inadequate hinterland logistics connectivity (Limao & Venables, 2001). Bunker operation is efficient and effective if it does not contribute to vessel

delays as well as deviation from its route (Institute of Chartered Shipbrokers (ICS), 2010). The bunker activities as a whole need to be cost-effective and not have an impact on the vessel's operating costs. The right number and grade of bunkers should be delivered as promised.

Decreased demand for oceanic freight arising from meagre worldwide trade associated with diminished carriage rates coupled with high prices of fuel compel both ship owners as well as operators to device every possible approaches to keep their businesses afloat. Delayed bunker calls contribute to a significant loss of efficiency to vessels operators (Lam et al., 2011). Adding to the list, a ship's schedule might be severely disrupted by delayed bunker operations, which has an adverse effect on other supply chain elements (Institute of Chartered Shipbrokers, ICS, 2010).

Adopting SCE practices serves as the most viable option that can offer the ultimate solution to bolster the development and improvement of bunkering operations in diversified dimensions. SCE practices will offer new impetus in adapting and withstanding the economic turbulences as well as harnessing the potential benefits of bunkering firms. The study will explore the need to adopt the right competencies in relation to all operators across the supply chain. The study will reveal the necessity of using information technology to oversee data exchanges in order to accommodate smooth information flow as well as to facilitate real-time data. It will also reveal the necessity of having the appropriate inventory management system or procedures that help in satisfying customer needs while minimizing costs.

1.2 Research Problem

Firms can hardly survive alone; it is critical operating closely together with their business partners as well as leveraging their partner’s potentialities to ensure cost minimization, increasing quality (Fisher, 1997; Handfield & Nichols, 2002) as well as establishing a viable SC competitive advantage (Taylor, 2003). Employing a comprehensive approach that facilitates overall maximization in supply chain enhancement, instead of functional maximization, need to be prioritized (Simchi & Kaminsky, (2003). Operational efficiency is significantly vital in establishing a sustainable cost leadership approach (Osazefua, 2019). Firms can barely attain a sustainable competitive edge by only depending on internal developments in the firm (Yu, Luo, Feng & Liu, 2018). Owing to unpredictability in the business economy as well as global competition escalating, companies need to devise techniques to initiate latest competencies in

supply chains in order to adapt, cope and sustain their competitiveness in volatile business economy (Moon & Huh, 2013). Corporate supply chain enhancement practices are primary mechanisms that stimulate innovations and improved performances (Hong & Jeong, 2006), as they enable firms to adjust to changes in the environment and expedite their growth. Thus, SCE practices can aid firms maneuver these challenges successfully.

Despite the fact that the bunker market in Africa continent is still developing and advancing on providing more quality services in a better controlled environment, its growth potential is still confronted by notable challenges (International Bunker Industry Association, IBIA, 2016). Comparing bunkering in the continent is a bit hard owing to varying environmental factors such as service level standards, regulatory standards and infrastructure (Mdlalose, 2019). Notwithstanding the essential roles associated with shipping firms, they encounter relentless challenges in obtaining better than meager profits (Hwang et al., 2008). Apparently, shipping participants have been recognized to have a weak connection because of its low reliability and slow speed **(**Saldanha, Tyworth, Swan, & Russell, 2009). Bunkering along Indian Ocean ports is not well established. Additionally lacking is a strong supply system, and the region only offers a small number of expensive goods. Some of the challenges cited by local suppliers are; taxes and bureaucracy which in turn contribute to hiked cost of operating businesses as well as offering services. Adding to the list, suppliers' firms face challenges in holding big quantities of stock owing to inconsistent price fluctuations, therefore prohibitive for small enterprises (IBIA, 2016). This translates to unpredictable bunker supplies. Waiting times as well as delays as a result of port congestion and constraints of infrastructure attract apprehension in the schedule reliability in shipment which escalates logistic costs to the customers (Notteboom, 2006).

Based on SCM perceptive, internationally a number of studies have been conducted. A South African model was used in Mdlalose's (2019) study on the factors that influence a competitive bunkering service. The researcher demonstrated that quality of service tops highest among the factors that necessitate the achievement of more improved bunker industry competitiveness. Lam and Voorde (2011) conducted research on scenario analysis for container shipping supply chain integration. The researcher established that firms need to come up with a sustainable strategy to realize win-win opportunities with their partners. The study further found out that in the market environment, supply chain entities need to join networks of collaboration to learn techniques of

managing sustainable relationship. According to Boutsikas' (2004) study on the bunkering industry's impact on shipping tanker operations, there should be consideration to the quality of oil carried, supply chain integration, and bunker price control for effective bunkering and shipping operations.

A study on the turnaround factors affecting cargo vessel efficiency at the Port of Mombasa was undertaken in Kenya by Mutua and Gichinga (2019). The researchers adopted descriptive design. They established that IT Infrastructure is essential for efficient cargo vessel performance. The research established that both ports present equal technical inefficiency and this calls for management collaboration so as to minimize supply chain and logistics management cost. Khayumbi (2015) undertook a study on contributions by Mombasa port to the improvement of international maritime trade. The researcher employed a case study and established that effective infrastructure improved importation and exportation of commodities. It was further found that a motivated port management team promotes reduced congestion at the port and major challenges crippling the port are inefficiency, cumbersome documentation, corruption and political interference.

From the aforementioned analysis, the need for enhancing or implementing effective supply chains on bunkering sector for its efficient operations cannot be gain as said. Therefore, the study aimed to fill the knowledge vacuum by answering the following question: to what extent do bunkering enterprises in East Africa's seaports apply supply chain enhancement practices? How do bunkering companies in East African ports benefit from supply chain development practices?

1.3 Research Objectives

This research was centered on the objectives below:

i. To determine the degree at which the bunkering firms have applied supply chain enhancement practices in facilitation of bunkering operations at the bunkering firms along Indian Ocean ports.
ii. To identify the factors that contribute to the success of bunkering companies in the ports along the Indian Ocean coast.

1.4 Significance of the Study

The results of the study will be extremely important to the management and staff of bunkering firms at sea ports in East Africa along Indian Ocean as they will gain an insight on the significance of enhancing supply chains for efficient bunkering operations. It will act as a pivotal key to competing in African bunkering specifically ports in Egypt all the way to South Africa with world bunker market on sight. This will encourage the management to appreciate the need to put in place the effective approaches that will ensure firms take part in global markets competitively. The study will also sensitize the management of ports and other associated stakeholders on the benefits of attaining the international standards and participating in international markets hence promptly tracing any change that promote improving efficiency and competitiveness of the port.

The perception of the effect of supply chain enhancement on efficient bunkering operations in fostering global trade in the nation will be significantly important to policy makers. The study will aid policy makers to device programs and policies that will diligently promote the development and sustainability of such firms due to the participatory role they carry. Additionally, it will allow them to advocate, assist, and promote the creation of suitable policies to direct the firms.

A monograph that is created as a result of this research may be used in other relevant areas of the economy. Most importantly, this research findings will add to the literature on international shipping and bunkering firms, particularly for emerging or impoverished nations like Kenya, Tanzania, and the rest of East Africa. The study is anticipated to be useful to academics who will find pertinent material that may pique their curiosity in learning more about the advantages of SC and bunkering activities. In the end, this research will identify the knowledge gaps that merit additional attention and leave space for future research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

To better understand the connection between supply chain improvement strategies and effective bunkering operations, this part analyzes the study's theoretical foundations, components, and empirical research. This section concludes by reviewing existing empirical research on the topic and noting any gaps in our understanding. Next, the research's conceptual framework is introduced.

2.2 Theoretical Foundation of the Study

The study is anchored on two theories; theory of constraints and stakeholder theory. These are discussed in the following subsections.

2.2.1 Theory of Constraints

The Theory of Constraint (TOC) recognizes constraints and impediments that obstruct accomplishment of firm's goal by comprehensively operating to transfigure the obstacle to a positive component hence devising solutions after evaluating systems (Goldratt, 1990). Eliyahu M. Goldratt is the founding author of theory of constraint in the year 1984. He highlighted the theory in his book titled "The Goal". The theory was meant to help organizations continually achieve their goals. TOC adopts scientific procedures which appreciate that any system which is multiplex and has series of activities interconnected whereby one stands to be a barrier to the whole structure. As a basis of accomplishing system goals, TOC devises an approach for recognizing the hindrances hence eliminating them. The theory takes it that logistics network is interlinked network of elements that function together so as to convert inputs to outputs with regard to the set system goals.

In order to better performance, quality and achieve efficient operations, SCE practices can be employed as pivotal initiative in counteracting bottlenecks associated with costs, flexibility and responsiveness, lead time and capacity expansion. The operational efficiency of firms eventuates whenever there is unerring integration of people, technology and processes collaborate and cooperate to boost the productivity and value addition of any business as well, while eliminating the costs of regular operations to level longed for. The end consequence is that resources that

were previously required to complete operational activities may be organized or directed into cutting-edge, high-value strategies that give the company access to more possibilities (Dhillon, 2013).

In this context, TOC is essential as it will necessitate analysis of each element that act as a limitation and paralyze operational efficiency. Therefore, employing and properly implementing SCE practices can effectively clear them up. SCE practices bring advantages to the organization by surpassing operation efficiency through reducing excessive costs, minimizing time wastage and employing up-to-date technologies.

2.2.2 Stakeholders Theory

Any member according to Freeman (2010), who influences or is influenced by the organization in any dimension is referred to as a stakeholder. Stakeholders theory avers that any stakeholder either as individual or group engage in firm's activity with the aim of benefiting (Donaldson & Preston, 1995). Stakeholders theory was founded by R Edward Freeman in 1884. In regard to improving business performance, both needs and wants of stakeholders should be fulfilled (Friedman & Miles, 2006). Operating any form of business involves integration of stakeholders who have a significant influence either internally or externally. In the routine interaction, stakeholders take part in impacting firm's performance remarkably therefore, acting as an essential component (Fassin, 2008).

Given the synergistic connectivity of all organizations in the value chain process, stakeholder theory is highly pertinent to this study in this setting. The idea will be essential for decision-making as well as for the establishment of stakeholder alliances and buy-make decisions. Stakeholders create salient points in the firm, which may greatly impact effective implementation of supply chain enhancement practices to achieve the set approaches and guidelines on costs minimization while meeting customers' satisfaction (Laplume, Sonpar, & Litz, 2008). It is very vital for bunkering firms to appreciate the mutual relationship between firm's management and every stakeholder owing to interrelationship of the main processes for effective implementation of any approach in regard to supply chain enhancement.

2.3 Indicators of Supply Chain Enhancement

It is very crucial how firms adapt to cope and survive within its business market as well as adopting SCE practices in regard to its business environment, with a view to improve supply chain performance in an effort to achieve a competitive advantage (Perera, Wickramarachchi, Abeysekara, & Aidanagamachchi, 2020). SCE practices comprises of cooperation and training in addition to support in the development of products, purchases, products as well as delivery systems with a company's suppliers (Da Silva, Neto, & Pires, 2012).

2.3.1 Strategic Information Sharing

The extent to which an institution explicitly shares important and sensitive information with all of its participants or members is known as information sharing (Shou, Yang, Zhang, & Su, 2013). E-collaboration among supply chain entities to a great extent promotes information sharing (Choi & Ko, 2012) as well as enhancing performance of individual firm and facilitating a continuous competitive advantage (Cao & Zhang, 2010; Chu & Lee, 2006). Many supply chain partners are reluctant to exchange strategic information (Prajogo & Olhager, 2012). This frequently occurs, particularly when disclosing supply chain associates poses a complete burden on the risk and cost of releasing strategic information. To a greater extent, this is also possible in the absence of prior defined mechanisms set to take care of the consequences of extra costs and additional risk as well as profit to the disclosing SC member (Chu & Lee, 2006).

Effective sharing of information as well as supply chain practices is an essential factor in attaining a splendid SCE in operations in that it facilitates amassing significant benefits including; reducing inventory, improving efficiency in inventory management, cutting cost, increasing visibility, eliminating bullwhip effect, facilitating improved resource utilization and spearheading general firm efficiency (Lotfi, Mukhtar, Sahran, & Zadeh, 2013; Zhou & Benton, 2007). The key foundation that facilitates close coordination as well as collaboration in supply chain enhancement is sharing of information across the supply chain entities (Lee, 2000). Therefore, it is reasonable to consider strategic information sharing to be a crucial part of SCE since it enables businesses to efficiently coordinate their operations with all of the supply chain's participants, improving performance and operational effectiveness.

Information sharing is essential for sharing knowledge and also enables maintaining tight buyer-supplier linkages which are critical factors for escalating supply chains enhancement (Rashed, Azeem, & Halim, 2010), thus increasing operational efficiency. Information creates fundamental relationships among supply chain entities which suitably synchronizes major operations across the supply chain hence boosting supply chain enhancement. For instance, by lowering inventory and streamlining processes, strategic information exchange can boost the supply chain even more. Timely sharing of information in SCE facilitate improvement in performance of every participant across the chain by minimizing variations as well as shifts in both inventory and customers' demands (Chopra & Meindi, 2010).

2.3.2 Supply Chain Competence

According to one definition, SC expertise is an untouchable asset that demonstrates a company's suitability to work in a particular industry (De Wit & Meyer, 2010). If a business simply contains the skills, knowledge, and attitude needed to excel in a certain field, then it is said to exhibit competence (Hove & Pooe, 2018). According to Leuschner, Rogers, and Charvet (2013), SC competence refers to significant company strengths that can maximize the synergistic coordination of intra- and inter-firm operations (Flynn, Huo, & Zhao, 2010).

The source of competitive advantages for the entire SC is allegedly collective learning. It results from all supply chain participants working across their companies' margins and demonstrating excellent communication, full involvement, and profound commitment (De Wit & Meyer, 2010). Similar to this, a SC as a strategy that develops learning organizations and reinvents itself as a result of the continuous knowledge of all its SC partners makes learning easier (Breite & Koskinen, 2014). The concept here is that SC profit from the key competencies of their respective supply chain enterprises, such as tacit knowledge (Hove & Pooe, 2018). Supply chain competencies are critical in improving supply chain operations hence enhancing the entire supply chain performance of all the participating firms (Chow et al., 2008).

In view of the ongoing competition trend, whereby competition is changing from organizational level to supply chain level, companies ought to focus on supply chain competence in lieu of resource-based view solely, so as to promote development of competitive SC. SC competence as a technique, is pivotal in shining competitiveness to aid in strategic market requirements while

improving sales and profit concurrently (Krishna, 2014), and when it achieves superiority over the competitions, firms attains a competitive edge. It maximizes competitiveness by efficiently connecting firm's internal sectors to SCE approaches (Park & Kim, 2007). The companies' market as well as financial growth thrives when such competitive edge is perpetuated by practicing continuous improvement of supply chain competence oriented with competitive elements and SCE practices. Effective marshalling of supply chain competence with the right competitive elements and customer–alignment is a significant strategic feature of developing efficient SCE capability that provides right competitiveness and an edge. Adopting a competent as well as competitive supply chain not only propels sales and profitability but it also facilitates sustainability in the industry, market and economic growth (Krishna, 2014).

2.3.3 Information Technology

Employing information and communication technologies in supply chains has brought immense impacts on the supply chain and operational efficiency (Lee, 2000) as well as maintaining interrelationships network (Saraf, Langdon, & Gosain, 2007). Some information Technologies (IT) mostly adopted to facilitate prompt exchange of information, make precise plans as well as carry out several SC operations and functions efficiently include; radio frequency identification (RFID), SCM systems, Internet or Web, and mobile technologies (Niu, 2010).

The SC interrelationships at strategic level require gathering and dispensing of competitive acumen and this calls for the decision support capabilities of IT (Akkermans, Bogerd, Yucensan, & Wassenhove, 2003). IT resources have the capability of indirectly contributing to improved performance and sustainable competitive advantage through multiplex chain of assets as well as potentialities (Wade & Hulland, 2004). IT potentialities impact organizational performance especially through entrepreneurial alertness, agility and digital options (Sambamurthy, Bharadwaj, & Grover, 2003).

Understanding how supply chain may leverage IT to set up the potentialities of managing knowledge resources is extremely important since SC interconnectivities are moving outside price-focused or arm's length partnerships and fetching experience and understanding, for relationships are key (Van de Ven, 2005). IT acts as a pillar of supply chain enhancement as it is involved in acquiring, processing as well as transmitting information among supply chain entities

for efficient and effective decision making **(**Sanders & Premus, 2002). Insufficient and shattered IT constrains firms in exploiting knowledge of data shared amongst the SC partners. The development of IT presents businesses with a number of chances to achieve cost-effective, seamless integration of their supply chain partners (Siau & Tian, 2004). All these benefits associated with effective application of IT in firm's operations serve as backbone in establishing SCE. In this context, for bunkering firms to exploit the trade prospects emanating from e-commerce, operators have to adjust and leverage the IT potentials for better efficiencies and devise integrated supply chain solutions which are entirely e-commerce friendly.

2.3.4 Inventory Management

An operational management program called inventory management enables for the control of the operation of various organizational parts (Lavely, 1996). Inventory management and control is critical to any firm as any mismanaging of firm's inventory jeopardizes capabilities of the firm to perform effectively and efficiently (Sprague & Wacker, 1996). More so it affects a company's financial preeminence and outsmarting, since inventory management technique adopted by a firm determines the equity capital, client service as well as output (Ng, Partington, & Sculli, 1993). Performance of inventory management is pivotal in determining the sustainability or collapsing of a firm. A good organized inventory management system equalizes results to optimum by boosting competitive capability as well as market share of firm(s) (Chalotra, 2013).

Firms can survive cut-throat competition and stand better positions in financial performance from well managed inventories (Isaksson & Seifert, 2013). In addition, it facilitates expansion of a company as well as success since the quality of product is closely linked to the volume of product sold and the overall generated profit (Anichebe & Agu., 2013). Inventory management is significantly pivotal in cutting cost and improving customer service performances (Jeffrey et al., 2008). Consequently, achieving minimum inventory cost allows the firm to save a considerable amount which can be fueled in optimizing profit and the overall performance. Combining SCE practices and IT can facilitate exchange of information among the partners in the chains become more efficient and minimize occurrences of bullwhip effects in case of inventory swings up the chains amongst the firms (Bendoly & Jacobs, 2005). In addition, it can expand the degree of cooperation between supliers and distributors, shortening lead times and products shortages

(Claassen, Van Weele, & Van Raaij, 2008), therefore serving a critical role in establishing effective SCE practices.

2.4 Empirical Review

Empirical literature evaluated reveals that appreciable studies have been undertaken on both supply chains performance and SCE practices. Using an outlook on information synthesis from Indian manufacturing firms, in their study Dhaigude, Kapoor, Gupta, and Padhi (2021) examined the relationship between SC integration and SC orientation and performance. The investigation's major goal was to assess the intricate relationships among SC performance, SC orientation, and SC integration in Indian manufacturing firms. These interrelationships were investigated by employing the relation view (RV) and the knowledge-based view (KBV) as theoretical concepts and undertaking a survey of sample size of 122 Indian manufacturers. The research discovered that SCO has a significant impact with SCI as well as SCP. The study was limited since it concentrated on Indian manufacturing firm focusing only on specifically; SC orientation and SC integration as the main variables impacting SC performance.

Park and park (2019), undertook a study on the evaluation of facilities in liquefied natural gas (LNG) fuel bunkering terminal**.** The study applied simulation modeling technique as a tool of research, with Arena software. The research adopted a case study of Busan Port in Korea and posited a method of approximating the proportions of LNG infrastructure needed with deliberation for operational condition of ports based on the approximated amount of bunkering demand at a later time. The study recommended that infrastructure with sufficient utility value is required for efficient bunkering operations. The study exhibit both contextual and conceptual gaps. Conceptually, it did not consider supply chain enhancement practices as vital procedures in establishing efficient bunkering operations. Contextually, it only focused on Korean ports.

Mdlalose (2019) carried out a study on factors of a competitive bunkering service. The study developed a theoretical model for a competitive bunker market and found a strong correlation between the bunker market and the measures that were identified, including service, port accessibility, infrastructure, bunker fuel quality, cost of service, and laws and regulations. The findings also adduced that it is considerably important to adopt a collective approach which will employ all the stated variables simultaneously and align them so as to attain the efficiency and

sustainable results for creation of a competitive bunker industry. However, the study was limited in that it concentrated on South African Ports and it did not consider the relation between SCE and operational efficiency.

Locally, Mutua and Gichinga (2019) undertook a study to investigate turnaround determinants impacting performance of cargo vessels at the port of Mombasa guided by the goal setting theory, technology diffusion theory and transaction cost theory. The findings assert that infrastructure is a key determinant for efficient operations of cargo and therefore lays a necessity for adequate infrastructure to eliminate congestion, promote trade development and securing deep sea container integration. The study exhibits conceptual gap since it does not point out which supply chain enhancement measures to employ so as to achieve efficiency.

Ngangaji (2019) used data envelopment analysis (DEA) to conduct a study on the assessment of container terminal effectiveness at East African ports, focusing on Mombasa and Dar es Salaam. The results adduced that both ports suffer similar inefficiencies which call for cooperation and collaboration between the two hence promoting synergies to enhance mutual benefits as it will higher container throughput as well as minimizing costs emanating from fierce competition. The research further recommended that the Mombasa Sea port should prioritize on optimal infrastructures well as substructure investment to counteract hyper-competition. The study though exhibits a crucial conceptual gap in that it does not connect efficiency with the supply chain enhancement measures to be initiated to maintain the terminal efficiency.

Khayumbi (2015) undertook a study to investigate contributions of Mombasa port to the improvement of international maritime trade. The study used a case study and content analysis to examine primary material collected using an interview guide. According to the research, infrastructure has increased consumer choices, facilitated better export and imports, and increased the availability of commodities. The study further expounds that effective motivated port management, minimizes traffic and congestion, facilitates international interrelationships, and promotes international trade by offering propitious port as well as port services. The research exhibits a significant gap since it seems to have overlooked critical approaches to be done to increase efficiency, particularly in the bunkering sector.

2.5 Summary of Literature Review and Knowledge Gaps

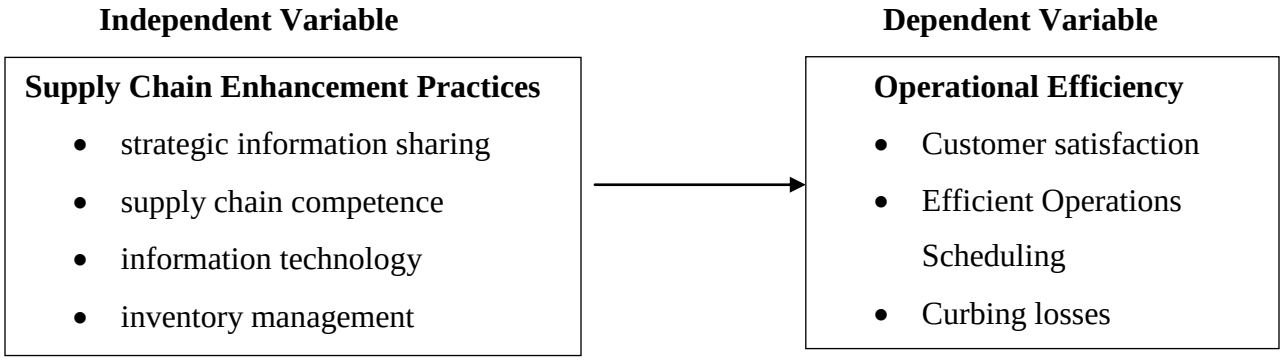
After reviewing the aforementioned empirical investigations, it is important to note that there aren't many conceptual and contextual gaps in them. Some of the studies employed contrasting study methodologies including methods of analyzing data, research designs and data collection instruments hence facilitating great deal of variability in research findings. It is also noted that most studies have been confined to other approaches and sectors rather than strategies that would facilitate efficient bunkering operations.

In addition, bunkering studies have been scarcely undertaken especially on East African seaports. Various studies done mostly focus either at Kenya Port Authority (KPA), Port of Dar es Salaam or holistically concentrate on management and operational performance, isolating the core bunkering section. This study therefore, seeks to pursue these gaps by emphasizing on the effect of supply chain enhancement practices on operational efficiency of bunkering of firms in East African seaports.

2.6 Conceptual Framework

The independent variable in this study is supply chain enhancement practices. There are various supply chain enhancement practices that impact operational efficiency although, some measures are more critical in impacting operational efficiency since when properly implemented has been attested to amass multiple benefits. The indicators of SCE are strategic information sharing, supply chain competence, information technology and inventory management. The dependent variable of this study is operational efficiency customer satisfaction, efficient operations scheduling and curbing losses. The operationalization of the variables is as demonstrated in Figure 2.1.

Figure 2. 1: Conceptual Framework



(Author, 2022)

2.7 Research Hypotheses

H_{01}: Strategic information sharing has no significant effect on the operational efficiency of bunkering firms along Indian Ocean Ports

H_{02}: Supply chain competencies has no significant effect on the operational efficiency of bunkering firms along Indian Ocean Ports

H_{03}: Information technology has no significant effect on the operational efficiency of bunkering firms along Indian Ocean Ports

H_{04}: Inventory management has no significant effect on the operational efficiency of bunkering firms along Indian Ocean Ports

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This section displays the wrap-up of the procedure which was adopted in this study. It reviews the design, study population, collection of data, study variables' operationalization and techniques employed to achieve study objectives evaluated.

3.2 Research Design

Descriptive cross-sectional survey was used in the study. Descriptive research entails gathering information to verify a relationship that has been predicted in order to encourage answers that disclose the current state of the circumstances under examination (Mugenda & Mugenda, 2003). While cross-sectional studies need data collection across multiple businesses at specific times, descriptive research encourages data gathering from the targeted population by observing, describing, documenting, evaluating, and reporting on the current situation (Copper & Schindler, 2006). This technique was significantly suitable as it thoroughly explores the relationships between variables and collected data from various targeted bunkering firms in East Africa seaports.

3.3 Population of Study

The target population incorporated all bunkering firms at East African seaports. According to Lloyd (2022) there are 168 bunkering firms. The study was a census of all the firms since the population was relatively small.

3.4 Data Collection

Primary data was employed in this study that was produced by using a three-section, semi-structured questionnaire. The first section sought statistics about the company; the second section collected data on SCE practices and the last one collected data on operational efficiency. The questionnaires were administered via Google forms to the operation managers of the firm. One respondent in each firm was targeted.

3.5 Operationalization of Study Variables

This process makes it easier to lessen the potential for abstract variables. The operationalization of the constructs is shown in Table 3.1.

Table 3. 1 Operationalization of Study Variables

Supply chain enhancement practices (Independent variable)			
Sub Variable	**Indicators**	**Measurement Scale**	**Source**
Strategic Information Sharing	-Participation of stakeholders at each vital critical stage -Existence up-to-date technology on information flow -Existence of integrated Platforms information connecting relevant stakeholders -Sharing of data information	Ordinal scale-5	Fawcett,Wallin, Allred and Magnan, (2009)
Supply Chain Competence	-Integrated capabilities and member resources -Competencies of different entities -Knowledge sharing routines -Practicing effective governance	Ordinal scale-5	Breite and Koskinen, (2014)

IT	-Existence of integrated capabilities and resources of the partners in the value chain. -Competencies of different entities at each stage in the value chain. -Existence of Sources of relational rents -Existence of knowledge-sharing routines -Availability complementary resource endowments. -Existence effective governance	Ordinal scale-5	Krishna, (2014)
Inventory management	-Increasing productivity by switching to a vendor-managed stock	Ordinal scale-5	Krishna, (2014)

	system. -Working together with vendors and consumers to ensure a constant supply of stock. -The implementation of numerical control pins (QR codes).		
Operational efficiency (Dependent variable)			
Customer Satisfaction	-Use of Customer Satisfaction Score -Use of Net Promoter Score (NPS) -Use of Customer Effort Score (CSE) -Use of social media metrics	Ordinal scale-5	Yeung, Cheng, and Chan (2004)
Efficient Operations Scheduling	-Keeping of job skills up-to date. -Accepting and learning from feedback. -Ability to come up with creative solutions to novel and difficult issues. -Customer oriented abilities.	Ordinal scale-5	Li and Lo (2014)

Curbing Losses	-Adopting Gross Domestic Product (GDP) per each hour worked. -Maximization of Capacity utilization -Educational and skills attainment	Ordinal scale-5	Akkerman and van Donk (2008)

3.6 Reliability and Validity

Both reliability as well as validity ascertains credibility of study findings. Reliability assessment facilitates consistency, repeatability and precision of the indicators verification (Kline, 1998). Validity help to elucidate the extent at which tools can precisely measure what is expected to measure (Forzano & Gravetter, 2009).

3.6.1 Reliability Test

To evaluate the reliability of each and every construct used in the investigation, the study used Cronbach's Alpha. Using SPSS version 21, the measurement scale for item-total correlation for each variable in each construct was validated. The minimum allowed item-total correlation should be 0.30. (Cristobal et al., 2007). Composite reliability was utilized to assess the internal consistency of each latent construct used in the model. If the composite reliability is greater than 0.6, it is believed that high dependability has been obtained. 1994 (Hatcher). The internal consistency of the model will be evaluated using SPSS.

3.6.2 Validity Test

In order to achieve content validity, measurement instruments were created in two stages: first, specificity, face validity, clarity, content, representativeness, and readability were discussed with knowledgeable academic specialists (Zacharia, Nix, & Lusch, 2009); second, a pretest was conducted on a group of at least five specialists with substantial knowledge and experience using SCE practices, and they were asked to complete a questionnaire.

3.7 Diagnostic Tests

The data was submitted to a variety of diagnostic tests prior to the analysis with the purpose of enabling subsequent analyses. Test for normality were carried out using Skewness and Kurtosis, while Durbin-Watson Statistic was employed to assist in evaluating Autocorrelation and Test for Multicollinearity was evaluated using Variance Inflation Factors (VIFs).

3.8 Data Analysis

The data gathered underwent cleaning, validating and editing to assure that it is accurate, uniform, consistent as well as complete. The research employed SPSS (Statistical Product for the Social Scientists) to provide descriptive and inferential statistics. Descriptive statistics was useful in offering significant details of the respondent. In evaluating the relationship between SCE and operational efficiency, regression analysis will be employed. To establish the relevance of all the variables adopted, the study applied t-test and p-values. To ensure suitability of regression analysis, f-test and p-values were used. Pearson's correlation coefficient was computed by evaluating p-values, Beta coefficient as well as R^2.

Table 3. 2: Analytical Model of Data

Objective	Hypotheses	Analytical Model	Explanation
To establish the effect of supply chain enhancement practices on efficiency of bunkering operations East Africa along Indian Ocean ports	H_1: Supply Chain enhancement practices have positive significant effect on operational efficiency.	Multiple Linear Regression Analysis: $\mathbf{Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mathcal{E}}$ **Where:** Y = Operational efficiency a = Constant β = Coefficient of Independent Variables X_1 = strategic information sharing X_2 = supply chain	A hypothesis is only accepted if $p<0.05$, demonstrating a significant improvement in operational effectiveness as a result of supply chain improvement activities that assert the relationship. When the F-ratio is significant (P 0.05),

		competence and accessibility X_3 = information technology X_4 = inventory management ε = Error term	the model's fitness is supported; nevertheless, the importance of the link between the variables is only apparent when the t-statistics is statistically significant.

Source: Researcher (2022)

CHAPTER FOUR
DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

This section presents the findings, analysis, and interpretations of the findings.

4.2 Response Rate

The study targeted 168 bunkering firms. 168 questionnaires were disbursed to managers in these firms. 118 managers responded to the questionnaire representing 70.2%, 50 managers in these firms did not respond which represents 29.8%. A response rate of 50% is considered sufficient, 60% is desirable, and 70% or higher is outstanding, as stated by Mugenda & Mugenda (2012). Therefore, the high rate of participation in the study was considered satisfactory.

Table 4. 1 Response Rate

Details	Frequency	Percentage
Response	118	70.2%
Non- Response	50	29.8%
Total	168	100%

4.3 Respondent Demographics

The researcher endeavored to get the demographics of the interviewees (period of service, work position in the firm, period worked in the present position and highest level of operation) and firm demographics (years of operation). The frequencies and percentages of the responses were calculated and tabulated in the subsequent subsections below.

4.3.1 Period of Service

The study sought to find the period of continuous service for the respondents (staff in the bunkering firms). Those who worked for less than five years continuously were 19 which represents in 16.1% of the total. Those who worked for 5-10 years continuously were 39 which represent 33.1%. The majority of the respondents worked for 10-15 years continuously at 50 representing 42.4%. Ten respondents worked for more than 15 years continuously representing

8.4% of the total. The study construes that the respondents had worked continuously for the bunkering firms to be capable of understanding the contents of the questionnaire.

Table 4. 2 Period of Continuous Service

Period of Service	Frequency	Percent
<5 years	19	16.1
5-10 years	39	33.1
10-15 years	50	42.4
>15 years	10	8.4
Total	118	100.0

4.3.2 Period Worked in the Present Position

There were 18 responders, or 15.3%, who had held the same job for less than five years. The respondents who worked for 5-10 years in the same position were 30 representing 25.4%. The majority worked for 10-15 years in the same position at 50 representing 42.4%. Those who worked for more than 15 years in the same position were 20 representing 16.9%. The study asserts that most respondents worked for long periods in the same position to understand supply chain enhancement practices

Table 4. 3 Period worked in the Present Position

Period worked in the present position	Frequency	Percent
Less than 5 years	18	15.3
5-10 years	30	25.4
10-15 years	50	42.4
More than 15 years	20	16.9
Total	118	100.0

4.3.4 Period of Operation

The study sought to find the period the bunkering firms had been in operation in the industry. Nine respondents said their firms had operated for less than 5 years representing 7.6%. Yet 30 respondents said that their firms had operated for 5-10 years representing 25.4%. 49 respondents said that their firms had operated for 10-15 years which represents 41.6%. Thirty respondents said that their firms had operated for more than 15 years representing 25.4%. The firms had operated long enough to have utilized supply chain enhancement practices.

Table 4. 4 Period of Operation

Period of Operation	Frequency	Percent
Less than 5 years	9	7.6
5-10 years	30	25.4
10-15 years	49	41.6
More than 15 years	30	25.4
Total	118	100.0

4.3.5 Highest Level of Education

The respondents who had a secondary school education were 20 representing 16.9% of the total. Those with a college qualification were 29 representing 24.6%. The majority, 49 had an undergraduate qualification which represents 41.6%. Those with a Master's degree were 20 representing 16.9%. According to the study, the respondents had a sufficient education to comprehend the questionnaire's contents and provide accurate answers.

Table 4. 5 Highest Level of Education

Highest Level of Education	Frequency	Percent
Secondary School	20	16.9

College	29	24.6
Undergraduate	49	41.6
Masters	20	16.9
Total	118	100.0

4.4 Reliability and Validity Tests

This section covers the instrument's reliability and validity tests.

4.4.1 Reliability Test

The dependability of the proposed structures was calculated using Cronbach's Alpha. A connection of 0.890 was found between the frequency with which strategic information was shared and the effectiveness of operations supply chain expertise of 0.958, information technology of 0.917, inventory management of 0.897, and supply chain competence of 0.958. All constructions showed that the Cronbach's Alpha value was higher than 0.700, indicating the reliability of the study's constructs. This information is shown in Table 4.6.

Table 4. 6 Reliability Test

Construct	Cronbach's Alpha	Comments
Strategic Information Sharing	.895	Reliable
Supply Chain Competence	.958	Reliable
Information Technology	.917	Reliable
Inventory Management	.896	Reliable
Operational Efficiency	.890	Reliable

4.4.2 Validity Test

To ensure that all of the constructs used in the investigation were valid, factor analysis was used in the study. Kaiser-Meyer-Olkin and Bartlett's test of sphericity measurements are the two most

commonly used indicators of sampling adequacy. For Kaiser-Meyer-Olkin, a factor's acceptable value to be deemed significant should range from 0 to 1, and an index higher than 0.5 is considered to be excellent. The relevance of the study is presented by the Bartlett's Test of Sphericity, which takes into account the applicability and validity of every component included in the investigation. Bartlett's Test of Sphericity results should be less than 0.05 to be considered satisfactory. According to the findings of the Kaiser-Meyer-Olkin test for sample adequacy shown in table 4.7 below, the realized value was 0.851, which is greater than 0.5 but less than 1, making it a respectable index. Additionally, the significance of the Bartlett's test of sphericity, with a p-value of 0.000 (below 0.05), was demonstrated. The researcher deduces that the validity of the chosen instrument is supported by these findings.

Table 4. 7 Validity Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.851
Bartlett's Test of Sphericity	Approx. Chi-Square	653.500
	Df	10
	Sig.	.000

4.5 Descriptive Statistics for Supply Chain Enhancement Practices

Various statements were posed to the respondents regarding the level at which their firms had applied supply chain enhancement practices in facilitation of bunkering operations. A look of the supply chain's standard deviation and mean enhancement practices were tabulated and presented in the following subsections.

4.5.1 Descriptive Statistics for Strategic Information Sharing

The average of 4.56 shows that to a very great extent bunkering firms adopted strategic information sharing. Further to a very great extent the firms employed integrated information platforms for connecting relevant stakeholders and effective facilitate establishment of supply chain enhancement practices has a mean that is nearly 5 on the Likert Scale, or 4.75. With a standard deviation of.732, the comparable variation was second-least. The firm involved participation of stakeholders to a very great extent at each critical situation in an effort to

establish supply chain enhancement practices with a mean that is close to 5 on the Likert Scale, 4.67. The response to the statement's standard deviation was.956, which is the biggest and largest demonstrating the greatest range.

The firms to a very great extent employed up-to-date technology on information flow in facilitation of supply chain enhancement practices has a mean that is close to 5 on the Likert Scale, 4.64. The responses to this statement had the least variance, as indicated by the related standard deviation, which was the lowest at.593. Finally, sharing of data information to all members assists management in achieving effective supply chain enhancement practices to a with a mean of 4.19, to a large extent. The replies to this statement had the second-highest variation, with a corresponding standard deviation of.920 being the second-largest.

Table 4. 8 Strategic Information Sharing

Strategic Information Sharing	Mean	Std. Deviation
The integrated information platforms employed by the firm for connecting relevant stakeholders effective facilitate establishment of supply chain enhancement practices	4.75	.732
The firm involves participation of stakeholders at each critical situation in an effort to establish supply chain enhancement practices	4.67	.956
The firm has employed up-to-date technology on information flow in facilitation of supply chain enhancement practices	4.64	.593
Sharing of data information to all members assist management in achieving effective supply chain enhancement practices	4.19	.920
Average of the Means	4.56	

4.5.2 Descriptive Statistics for Supply Chain Competence

The mean of 4.81 shows that to a very great extent supply chain competence was practiced by the bunkering firms. Further to a very great extent integrated capabilities and resources of members across value chain impacted application of supply chain enhancement practices on the Likert Scale, the average is 4.92, which is close to 5. This statement's equivalent standard

deviation was. The answer variety was the least, with a score of 280. Knowledge-sharing routines in assisting the firm in enhancing supply chain practices and practicing effective governance assist the firm in realizing SCE practices were practiced to a very great extent has a combined mean that is close to 5 on the Likert Scale, or 4.83. The associated standard deviation was at, which was the second-lowest .378 which showed second least variation in responses for the statements. Competencies of different entities at each stage in the value chain impact the overall establishment of supply chain enhancement practices on the Likert Scale, the average is 4.92, or about 5. For this assertion, the standard deviation was appropriate. The least number, 280, demonstrates how inconsistent the responses were.

Table 4. 9 Supply Chain Competence

Supply Chain Competence	Mean	Std. Deviation
Integrated capabilities and resources of members across value chain impact application of supply chain enhancement practices	4.92	.280
Knowledge-sharing routines in assisting the firm in enhancing supply chain practices	4.83	.378
Practicing effective governance assist the firm in realizing SCE practices	4.83	.378
Competencies of different entities at each stage in the value chain impact the overall establishment of supply chain enhancement practices	4.67	.632
Average of the Means	4.81	

4.5.3 Descriptive Statistics for Information Technology

The average of 4.56 shows that bunkering firms used information technology in their operations. Further, to a very great extent adoption of electronic data interchange in the overall management and establishment of supply chain enhancement practices with a mean of 5.00. The standard deviation was .000 showing all the respondents said the same thing. There is no variation in the responses. To a very great extent SCM systems in the firm assist in enhancing supply chain

practices in bunkering operations has a mean that is nearly 5 on the Likert Scale, or 4.75. The corresponding standard deviation shows moderate variation at .841. Radio frequency identification (RFI) in facilitating supply chain enhancement was heavily utilized by the companies, with a mean of 3.92, or nearly 4, on the Likert Scale. Highest variation is shown by the matching standard deviation, which is.967.

Table 4. 10 Information Technology

Information Technology	**Mean**	**Std. Deviation**
Adoption of electronic data interchange in the overall management and establishment of supply chain enhancement practices	5.00	.000
Supply chain management systems in the firm assist in enhancing supply chain practices in bunkering operations.	4.75	.841
Use of radio frequency identification (RFI) in facilitating supply chain enhancement.	3.92	.967
Average of the Means	**4.56**	

4.5.4 Descriptive Statistics for Inventory Management

The mean of 4.59 shows that the firms practiced inventory management to a very great extent. Further the firms adopted quick response codes for control to with a mean of 4.72, which is close to 5 on the Likert Scale, there is a relatively large extent. The matching standard deviation, which was.741, was the second-least significant, indicating that the responses varied moderately. To a very great extent the firms collaborated with customers and suppliers for smooth flow of inventory with a mean that is close to 5 on the Likert Scale, 4.69. With a matching standard deviation of.668, this fluctuation was the least. The firms adopted vendor managed inventory for efficiency an average of 4.36. The most variation was shown by the largest standard deviation, which was .931.

Table 4. 11 Inventory Management

Inventory Management	Mean	Std. Deviation
Adoption of quick response codes for control.	4.72	.741
Collaborating with customers and suppliers for smooth flow of inventory.	4.69	.668
Adoption of vendor-managed inventory for efficiency	4.36	.931
Average of the Means	**4.59**	

4.6 Descriptive Statistics for Operational Efficiency

Various statements were posed to the respondents regarding the level at which their firms had were operationally efficient. The mean and standard deviation of operational efficiency were tabulated and presented in the following subsections.

4.6.1 Descriptive Statistics for Customer Satisfaction

The results in Table 4.12 show that there was customer satisfaction significantly because of a mean of 4.72. Further, there is quality customer experience with the organizations and the firms dealt with complaints and problems satisfactorily to a joint mean of 4.75, which is close to 5, on the Likert Scale indicates a very large extent. The standard deviations, however, were different, with the former having a value of.439 demonstrating the least variance of the replies whereas the latter having a std. deviation of.841 suggesting substantial variation. Customers perceived that firms genuinely care about customers and build the experience around their customers' needs to a very great extent an average of 4.36. The most variation was shown by the largest standard deviation, which was .931

Table 4. 12 Customer Satisfaction

Customer Satisfaction	Mean	Std. Deviation
There is quality customer experience with the organizations	4.75	.841
The firm deals with complaints and problems	4.75	.439

satisfactorily		
Customers perceive that firms genuinely care about customers and build the experience around their customers' needs	4.67	.862
Average of the Means	4.72	

4.6.2 Descriptive Statistics for Efficiency in Operations Scheduling

The mean of 4.20 shows there was efficiency in operations scheduling at the bunkering firms to a great extent. Further, the ability/grade efficiency was substantial to a very great extent at 4.50 on the Likert Scale is quite close to 5.The standard deviation was the largest at .878 showing highest variation of the responses. At the firms, there was a high sales deployed per hour to a great extent an average of 4.17. With a mild variance of.697, the matching standard deviation was the second lowest. With a mean of 3.92, there is a high based on resource efficiency to a significant extent. The least amount of variety in the replies to the statement was shown by the standard deviation of.649.

Table 4. 13 Efficiency in Operations Scheduling

Efficiency Operations Scheduling	Mean	Std. Deviation
The ability/grade efficiency is substantial	4.50	.878
There is a high sales deployed per hour	4.17	.697
There is a high actual resource efficiency	3.92	.649
Average of the Means	4.20	

4.6.3 Curbing of Losses

The firms were able to curb losses to a great extent as seen in Table 4.14, the mean was 4.50. Additionally, the enterprises have significantly decreased their operational losses, with a mean that is nearly 5 on the Likert scale, at 4.92. When the appropriate standard deviation of.280 was chosen, the answer variation was at its lowest. The firms also diversified their operations in a bid

to spread the risk of loss to a very great extent with a mean that is close to 5 on the Likert scale, or 4.75. The second-lowest standard deviation, at .439, indicates that the replies varied the second-least. The firms prevented losses through their operations with to a very great extent with a Likert scale mean of 4.5, which is close to 5. The matching standard deviation, which was.507, was the second-highest, indicating that the replies varied most. The firms to a great extent had strategies to avoid losses with a mean of 3.83, or almost 4 on the Likert Scale, was obtained. The associated standard deviation was the greatest, at.811, indicating a wide range.

Table 4. 14 Curbing Losses

Curbing Losses	Mean	Std. Deviation
The firm has reduced losses in its operations	4.92	.280
The firm has diversified its operations in a bid to spread the risk of loss	4.75	.439
The firm prevents losses through its operations	4.50	.507
The firm has a strategy to avoid losses	3.83	.811
Average of the Means	4.50	

4.7 Diagnostic Tests

Diagnostic tests in this study were test for normality, tests for autocorrelation and test for multicollinearity. These tests are discussed hereunder.

4.7.1 Tests for Normality

The dependent variable for each independent variable must roughly follow the normal distribution for several parametric statistical techniques, including Analysis of Variance (ANOVA), Pearson Correlation, Discriminant Analysis, F-Test, T-Test and Linear Regression, (Razali & Wah, 2011). The Z-values of skewness and kurtosis, which should be between -1.96 and + 1.96, can be used to measure the results of normality tests. In this investigation, Kurtosis and Skewing were applied. Table 4.15 displays a skewness score of 0.653, a standard error (SE) of 0.564, and a kurtosis score of -1.703. (SE 1.091). All of the skewness and kurtosis values fall between -1.96 and 1.96. This demonstrates that the data is somewhat curved and Kurtotic but

does not deviate greatly from normalcy. The study claims that the data is typically distributed as a result.

Table 4. 15 Skewness and Kurtosis

		Statistic	Std. Error
Mean		1.3438	.11609
95% Confidence Interval for Mean	Lower Bound	1.0963	
	Upper Bound	1.5912	
5% Trimmed Mean		1.3264	
Median		1.0000	
Variance		.216	
Std. Deviation		.46435	
Minimum		1.00	
Maximum		2.00	
Range		1.00	
Interquartile Range		.94	
Skewness		.653	.564
Kurtosis		-1.703	1.091

4.7.2 Test for Autocorrelation

A result of 1.5 to 2.5 showed the absence of autocorrelation when using the Durbin-Watson value to test for it. The Durbin-Watson value for the data was 1.816, indicating that there was no autocorrelation for the research variables.

Table 4. 16 Tests for Autocorrelation

Model	Durbin-Watson
1	1.816

a. Predictors: (Constant), Inventory Management, Supply Chain Competence, Information

Technology, Strategic Information Sharing

b. Dependent Variable: Operational Efficiency

4.7.3 Test for Multicollinearity

Variance inflation factors were used to evaluate the predictor variables for multicollinearity (VIFs). Strong correlations between the independent variables are known as multicollinearity, which is an undesirable scenario. When VIF is larger than 10 and Tolerance is less than 0.2, multicollinearity arises. The VIF for supply chain competency was 1.420, the VIF for information technology was 2.709, and the VIF for inventory management was 8.191, according to Table 4.17. This indicated that there was no multicollinearity and that the majority of the tolerance statistics were more than 0.2 because the variance inflation factors for all predictor variables were all less than 10.

Table 4. 17 Test for Multicollinearity

Independent Variables	**Collinearity Statistics**	
	Tolerance	**VIF**
Strategic Information Sharing	.113	8.872
Supply Chain Competence	.704	1.420
Information Technology	.369	2.709
Inventory Management	.111	8.969

4.8 Regression Analysis

The dependent (operational efficiency) and independent variables of the study were examined using regression analysis to see if they were linear (supply chain enhancement practices). The outcomes were compiled and explained, as shown in the subsections below;

4.8.1 Multiple Regression Model Summary

According to Table 4.18, the model accounts for 89.5% of the variance in operational efficiency, with an adjusted R-square value of 0.895. This suggests that the model is unable to account for

10.5% of the overall variance in operational efficiency. Therefore, the findings show that operational efficiency is impacted by supply chain management strategies. Table 4.14 displays the findings for variances between the dependent and independent variables.

Table 4. 18 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.948a	.898	.895	.27721	1.816

a. Predictors: (Constant), Inventory Management, Supply Chain Competence, Strategic Information Sharing, Information Technology

b. Dependent Variable: Operational Efficiency

4.8.2 Analysis of the Variance

The residuals are positive, indicating that the dependent and independent variables utilized in the study had a substantial association. Given that $F_{critical}$at (4, 35) degrees of freedom is 2.31 and $F_{calculated}$ 249.210 at 5% level of significance, it can be concluded from the ANOVA Table 4.19 that operational efficiency was significantly impacted by inventory management, supply chain competence, strategic information sharing, and information technology. The Analysis produced the ANOVA table.

The ANOVA table was generated from the Analysis

Table 4. 19 Analysis of Variance

Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	76.604	4	19.151	249.210	.000[b]
Residual	8.684	113	.077		
Total	85.288	117			

a. Dependent Variable: Operational Efficiency

b. Predictors: (Constant), Inventory Management, Supply Chain Competence, Strategic Information Sharing, Information Technology

4.8.3 Coefficients of the Regression Model

The study produced the regression model's co-efficient, which was then presented. The regression equation is represented as follows;

$$\mathbf{Y=0.047+0.249X_1+0.181X_2+0.158X_3+0.380X_4}$$

Y –Operational Efficiency

$\mathbf{X_1}$–Strategic Information Sharing

$\mathbf{X_2}$–Supply Chain Competence

$\mathbf{X_3}$ –Information Technology

$\mathbf{X_4}$–Inventory Management

Operational efficiency will be at 0.047 units when the independent variables are all zero. Operational efficiency increases by 0.249 units for every unit increase in strategic information exchange. Operational efficiency rises by 0.181 units for every unit improvement in supply chain competency. Operational efficiency rises by 0.158 units for every unit increase in information technology. Operational efficiency rises by 0.380 units for every unit increase in inventory management.

Table 4. 20 Coefficients of the Model

Model	**Unstandardized Coefficients**		**Standardized Coefficients**				
	B	**Std. Error**	**Beta**	**T**	**Sig.**	**Collinearity Statistics**	
(Constant)	.047	.114		.413	.680	Tolerance	VIF

Strategic Information Sharing	.249	.074	.300	3.357	.001	.113	8.872
Supply Chain Competence	.181	.039	.167	4.665	.000	.704	1.420
Information Technology	.158	.050	.156	3.156	.002	.369	2.709
Inventory Management	.380	.079	.434	4.826	.000	.111	8.969

a. Dependent Variable: Operational Efficiency

4.9 Hypothesis Testing

In the first null hypothesis, we hypothesized that exchanging strategic information among bunkering companies operating in ports throughout the Indian Ocean would not improve their operational efficiency. Table 4.21 shows that the strategic exchange of information significantly increased the operational efficiency of the bunkering enterprises located in the ports along the Indian Ocean (B1=0.300, t=3.357, p0.001). Therefore, the study concluded that bunkering companies operating in ports throughout the Indian Ocean benefited significantly from strategic information exchange.

As for the second, it was hypothesized that bunkering companies located in and around the Indian Ocean would not see any noticeable improvement in their performance as a result of an increase in SC skills. According to Table 4.21 (B1=0.167, t=4.665, & p=0.0000.05), supply chain competences significantly impacted the operating efficiency of bunkering enterprises located near ports on the Indian Ocean. Therefore, the study concluded that SC skills significantly affect the operational efficiency of bunkering enterprises along Indian Ocean ports, contradicting H02.

When it comes to the productivity of bunkering businesses located near the ports of the Indian Ocean, the third null hypothesis states that data processing and storage have no bearing whatsoever. Table 4.21 shows that the use of IT significantly improved the efficiency of operations for bunkering companies located in ports throughout the Indian Ocean (B1=0.156, t=3.156, p=0.0020.05). The research disproved H03, leading the authors to conclude that IT has

a major impact on the productivity of bunkering businesses located near the ports of the Indian Ocean.

Finally, the fourth null hypothesis indicated that bunkering enterprises operating out of Indian Ocean ports do not benefit from improved inventory management. Table 4.21 displays the results, which showed that effective inventory management significantly impacted the operating efficiency of bunkering enterprises located in ports throughout the Indian Ocean (B1=0.434, t=4.826, p0.00005). The research disproved H04 and found that bunkering companies operating at ports along the Indian Ocean benefit much from careful inventory management. Results from the multiple regression analysis used in this study to test the hypothesis about the impact of supply chain enhancement strategies on the operational efficiency of bunkering enterprises located near ports on the Indian Ocean are presented in Table 4.21.

Table 4. 21 Test of Hypothesis Results

Research Hypotheses	B	T	p-value	Decision
H_{01}:: Strategic information sharing has no significant effect on the operational efficiency of bunkering firms along Indian Ocean ports	0.300	3.357	0.001	H_{01} rejected since p=<0.05
H_{02}: Supply chain competencies has no significant effect on the operational efficiency of bunkering firms along Indian Ocean ports	0.167	4.665	0.000	H_{02} rejected since p=<0.05
H_{03}: Information technology has no significant effect on the operational efficiency of bunkering firms along Indian Ocean ports	0.156	3.156	0.002	H_{03} rejected since p=<0.05
H_{04}: Inventory management has no significant effect on the operational efficiency of bunkering firms along Indian Ocean ports	0.434	4.826	0.000	H_{04} rejected since p=<0.05

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the results, draws a conclusion, and offers suggestions for additional research. It is totally based on the chapter four findings and outcomes of this investigation.

5.2 Summary of Findings

The study targeted managers in 168 bunkering firms and managed a 70.2% response rate which was excellent and deemed fit for the study. On period of continuous service, the study construes that the respondents had worked continuously for the bunkering firms to be able to understand the contents of the questionnaire. On the period worked in the present position, the study asserted that most respondents worked for long periods in the same position to understand supply chain enhancement practices. On period of operation, the firms had operated long enough to have utilized supply chain enhancement practices for operational efficiency. Regarding the greatest degree of education, the study claimed that the respondents had a decent education that allowed them to comprehend the questionnaire's contents and provide accurate answers.

Reliability and validity tests found out that the constructs were reliable and the data collection instrument was valid. The data was submitted to a variety of diagnostic tests prior to the analysis with the purpose of enabling subsequent analyses. Testing for normalcy was done using skewness and Kurtosis, Durbin-Watson Statistic was used to help assess autocorrelation, and Variance Inflation Factors were used to assess the test for multicollinearity (VIFs). It was discovered that the data was normally distributed. The study variables showed no autocorrelation either. Furthermore, the study variables did not exhibit multicollinearity.

The bunkering firms adopted strategic information sharing. The firms employed integrated information platforms for connecting relevant stakeholders and effective facilitate establishment of supply chain enhancement practices. The firms involved participation of stakeholders at each critical situation in an effort to establish supply chain enhancement practices. The firms employed up-to-date technology on information flow in facilitation of supply chain enhancement practices. Sharing of data information to all members assist management in achieving effective supply chain enhancement practices.

SC competence was practiced by the bunkering firms. Integrated capabilities and resources of members across value chain impacted application of supply chain enhancement practices. Knowledge-sharing routines in assisting the firm in enhancing supply chain practices and practicing effective governance assist the firm in realizing SCE practices were practiced. Competencies of different entities at each stage in the value chain impact the overall establishment of supply chain enhancement practices.

Bunkering firms used information technology in their operations. Adoption of electronic data interchange in the overall management and establishment of SC enhancement practices SCM systems in the firm assist in enhancing supply chain practices in bunkering operations. Radio frequency identification (RFI) in facilitating supply chain enhancement was used. Bunkering firms practiced inventory management. The firms adopted quick response codes for control. The firms collaborated with customers and suppliers for smooth flow of inventory. The firms adopted vendor managed inventory for efficiency.

On operational efficiency, as a result of SSCM practices there was customer satisfaction. There was quality customer experience with the organizations and the firms dealt with complaints and problems satisfactorily. Customers perceived that firms genuinely care about customers and build the experience around their customers' needs. There was efficiency in operations scheduling at the bunkering firms. The ability/grade efficiency was substantial. At the firms, there was a high sales deployed per hour. There was a high actual resource efficiency. Through supply chain enhancement practices the firms were able to curb losses. The firms also diversified their operations in a bid to spread the risk of loss. The firms prevented losses through their operations. The firms to a great extent had strategies to avoid losses.

5.3 Conclusion of the Study

It has been found out that inventory management, SC competence, strategic information sharing and information technology affected operational efficiency significantly. Particularly, the relationship was positive, an increase in supply chain enhancement practices (strategic information sharing, SC competence, inventory management and information technology) led to an increase in operational efficiency. The entire difference in operational efficiency was 89.5%, with management techniques in SC being the main contributor. The model used in the study only

explained 85.5% of the overall variance in operational efficiency. The findings of this study averts the limitation of Dhaigude, Kapoor, Gupta and Padhi (2021) who linked SC integration to SC orientation and performance on Indian manufacturing firms by studying bunkering firms for Indian Ocean ports by building on the empirical literature and also the limitation of Park and Park (2019) which concentrated on the Korean bunkering firms at Busan Port.

The study found a correlation between SC practices and operational effectiveness that is positive; this is contrary to the findings of According to Khayumbi (2015), there is no connection between SCM procedures and the operational effectiveness of Mombasa Port in terms of global maritime trade. Also Ngangaji (2019) in the study on terminal efficiency in East Africa ports at Dar es Salaam and Mombasa ports did not link supply chain management practices with terminal efficiency. Further contrary to Mutua and Gichinga (2019) undertook a study to investigate turnaround determinants impacting performance of cargo vessels at the port of Mombasa.

5.4 Recommendations

The researcher discovered that some bunkering companies had now ceased operations while performing the investigation. The researcher proposes an industry-wide collaborative approach that must consider how sector players might cooperate to restore the bunker industry. To build a sustainable business ecosystem, gaps which have been found must be mutually filled. The key players must recognize and comprehend one another's positions and needs in order to develop a strategy that benefits everyone.

Government officials can use the study's findings, but bunkering businesses also value them. The knowledge gained enables the ship bunkering operators to strengthen their competitive position. This can be realized through implementing SC enhancement methods to focus on the most crucial aspects of bunkering operations and enhance the market's competitiveness. The results of this study can potentially be used by governments to increase the operational effectiveness of bunkering companies.

Policy makers can also take the findings of this study as buffer to come up with policies on operational efficiency. Under strategic information sharing, policy makers can come up with policies that allow for the development of information systems to the top in class technologies for better operational efficiency for bunkering firms. Proper information flow will help in

facilitation of supply chain enhancement practices. For supply chain competence, policies can be made to enable firms obtain much needed resources for competitive advantage and overall competencies. Policy makers can further create user friendly platforms to enable firms utilize RFI effectively.

5.5 Limitations of the Study

The success of the investigation was carefully ensured by the researcher. However, despite these attempts, the study had a number of shortcomings. Information was not readily available because it was difficult to reach the respondents in the bunkering firms due to geographical proximity.

A Google form was designed to reach the respondents online. Additionally, for fear of retaliation, the staff was reluctant to disclose the requested information. By providing an authorization letter from the university and outlining the goal of the research study, the researcher was able to overcome the difficulty.

5.6 Suggestions for Further Studies

The study was conducted with the end goal of discovering how various supply chain enhancement strategies affect operational effectiveness. The SC enhancement practices were limited to strategic information sharing, SC competence, and information technology and inventory management. The paper recommends conducting additional research utilizing different supply chain improvement techniques. Considering that the criteria examined in this study account for 89.5% of operational efficiency. This indicates that the study's variables were unable to account for a full 10.5% of the operational efficiency variance. To generalize findings the study also suggests more research be done in more advanced economies in Africa like South Africa, West and North Africa who have elaborate supply chain enhancement practices for their bunkering firms. These nations may offer different findings. The researcher also recommends conducting the same study in each location separately to provide for a longer time for data collection. This will make it possible to collect data by region and determine how perceptions about the industry vary between locations.

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APPENDICES

Appendix 1: Letter to the Respondent

Dear Sir/Madam,

You are kindly requested to spare some time to be interviewed and provide relevant data on issues regarding sustainability and efficiency of bunkering operations. The data provided will be used specifically for the academic study.

All information obtained will be kept private and the source will never be disclosed. Your genuine response will be much valued.

I'm grateful in advance.

Appendix II: Questionnaire

Section A: Demographic Data

1. What is the length of your period of continuous service in the firm?
    a. [ ] less than 5 years
    b. [ ] 5- 10 year
    c. [ ] 10- 15 years
    d. [ ] more than 15 years

2. What is your position in the firm?
    a. [ ] senior manager
    b. [ ] manager
    c. [ ] entry level
3. How long have you worked in the present position?
    a. [ ] less than 5 years
    b. [ ] 5- 10 year
    c. [ ] 10- 15 years
    d. [ ] more than 15 years

4. What period has the firm been in operation in the industry?
    a. [ ] less than 5 years
    b. [ ] 5-10 years
    c. [ ] 10-15 years
    d. [ ] more than 15 year
5. What is current level of your educational qualification?

a) [ ] Secondary school level
b) [ ] College level
c) [ ] Undergraduate level
d) [ ] Masters degree
e) [ ] PhD

Section B: Supply chain enhancement practices

Please tick as appropriate to indicate the level at which firms has applied supply chain enhancement practices in facilitation of bunkering operations.

[1] Not at all [2] Small extent [3] Moderate extent [4] Great extent [5] Very great extent

	Statement	1	2	3	4	5
A	**Strategic information sharing**					
SIS1	The firm involves participation of stakeholders at each critical situation in an effort to establish supply chain enhancement practices					
SIS 2	The firm has employed up-to-date technology on information flow in facilitation of supply chain enhancement practices					
SIS 3	The integrated information Platforms employed by the firm for connecting relevant stakeholders effective facilitate establishment of supply chain enhancement practices					
SIS 4	Sharing of data information to all members assist management in achieving effective supply chain enhancement practices					
B	**Supply chain competence**	1	2	3	4	5
SCC1	Integrated capabilities and resources of members across value chain impact application of supply chain enhancement practices					
SCC 2	competencies of different entities at each stage in the value chain impact the overall establishment of supply chain enhancement practices					

SCC 3	Knowledge-sharing routines in assisting the firm in enhancing supply chain practices					
SCC 4	Practicing effective governance assist the firm in realizing SCE practices					
C	**Information technology**	1	2	3	4	5
IT1	Supply chain management systems in the firm assist in enhancing supply chain practices in bunkering operations.					
IT 2	Use of radio frequency identification (RFI) in facilitating supply chain enhancement.					
IT 3	Adoption of electronic data interchange in the overall management and establishment of supply chain enhancement practices					
E	**Inventory management**	1	2	3	4	5
IM1	Adoption of vendor-managed inventory for efficiency					
IM 2	Collaborating with suppliers and customers for smooth flow of inventory.					
IM 3	Adoption of quick response codes to control.					

Section C: Operational Efficiency

Kindly indicate the degree of realization of performance using a **TICK**

	Statement	**1**	**2**	**3**	**4**	**5**
A	**Customer Satisfaction**					
CS1	There is quality customer experience with the organizations					

CS 2	The firm deals with complaints and problems satisfactorily					
CS 3	Customers perceive that firms genuinely care about customers and build the experience around their customers' needs					
B	**Efficiency Operation Scheduling**	**1**	**2**	**3**	**4**	**5**
EOS 1	The ability/grade efficiency is substantial					
EOS 2	There is a high sales deployed per hour					
EOS 3	There is a high actual resource efficiency					
C	**Curbing Losses**	**1**	**2**	**3**	**4**	**5**
CL 1	The firm has reduced losses in its operations					
CL 2	The firm has diversified its operations in a bid to spread the risk of loss					
CL 3	The firm prevents losses through its operations					
CL 4	The firm has a strategy to avoid losses					

Thanks for your time

Appendix III: List Of Bunkering Firms In East African Ports along Indian Ocean

BUNKERING FIRMS

1. GLOBAL MARITIME SURVEYORS S.A.R.L
2. A FRICA SHIPPING LIMITED SARL
3. AFRO HANDLING
4. ALLIED SURVEY & TESTING
5. BLUE NILE SHIPPING SERVICES
6. CABINET AVOCATS ASSOCIES ABAYAZID & ABDOURAHMAN (CAA) SCP
7. CHAB EXPRESS TRANSIT SERVICES SARL
8. COMAD
9. DELTA MARITIME SERVICES
10. DIAMOND SHIPPING SERVICES SARL
11. DJIBOUTI FREE ZONE
12. DJIBOUTI REGISTER OF SHIPS
13. GAMBELLI FRERES
14. GENERAL TRANSPORT SERVICES (GTS)
15. GENERAL TRANSPORT SERVICES (GTS)
16. GLOBAL SHIPPING SERVICES
17. GROUP MARILL SARL
18. HARED TRANSIT & TRANSPORT SERVICES
19. INTEGRATED SHIPPING SERVICES
20. INTERNATIONAL MARITIME SHIPPING SERVICES IMSS
21. KOTHARI, J.J., & COMPANY LIMITED
22. LIBYA OIL DJIBOUTI S.A.
23. MANUTENTION DE DJIBOUTI, COMPAGNIE MARITIME ET DE
24. MARITIME L SAVON & RIES, SOCIETE
25. MARITIME TRANSPORT INTERNATIONAL
26. MARTINET & MARTINET
27. MASSIDA LOGISTICS
28. MTS
29. OKAR
30. PORT OF DJIBOUTI
31. REGISTRO ITALIANO NAVALE (RINA)
32. REGISTRO ITALIANO NAVALE (RINA)

33. SG SALVAGE
34. SHELL DJIBOUTI
35. SIYAN TRANS EXPRESS
36. SOCIETE DJIBOUTIENNE DE TRAFFIC MARITIME
37. STM SHIPPING
38. SWIFT STEVEDORING COMPANY
39. THREE SIXTY STEVEDORING
40. TOTAL DJIBOUTI
41. TRANS AFRICAN STEVEDORING SERVICES
42. UNIVERSAL SUPPLY COMPANY
43. INTEGRATED SHIPPING SERVICES BERBERA
44. OMER ALI DUALEH & COMPANY
45. ALBA PETROLEUM LIMITED
46. FOSSILS FUELS LIMITED
47. KANGAROO BUNKERS LIMITED
48 OCEANINC BUNKERING LIMITED
49. VIRO SHIPPING LIMITED
50 WANAINCH MARINE PRODUCTS (K) LIMITED
51. ALFOSS ENERGY LIMITED
52 AGIP TANZANIA LIMITED
53. BP TANZANIA LIMITED
54. CALTEX TANZANIA LIMITED
55. ENGEN PETROLEUM LIMITED
56. GAPCO
57. HAM EGINEERING
68 MARINE ENERGY LIMITED
59 SHELL TANZANIA LIMITED
60 TOTAL TANZANIA

61 UNITED GROUP LIMITED (United Petroleum)

62 AMI MALAWI LIMITED
63 GMS FREIGHT LIMITED
64 INTERNATIONAL FREIGHT AGENCY
65 MAKCON SHIPS AGENCY
66 MALAWI MARINE TRAINING CENTRE
67 MANICA (MALAWI) LIMITED
68 MCS FREIGHT LIMITED
69 MOLLER HOLDING AS, A.P.
70 MMS SHIPPING & BUNKERING AS, A.P.
71NEW PIG LIMITED

72 SDV MALAWI
73 SHIPPING MANAGEMENT SERVICES LIMITED
74 TRANS MARITIME LIMITED
75 WALFORD MEADOWS (MALAWI) LIMITED
76 AUSTRAL SERVICES
77 AUXIMAD NOSY BE
78 BUREAU VERITAS
79 CAPITAINERIE DU PORT
80 COMATO
81 COMMITTEE OF THE FLVONDRONAM-POKOTANY
82 DUPONSEL, ROGER, & CIE.
83 ECOLE NATIONAL D'ENSEIGNEMENT MARITIME
84 FREIGHT & TRANSIT COMPANY LIMITED (FTL)
85 GENERAL SERVICE MARITIME
86 GROUPE REFRIGEPECHE DE MADAGASCAR
87 IRELAND FRASER MADAGASCAR SARL
88 LIGNE SCANDINAVE, LA
89 MOLLER HOLDING AS, A.P.
90 PECHEXPORT SARL
91 PORT CAPTAIN
92 PORT ST. LOUIS
93 PORT SUPERINTENDENT
94 REFRIGEPECHE OUEST
95 SCTT
96 SOCIETE AUXILIAIRE MARITIME DE MADAGASCAR

97 VIP LOGISTICS SCS S.A.R.L.
98 AUSTRAL SERVICES
99 AUXIMAD NOSY BE
100 BUREAU VERITAS
101 CAPITAINERIE DU PORT
102 AAA INTERNATIONAL SERVICES LIMITED
103 ALLIED AGENCIES LIMITED
104 AMCOM ASSET MANAGEMENT COMPANY NIGERIA
105 AQUARIUS SHIPPING AGENCY LIMITED
106 BUREAU VERITAS
107 GLOBAL SUPPLY CENTRE
108 GREG LAWEN MARINE SURVEYING SERVICES
109 HUNT DELTEL & COMPANY LIMITED
110 LAND MARINE LIMITED
111 NAVAL SERVICES (1994) LIMITED
112 SAVY, HARRY, & COMPANY PROPRIETARY LIMITED
113 SEAGULL TRADING COMPANY LIMITED
114 SEYCHELLES PETROLEUM COMPANY LIMITED (SEYPEC)
115 SEYCHELLES PORTS AUTHORITY
116 SEYCHELLOISE DE NAVIGATION LIMITED, SOCIETE
117 HUNT DELTEL & COMPANY LIMITED
118 TRANS-MANAGEMENT LIMITED
119 VDL MARINE SERVICES (PROPRIETARY) LIMITED
120 MAYOTE ISLAND BUNKERING FIRMS
121 COMMANDANT PORTO DE DZAOUDZI
122 SOMARSAL
123 ADAM & COMPANY LIMITED
124 APPAVOU, M.C., & COMPANY LIMITED (TGA)
125 ASSOCIATED SURVEYORS LIMITED
126 ATLANTA SHIPPING LIMITED
127 AUSTRAL SHIPPING AGENCY LIMITED
128 BELSHIP COMPANY LIMITED
129 BLYTH BROTHERS & COMPANY LIMITED
130 BUREAU VERITAS
131 CARGO HANDLING CORPORATION LIMITED
132 CELERO SHIPPING
133 CHANTIER NAVAL DE L'OCEAN INDIEN LIMITED (CNOI)

134 DIVE SOLUTIONS MAURITIUS
135 EMCAR LIMITED
136 FAST SHIPPING & TRANSPORTATION COMPANY LIMITED
137 IKS CARGO LIMITED
138 IMMERSUB & COMPANY LIMITED
139 INDIANOIL MAURITIUS LIMITED (IOML)
140 INSPECTION & TESTING CONSULTING LIMITED
141 INTERNATIONAL SUPPLY COMPANY LIMITED
142 IRELAND BLYTH LIMITED
143 IRELAND, FRASER & COMPANY LIMITED
144 KEN LEE SHIPCHANDLERS
145 MARINE & GENERAL SURVEILLANCE LIMITED
146 MAURITIUS FREEPORT25. MAURITIUS PORTS AUTHORITY
147 MAURITIUS SHIPPING CORPORATION LIMITED
148 MAURITIUS SHIPPING CORPORATION LIMITED
149 MERRY FISHER SHIPPING COMPANY LIMITED
150 MEYER CURY & COMPANY LIMITED
151 MOLLER HOLDING AS, A.P.
152 MSCL CORALINE SHIP AGENCY LIMITED
153 NATECH & SON ENGINEERING COMPANY LIMITED
154 OCEANIC SHIPCHANDLER
155 PACIFIC WORLD SHIPPING LIMITED
156 PONAMBALUM
157 PORT AGENCY SERVICES (MAURITIUS) LIMITED.
158 ROYAL MARINE
159 SCOTT SHIPPING LIMITED
160 SOCIETE DE GERANCE MARITIME LTEE (SGM)
161 SOUTHBOND SHIPPING AGENCY LIMITED (SSAL)
162 SOUTHERN MARINE & COMPANY LIMITED
163 SWAN GENERAL LIMITED
164 TAYLOR SMITH GROUP
165 UNION SHIPPING LIMITED
166 UNITED AFRICA FEEDER LINE LIMITED (UAFL)
167 VIVO ENERGY MAURITIUS LIMITED
168 YVES ROZA LIMITED