

**Lean procurement practices and tools on procurement efficiency of
pharmaceuticals: the case of Ethiopian Pharmaceutical Supply Services**

Research dissertation presented in partial fulfilment of the requirements for the
degree of MSc in Pharmaceutical Business and Technology

Innopharma Faculty of Pharmaceutical Sciences
Griffith College Dublin

Dissertation Supervisor: Dr. Alessandra Vecchi

Candidate: Miraf Tesfaye Gebrewold


August 25/2024

Candidate Declaration

Candidate Name: Miraf Tesfaye Gebrewold

I certify that the dissertation entitled:

“Lean procurement practices and tools on procurement efficiency of pharmaceuticals: the case of Ethiopian Pharmaceutical Supply Services” is the result of my original work, and where the work of others is referenced, it is made with a due acknowledgement.

Candidate signature: 

Date: 25/08/2024

Supervisor Name: Dr. Alessandra Vecchi

Supervisor signature:

Date:

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My deepest gratitude goes to Almighty God, whose love, mercy, and grace have guided me throughout my life. All glory to Him!

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“God Is Kind!!!”

Dedication

I dedicate this work to my husband, whose love, understanding, and unwavering support have been my greatest strength. Stay blessed!!!

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List of Abbreviations

ANOVA.....	Analysis of variance
CRM.....	Customer Relationship Management
EPSS.....	Ethiopian Pharmaceutical Supply Services
ERP.....	Enterprise Resource Planning
ICT.....	Information Communication Technology
IT.....	Information Technology
JIT.....	Just-In-Time
LSCM.....	Lean Supply Chain Management
PSCM.....	Pharmaceutical Supply Chain Management
PSC.....	Pharmaceutical Supply Chain
SCM.....	Supply Chain Management
SD.....	Standard Deviation
SPSS.....	Statistical Package for the Social Science
SRM.....	Supplier Relation Management
TQM.....	Total Quality management
VSM.....	Value Stream Mapping
WHO.....	World Health Organization

Lean procurement practices and tools on procurement efficiency of pharmaceuticals: the case of Ethiopian Pharmaceutical Supply Services

Miraf Tesfaye Gebrewold

ABSTRACT

Pharmaceutical procurement is a critical undertaking in ensuring availability of essential medicine in the health care. In undertaking procurement, efficiency maximizing mechanisms are deemed important to ease the process together with managing costs. Among these, lean procurement practices and tools are notable as a means for customer value creation through eliminating waste. This study is designed with an aim of assessing the use, influence and implementation challenges of lean procurement practices and tools in pharmaceutical procurement function taking the case of Ethiopian Pharmaceutical Supply Services (EPSS).

In this research, a positivism philosophy is applied alongside a deductive approach, building in existing lean theories, to address the research objectives. Quantitative data by using structured survey questionnaire was collected in cross-sectional time horizon from sixty-three procurement experts working in EPSS. The collected data was cleaned in Microsoft Excel and analysed using SPSS. Both descriptive and inferential statistical analysis were used to present the overall result. In the process all ethical procedures are duly abided and followed.

The finding of this study showed, E-procurement, supplier relationship management, Kaizen, Just-in-time, total quality management, employee involvement and customer engagement are used in EPSS. A positive significant relationship is found between the lean procurement practices/tools and procurement efficiency as indicated by correlation coefficient ($r=0.423$, $p<0.001$) and the simple linear regression coefficient ($\beta=0.600$, $p=0.001$) values obtained from the data analysis. Moreover, the study identified challenges affecting the lean implementation in procurement such as gaps in skills and expertise and lack of employee training about the tools/practices among others.

As the finding demonstrated the utilization of the lean tools/practices in EPSS has brought positive influence in procurement efficiency. Hence, their use shall be promoted and the challenges hindering the proper implementation should be addressed systematically for optimum efficiency gain. Furthermore, to better understand lean in the context of pharmaceutical supply chain, future researches are recommended in the area to provide insight and enhance knowledge.

1. INTRODUCTION

1.1. Overview

In the current world, the application of lean in procurement and supply chain management (SCM) is getting attention as its importance has been proved in the manufacturing sector for long (Takeda-Berger *et al.*, 2021). It entails the strategic purchasing scheme based on the lean concept and principles embracing the planning, executions, and experts involved in the process (Backer *et al.*, 2017). In SCM, lean aims for cost reduction, quality improvement and process efficiency with minimal effort (Omwoyo *et al.*, 2019).

Pharmaceutical supply chain management (PSCM) is the extension of the concept of SCM in the health sector, procurement being one of the functions that could benefit from leanness (Hailu *et al.*, 2023). Procurement is a vital part of well-functioning health care system and involves activities of planning, managing, funding and communication between the point of origin and consumption (Gizaw *et al.*, 2021). The ultimate aim of PSCM is ensuring the right products are availed to support the patient care in the health system (Hailu *et al.*, 2023).

In PSCM, efficiency of procurement has implications in ensuring availability of pharmaceuticals, customer satisfaction and resource management (Boche *et al.*, 2022). In procurement, the presence of established procedures and tools plays a significant role. Among these, Lean practices and tools are well known aiming for customer value creation through reduced cost, shortened time and improved quality by eliminating waste (Mutiara Supatmanto *et al.*, 2023) (Argiyantari *et al.*, 2020).

The lean concept and practices have notable contribution across supply chain activities, procurement being an important SCM function. The concept of lean procurement has meaningful associations with lean practices and tools, such as supplier relationship management (SRM), Just-In-Time (JIT), Kaizen, customer relations among others (Osodo and Onjure, 2019). Concurrently, the implementation of lean practices in procurement contributes to procurement efficiency metrics such as cost reduction, lead time reduction, quality improvement and inventory turnover (Macharia, 2014).

Although the lean procurement practices and tools play prominent role in simplification and elimination of waste in process, there is complexity in the implementation (Deniz, 2021). Organizational cultural barriers, resistance of managers and employees, lack of technical

knowledge, absences of performance indicators are among the challenges in lean implementation (Maware and Parsley, 2022).

In Ethiopia where the study is conducted, pharmaceutical procurement is majorly managed through pooled procurement scheme (Boche *et al.*, 2022). Ethiopian Pharmaceutical Supply Services (EPSS) manages the pooled pharmaceutical procurement in Ethiopia. This is a governmental organisation mandated at national level for sustainably availing pharmaceuticals for public health facilities by procuring either from the local or international markets (EPSS, 2024).

1.2. Research Purpose

Pharmaceutical procurement is a critical undertaking in ensuring availability of essential medicine in the health care. Particularly, in the case of low-and-middle-income countries where there is a multiple disease burden (Coates *et al.*, 2021), ensuring availability and affordability of medicine in the health system is an indispensable component of care. Contrary to this, the pharmaceutical product cost in these countries are more than the average compared to their Gross Domestic Product (Dubois *et al.*, 2021).

Ethiopia, like all the other low-and-middle-income countries face difficulties in medicine availability and affordability. The government has set in place a scheme for pharmaceutical procurement through established organizational system for ensuring medicine availability throughout the country (Hailu *et al.*, 2023).

The establishment of EPSS has shown improvements in medicine availability and affordability, yet the procurement of the organization has efficiency gaps in forecast accuracy, procurement cycle time, inventory management, lead time to mention a few (Boche *et al.*, 2022). Even though lean based improvement schemes such as SRM and Kaizen are shown in the procurement plan (EPSA, 2020) the overall picture is not clearly defined and explored enough.

Not only in EPSS, but in general lean and its application haven't been explored well in the pharmaceutical sector, PSCM and in the setting of developing countries including Ethiopia. This research serves the purpose of assessing the applied lean practices/tools and how the procurement efficiency of EPSS has been influenced as a result of that. Given the prime importance of pharmaceutical availability and affordability, examining the efficiency of the process looking at parameters such as lead-time, quality, affordability and how these have been

influenced by lean implementation will bring some light on lean practice in SCM, particularly PSCM.

1.3. Significance of the study

The finding of this study serves as an input for the stakeholders in PSCM. As it assessed the current use of lean in procurement, its influence on procurement efficiency and implementation challenges in EPSS, the study brings an actionable insight. The finding enables decision makers and stakeholders to identify the specific areas where improvements can be drawn through the optimal use of lean in the procurement of the organization.

Moreover, this research contributes for scientific knowledge concerning the lean practice in PSCM looking the particular case of EPSS in Ethiopia. Given the lean application in PSCM is less studied compared to the other industries, the finding of this study provides a unique insight on better integration of lean practices and tools, addressing the implementation challenges based on the experience of EPSS.

Furthermore, this research provides significant contribution for academic and practical understanding. Academically, the study contributes to a body of knowledge through providing theoretical insight and empirical experience from the real-world PSCM setting. By evaluating the relationship between the lean practices/tools and pharmaceutical procurement efficiency, the research bridges the present gap in literature around the influence of lean on PSCM. Thus, offering an analysis and insight that can be referenced and applied in future research endeavours.

From the practical point of view, the result of this study comes up with a lesson that can be used by other similar organisations. By looking the efficiency gain and the challenges in implementation, the research provides a practical guide for managers and practitioner in similar organisations beyond EPSS.

1.4. Research Aim and Objectives

The aim of this research is to assess the use, influence and implementation challenges of lean procurement practices and tools in the pharmaceutical procurement function of Ethiopian Pharmaceutical Supply Services. With this aim the study sought to prove the below hypothesis and answered the research questions addressing the objectives.

Ho: Lean procurement practices and tools have no influence in the procurement efficiency of the Ethiopian Pharmaceutical Supply Services.

Ha: Lean procurement practices and tools influence the procurement efficiency of the Ethiopian Pharmaceutical Supply Services.

Research questions

1. What lean procurement practices and tools are currently utilized within EPSS?
2. How do lean procurement practices and tools influence the procurement efficiency of EPSS?
3. What are the challenges faced in the implementation of the lean procurement practices and tools within the procurement function of EPSS?

Objectives

- Assess the current utilization of lean procurement practices and tools within Ethiopian Pharmaceutical Supply Services
- Evaluate the influence of lean procurement practices and tools on procurement efficiency of Ethiopian Pharmaceutical Supply Services
- Identify challenges for implementation of lean procurement practices and tools in procurement function of Ethiopian Pharmaceutical Supply Services
- Draw recommendation on integration of lean practices and tools to optimize procurement efficiency of Ethiopian Pharmaceutical Supply Services

1.5. Methodology

In this research, a positivism philosophy is applied with deductive approach to address the research objectives looking at the case of EPSS. Quantitative data using structured survey questionnaire was collected in cross-sectional time horizon from staffs in three departments under the in-bound wing of EPSS. The developed questionnaire was organised in Google Forms and shared with the participants. This study used this method for obtaining data to understand the case study of EPSS on the use and influence of lean procurement practices and tools including the implementation challenge.

The quantitative design in this research is justifiable as it helps to assess and establish the extent of use of lean practice and tools in the organization. Moreover, it can measure the relation

between the lean tool and practice in procurement and their influence in procurement efficiency.

Ethical concerns are given due emphasis in undertaking this study. All participants were provided with a clear explanation of the research's purpose and participant information letter was attached with the questionnaires. The collected data was cleaned in Microsoft Excel and analysed using SPSS. Both descriptive and inferential statistical analysis are used to present the overall result. Following the analysis, the findings are presented using tables, figures and discussions.

1.6. Structure of the study

The dissertation encompasses five sections. It starts with the introduction and move to literature review, methodology, result and discussion, and finally the conclusion & recommendation.

1. Introduction provides an overview of the study highlighting the areas that are addressed in this research. It includes the research purpose, its significance, research aim and objective then finally a brief summary of the methodology.
2. The literature review goes through secondary data sources looking for lean practices and tools, their influence on the procurement efficiency and the challenges faced while implementing lean practice in the real world. Different themes relevant to the research objectives are addressed in this section.
3. The methodology elaborated the how part of doing this current study. The philosophy, the strategy, choice and other relevant information of the research method are addressed in this section.
4. The result and discussion presented the findings of the study based on the data obtained from the survey questionnaires. Furthermore, the discussion compared and contrasted the finding with other relevant studies.
5. Finally, the concluding statement, limitations of the study, its contribution and recommendation for further research in the area is presented.

2. LITERATURE REVIEW

2.1 Overview

The literature review encompasses the concept of supply chain management particularly the pharmaceutical supply chain management (PSCM) emphasising the procurement function in PSCM. The introduction of these concepts is followed by the public pharmaceutical procurement practice in Ethiopia as part of providing an insight about the context of the study setting.

In undertaking pharmaceutical procurement, how the efficiency of the process is crucial given its resource intensiveness and its critical place in ensuring pharmaceutical availability in the health sector is discussed. Together with this, the particular context of the low-and-middle income countries where there is high expenditure for pharmaceuticals, how efficiency of the process has an enormous influence on availability and affordability of medicine is indicted in second sub-section of the literature review.

In ensuring the efficiency of the pharmaceutical procurement process, different process optimization concepts, principles, practices and tools can be implemented. Among these, lean thinking, its principles, the practices and tools can be mentioned. The lean procurement and the different practices and tools in lean procurement are discussed in this literature review followed by the influence of these practices and tools in procurement efficiency.

The review started by addressing the lean concept in SCM and the different lean practices and tools under the lean supply chain. Starting from the overall lean supply chain, it tried to see the procurement aspect in depth giving an emphasis on pharmaceutical supply chain perspective. The various tools and practices in lean and their application in different sectors is discussed as part of the literature which is then followed by the specific context of the pharmaceutical sector.

Finally, the challenges and barriers in properly implementing the lean practice in procurement function of pharmaceuticals is explored which is then followed by the conceptual framework of the study and the conclusion of the overall literature review.

2.2 Procurement function in pharmaceutical supply chain management

According to Council of Supply Chain Management Professionals, Supply Chain Management is defined as active management of supply chain for maximizing customer value together with attaining competitive advantage in sustainable manner (CSCMP, 2024). Hailu *et al.*, (2023)

specifically defined pharmaceutical supply chain management as an application of the concept of SCM for managing pharmaceuticals and it requires the coordination of stakeholders, system and process for the flow of pharmaceuticals from the source to end user.

PSCM is among the complex SCM that functions under very dynamic and demanding situations (Gobachew *et al.*, 2021). A review by Argyantari *et al.*, (2020) similarly stated the complexity of PSC looking how it operates under regulated environment given the impacts on human health and safety. This complex task embraces the planning and management of all activities that are involved in sourcing and procurement including the logistic management activities, such as quantification, procurement, inventory management, distribution and information management (USAID|DELIVER PROJECT, 2011).

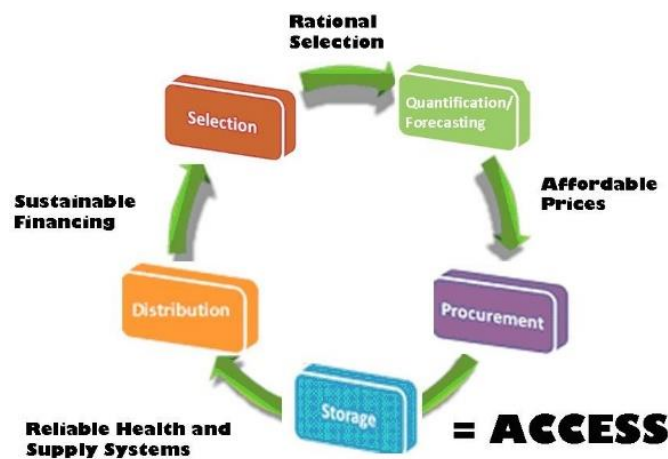


Figure 1: Medicine/Pharmaceutical management cycle (WHO, 2024)

WHO indicted procurement among the main steps in medicine management cycle (WHO, 2024). Similarly, MSH emphasised the procurement function for ensuring pharmaceutical availability and affordability in the health system as it determines the total expenditure of medicine (msh, 2012).

Pharmaceutical procurement can be made from the local market, regional or international sources of suppliers (Gamil, 2020). In all contexts, the procurement process ought to follow a specific standard and procedures that ensures the transparency of the undertaking together with the six rights (right product, right quantity, right quality, at the right time and place with right price) (EPSA, 2020). Mehralian *et al.*, (2017) similarly stated PSC as critical means to ensure accessibility of proper medications for right people, in right time and in right situation for curing disease and alleviating pain.

2.3 National-level public pharmaceutical procurement in Ethiopia

Pharmaceutical supply chain/Health commodity supply chain is a vital element for well-functioning health system. Particularly, in low-and-middle-income countries where vulnerability for communicable and other diseases is high (Donato *et al.*, 2016). It requires enormous investment exceeding 60% of the health expenditure as compared to 30% in developed nations (Maniadakis *et al.*, 2017). However, WHO figure shows slight difference indicating the spending ranges 20%-60% in low-and-middle-income countries compared to 18% in countries in Economic Co-operation and Development (WHO, 2017).

In Ethiopia, a four-year trend looking at pharmaceutical expenditure showed an increased monetary expenditure from 6.5 billion Ethiopian birr (\$112,524,815) in 2015/2016 to 13.3 billion Ethiopian birr (\$230,243,083) in the years 2018/2019 (EPSA, 2020). This figure is comparably higher than Kenya’s pharmaceutical expenditure that reached \$72,820,894 in similar fiscal year (MOH, 2019).

More than 80% of the health service in Ethiopian is provided by the public health facilities (Tadle *et al.*, 2022) and the government has established a pharmaceutical procurement organization called Ethiopia Pharmaceutical Supply Services (EPSS) to handle the PSCM of the country in streamlined approach. EPSS was established in 2007 (proclamation number 553/2007) with the aim of supplying quality and affordable pharmaceutical to all of the public health facilities throughout the country (Abrham Bongasse *et al.*, 2020).

EPSS’s pharmaceutical procurement is conducted through pooled procurement method at national level. Pooled procurement is a class of supply chain models where coordination among buyers motivates competition between suppliers providing advantages for both parties (Dubois *et al.*, 2021). According to Barton *et al.*, (2024), this method ensures reduction in unit price and supply chain process costs. Not only these, it simplifies the administrative burden and contributes for access to products with reduced risk.

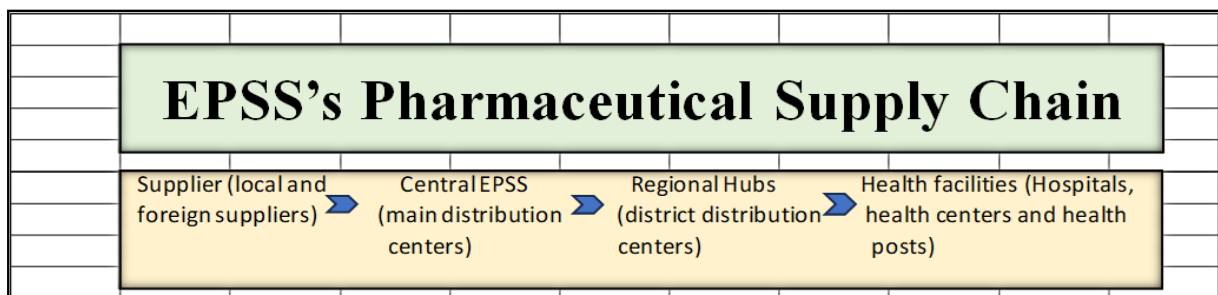


Figure 2. Public pharmaceutical supply chain scheme in Ethiopia -EPSS's pharmaceutical supply chain flow (*Gobachew et al., 2021*)

Currently, more than 80% of the pharmaceuticals supplied to the country is availed through EPSS (*Boche et al., 2022*). EPSS coverage is significantly high as compared to Kenya Medical Supplies Authority (KEMSA's) where the purchase accounts only 30 % of all prescription drugs for the Kenyan market (*Srinivasan and N, 2018*).

As a national pharmaceutical procuring organization, EPSS is working in system establishment, investment and reforms to ensure efficient PSCM. Yet, there are shortcomings in operation such as high level of demand forecasting error, long procurement lead time, inadequate logistic data recording, lesser coordination with supplier and customer among others (*EPSS, 2020*).

2.4 Lean procurement and pharmaceutical supply chain management

Lean as a philosophy and management system has evolved gradually from the original purpose as a tool in manufacturing and production area. Historically, lean was introduced in automotive manufacturer of the Toyota incorporate in their production system for improving operation excellence (*Argiyantari et al., 2020*). However, as highlighted by *Garcia-Buendia et al., (2021)*, through time the lean philosophy and management has developed to embrace human centric approaches that could encompass any process and services in any context. Likewise, another study indicted the application of lean being successfully implemented to sectors outside of the automobile including health care system and has continued to evolve and expand (*Macharia, 2014*).

A study on the relationship between barriers and practices in the lean supply chain management defined lean supply chain management (LSCM) as an adaptation and extension of lean application to supply chain for benefiting in business (*Takeda-Berger et al., 2021*). This is supported by *Kimari and Muli, (2022)* who stated the lean supply chain management in practice brings business benefit by targeting waste, defects and errors together with information communication along the value chain.

Specifically, in pharmaceutical supply chain the application of lean principle in both upstream and downstream functions of PSCM serves as a way of attaining integration and a means to achieve effectiveness sustainably (*Argiyantari et al., 2020*). Similarly, *Oduma, (2019)* stated

lean PSCM as a means to recognize and eliminate wasteful activities along the logistic cycle for increasing product flow and speed.

As part of lean in PSCM, lean procurement is taken as a dynamic practice and philosophy that is concerned with eliminating waste and harnessing continuous improvement in the system through the application of the principles, practices and techniques within the lean concept aiming for reduction of cost, improved quality and efficiency with minimal effort (Omwoyo *et al.*, 2019). Similarly expressed on an article about sustainable lean procurement, in the current demand-driven supply chains, lean procurement is required to achieve maximum customer satisfaction, reduced procurement lead time and costs together with decreasing inventory investment, enhancing inventory turnover, and eliminating waste in the procurement processes (Umasekar, 2024).

In addition, it was mentioned lean procurement is growing as strategic means for ensuring a competitive advantage, efficiency of execution and survival in the system where its use is no more limited in manufacturing context rather embraced by the services companies as adding value and eliminating wastes is no more an option (Macharia, 2014). In specific context of case study in pharmaceutical sector, it was found that lean procurement significantly improved and restructured the procurement process, thereby enhancing supply chain management (SCM) procedures and practices (Selvabaskar *et al.*, 2018).

An article on healthcare logistics and supply chain indicted, nowadays PSCM is extending up to the health facilities and have obtained several strategic places as part of organization management. Strategic decision in logistic management including procurement and the implementation of various lean managements have allowed for continuous improvement in execution. Due to lean implementation, prominent results have been obtained with regard to process improvement, quality and reduction of waste and errors (Ageron *et al.*, 2018). Additional performance improvements were mentioned by Selvabaskar *et al.*, (2018) as a result of lean procurement including minimizing transactions, eliminating wasteful activities, reducing costs, increasing stakeholder satisfaction, and ensuring collaboration with suppliers who meet performance expectations.

As reviewed articles around the lean procurement practices indicted, for the purpose of achieving lean logistic in their system, organizations need to embrace lean thinking (Oduma, 2019). This statement is in agreement with Umasekar, (2024), that stated a company can enhance its financial performance and overall benefits through applying lean to procurement

capability. Moreover, to be referred lean, attributes of lean and integration of lean practice and principles in SCM is mentioned as critical (Takeda-Berger *et al.*, 2021).

2.5 Lean procurement practices and tools in procurement function

It's believed that extending the lean practice throughout the supply chain is important for organizations success and competitiveness (Argiyantari *et al.*,2020). Particularly, in procurement function, several stakeholders with diverse experience and interest are involved. Hence, necessary tools are required to ease the process together with ensuring effective and efficient procurement execution (Mutiara Supatmanto *et al.*, 2023).

A review on lean SCM frameworks came up with eight pillars and sub-elements of lean SCM tools that can be applied across the functions. These included Information technology management (IT), supplier management, elimination of waste, Just in time (JIT), customer relationship management(CRM), logistic management, top management commitment and continuous improvement (Argiyantari *et al.*, 2020). Moreover, literature review of this study around the common lean procurement practices and tools in procurement function identified and came up with the following common practices and tools which are discussed in detail subsequently.



Figure 3. Identified Lean practices/ tools in procurement in lean supply chain management

Supplier Relationship Management (SRM)

Supplier relationship management is an important aspect in SCM since it's a means for competitive advantage in organizations (Rockson *et al.*, 2017). According to Argiyantari *et al.*, (2020), it's stated as a way of taking actions in supplier development, evaluation, long term partnership and cost-based negotiation to promote process outcome and cost-efficiency. similarly expressed by Kevin and Odero, (2023) it includes practices of supplier segmentation,

information sharing and communication, supplier selection, development, collaboration and evaluation.

In attaining an operational excellence, enhanced supplier-buyer relationship needs to be ensured by organizations. Strength of the relationship between the supplier and buyer immensely contributes for competitively priced products and service provision with better quality. Not only these, the positive relationship between supplier and buyer results in mutual trust, responsiveness and communication (Asa *et al.*, 2023).

Just-in-Time

Just in time procurement is taken as a strategy for ensuring provision of the right quantity of product at the right time by eliminating wasteful practices (Mutua *et al.*, 2021). This can be further elaborated by Balkhi *et al.*, (2022) statement which stated JIT as an advanced stock management strategy where the system of supply and demand relies on a flow that tries to perfectly match the demand with the supply side.

In JIT, inventor restocking and placing an order for future use is based on priorly set minimum level of inventory by using stock level indicators for meeting the current demand and avoiding unnecessary over stock (Taghipour *et al.*, 2019). Supported by ARWA AL-KARBI, (2021) JIT is generally characterized by holding minimum stock, in shorter supply chains and with small volume.

Customer Relationship Management

Customer Relationship Management (CRM) considered as organization and enterprises strategy that inclines to a customer focused perspective rather than the product focused one in the relationship management (Ferrer-Estévez and Chalmeta, 2022). This perspective is complemented by Argiyantari *et al.*, (2020) as CRM functions look value from the customer side and considers their involvement seeking for value adding process and cost reduction. It encompasses specifying value from the customers' viewpoint, involving them in the process and continuously evaluating the customer feedback for improvement.

E-procurement

In order to minimize expenditure on the procurement process, internet technologies and the application of E-procurement are getting popular in the current world and implemented by government and private enterprises (Lemayian, 2018). It is considered as a revolution due to

its potential in total cost reduction (Masheti,2016). According to the finding by Hailu *et al.*, (2023), the implementation of IT technology in pharmaceutical supply chain has positive relationship with the organization performance as a focus on automation and integration of information exchange are deemed essential in the supply chain practices and operational performance, procurement being among the vital operations.

Employee involvement

In organisations, lean culture enables employees to get equal opportunity for promotion and develop a greater sense of ownership. In lean supply chain, employee empowerment is considered among the elements of top management commitment that need to be fulfilled to ensure leanness in SCM (Argiyantari *et al.*, 2020). Furthermore, in procurement, especially in the implementation of lean procurement/ JIT procurement aiming for cost effective methods for delivering the right quantity and quality product at the right time, the total employee involvement and team work was found having crucial contribution (Macharia, 2014).

Continuous Improvement

The continuous improvement aspect embraces the use of lean tools like kaizen, Value-stream mapping (VSM), total quality management (TQM) to name a few as means of performance improvement in procurement function (Mutua *et al.*, 2021) (Osodo and Onjure, 2019).

Lean kaizen is a systemic approach for identifying and eliminating waste through continuous improvement. It contributes for waste reduction, cost cutting and managing non-value-added activities that results in development of company, agility and its responsiveness (Srinivasan and N, 2018). Whereas, total quality management is pointed as management system that is based on the principle where each organizational member or staff should be committed for maintaining high standard of work in all the aspects of the process and services of a business (Sharma and Modgil, 2019).

Accordingly, the use of these lean tools is stated to ensure product availability and enables the delivery of high-quality products to customers. The practices in TQM are the core for attaining a seamless supply chain that will have a bigger effect in achieving operation performance (Aguirre Manrique *et al.*, 2023).

2.6 Procurement efficiency and the influence of lean procurement practices and tools

Procurement efficiency is measured by the different dimension that explains its performance. According to Oxford College of procurement, the goals of procurement are measured against the metrics of price, quality, quantity, time and place (Barrington, 2019). Similarly, the procurement performance indicators guide, categorized procurement performance measures based on the time spent in process, the associated cost, quality and its system integrity (USAID, 2013). In procurement, the efficiency of process is influenced by different aspects (Oloo, 2021). The following review discusses about procurement efficiency considering the aforementioned procurement efficiency metrics and exploring how lean practices and tools influence efficiency of procurement across various sectors in particular looking the context of the pharmaceuticals procurement.

In current operation practices where uncertainties and resource constraints are common, lean offers the capability to optimize productivity and service through the application of lean principles, practices and tools (Kessy *et al.*, 2024). A Study done in Kenya on influence of lean tools on procurement found that JIT, E-procurement, SRM, and continuous improvement have positive relationship with procurement performance as measured by mean and standard deviation values. Statistically significant influence was observed as the findings indicted. E-procurement ($\beta=0.255$, $P=0.024$), SRM ($\beta=0.257$, $P=0.047$) and JIT ($\beta=0.279$, $P=0.035$) were found an influencing factors in the procurement performance as the regression coefficient evidenced (Osodo and Onjure, 2019).

A study conducted in Rwanda manufacturing industries showed, JIT having a significant contribution to procurement performance (M.J and M.P,2020). Similarly, study to assess the effect of JIT procurement strategy showed variation of 16.7% on the organization performance of food and beverage manufacturers after JIT implementation (Mutua *et al.*, 2021).

Likewise, an exploratory study of lean health care on the implementation of lean in the logistic management of a hospital showed JIT implementation reduce inventory and improve cost efficiency as interview respondents indicted (Munaa *et al.*, 2023). In contrast, a study discussing JIT implementation and operational performance showed, in private owned firms, JIT has no significant contribution for operational performance improvement ($\beta=0.284$, $P=0.062$) (Chen and Hua Tan, 2013).

A research paper looking the relationship between SRM and ethical procurement with supply chain performance showed there is a significant positive association between SRM practices and supply chain performance ($R^2 = 0.657$, $p = 0.000$) which is a change in 65.7% in supply chain performance due to SRM. As the study concluded the established SRM has increased the performance of supply chain in terms of effectiveness, efficiency, quality and customer satisfaction (Kevin and Odero, 2023). Likewise, supplier-buyer trust showed a positive significant influence on the performance of private and public hospitals in Ghana. According to the finding, the higher level of trust for the suppliers has a significant impact on performance from the perspectives of sale, customer service and the competitive positions as indicted by path coefficient of 0.56 with P-value < 0.001 (Oduro *et al.*, 2020).

Different from the above findings, a study looking the relationship between SRM & performance demonstrated negative and non-significant ($\beta = -0.03$, $p < .676$) relationship between SRM and cost capability (Poku, 2022). Asa *et al.*, (2023) in their finding indicted pharmaceutical organizations should make an emphasis and commitment to SRM through implementing system that optimize efficiency. According to the respondents 43% of them strongly agree and 25% agree that the existence of buyer-supplier relationship & trust have contributed to performance of the public procurement.

Regarding the relationship of IT implementation and procurement performance, study in Kenya on the factors that affect efficiency in the procurement process showed, IT integration has a positive result on procurement efficiency in public procurement projects (David and Charles, 2023). Similarly, a review on strategic issues in pharmaceutical supply chain showed E-procurement can be applied for reducing transaction costs through demand aggregation, improving operational efficiency, facilitating access to broader supplier base and evaluating the procurement patterns (Singh *et al.*, 2016).

In contrary, although most the study findings showed positive relationship between E-Procurement and supply chain performances, Madzimore *et al.*, (2020) finding showed E-procurement components of E-sourcing ($\beta = 0.31$, $P > 0.1$), E-evaluation ($\beta = -0.018$, $P > 0.1$), E-information (-0.002 , $P > 0.1$) were not significantly related to the supplier integration which is a contributor for procurement efficiency.

Concerning engagement of employee and customer in procurement, a study by Osodo and Onjure, (2019) on influence of lean procurement tools on procurement efficiency found employee personal performance and engagement has helped in improvement of procurement

performance as indicated by (mean value of 4/5 with SD=0.86). In similar way, a study investigating the relationship of SCM with performance (efficiency and productivity) in pharmaceutical companies revealed positive relationship between customer relationship management and performance. The relationship was quantified with standard beta coefficient of 0.613 and found statistically significant with p-value <0.001(Omoush, 2020). In agreement with the above findings, Das and Hassan, (2022) finding demonstrated CRM is significantly related to organizational performance in ensuring business effectiveness as asserted by the regression coefficient of $\beta=0.308$, ($p < 0.01$).

In research assessing the relation between SCM performance and lean tool, specifically TQM, an operational performance improvement was recorded in pharmaceutical company. Operational performance including procurement management of the company was impacted by the application of TQM (Sharma and Modgil, 2019). In the same way, in review paper about the impact of lean tools on SCM in pharmaceutical industry, it was showed the application of TQM has contribution for delivering high-quality products in procurement of goods. Not only that, its application has also impacted other lean practices like SRM and has brought improvement in transparency, quality and inventory (Aguirre Manrique, *et al.*, 2023).

Different from the other studies, finding of a research on TQM dimensions and performance improvement revealed only two of the practices, employee involvement ($\beta=0.347$, $P<0.05$) & continuous improvement ($\beta=0.319$, $P<0.05$) having significant positive relationship with performance whereas no significant relation was found between customer focused practice ($\beta=0.031$) & top management support ($\beta=0.211$) and performance (Mehralian *et al.*, 2017).

Looking to kaizen the other CIP lean tool, Ouma *et al.*, (2015) in their study about the effect of kaizen in managing cost levels in the pharmaceutical industry came up with a positive relationship between Kaizen and managing cost levels in the pharmaceutical industries. Accordingly, the overall relationship between Kaizen and cost level management was demonstrated statistically significant ($\chi^2=12.989$, $df=6$, $p=0.043$).

Similarly, in a review about lean supply chain management in health care, in a hospital setup, it was found that implementation of kaizen has improved medication distribution system, decreased the health care cost, created value chain and improved organizational performance. The review concluded that for improving the SCM in health care, consideration need to be made for adopting lean thinking approach in the supply chain management (Khorasani *et al.*, 2019).

2.7 Challenges in implementing lean procurement practices and tools

Lean practices and the use of lean tools have been successfully adopted in various sectors such as manufacturing, construction and to some extent in the healthcare. Despite these successes, the implementation of LSCM practices face significant challenges due to the inherent complexity of supply chain (Ali *et al.*, 2020). According to Takeda-Berger *et al.*, (2021), while LSCM practices provides multiple benefits, their implementation is hindered by several barriers such as lack of understanding of concepts, resistance to change from senior management and cultural aspects that push behind the necessary steps to sustain the implementation.

Similarly, a comprehensive study analysing critical barriers to LSCM implementation categorized the barriers into internal to the organizations and external barriers. Internal barriers included the culture of the organization, resources, management issues, technology, and partially issue of infrastructure. The mentioned external barriers were lack of supply chain integration and other environmental factors including infrastructure. According to this study internal barriers are the most impactful obstacles to the successful implementation of lean practices in supply chain (Rossini, 2019).

Different studies around the challenge in implementing lean tools and practices came up with findings that are fairly closer to each other. A study to examine Lean Six Sigma (LSS) implementation in supply chain found that lack of executive management involvement as a significant barrier for its implementation as part of resistance to organizational cultural change (Ali *et al.*, 2020). Similarly, an article on challenges in lean transformation indicated the organizational culture as a major barrier to successful lean implementation. The finding highlighted cultural shift as a backbone for effectiveness of the lean approach (Maware and Parsley, 2022).

Specifically looking to procurement, an evaluation of lean procurement design identified challenges in the implementation of lean tools that were linked to the commitment of leadership, involvement of suppliers, cooperation and knowledge of employees and training of workers involved in procurement (Yaqoobi, 2021). Likewise, a review on lean transformation in pharmaceutical supply chain emphasized the competence of human resources as a crucial factor in effectively executing the lean framework in the actual setting of the PSCM (Argiyantari *et al.*, 2020).

According to the study of Alrashed, (2020) exploring the application of lean thinking in health economics to enhance healthcare delivery, several challenges were identified. These include difficulty of managing product supply on a JIT basis, cultural barriers, and technological challenges, particularly system automation. Additionally, a systemic review and meta-analysis on LSC implementation in health care setting showed it is challenging to implement LSC in health care. The major constraints summarized based on the review were, complexity of Health SCM, leadership and organizational characteristics, cost and funding issues, ICT, stakeholders and customers characteristics, technical know-how and lean process and priorities (Khorasani *et al.*, 2019).

On introducing the lean concept into the internal drug supply chain of a hospital using an innovative approach, it was demonstrated that the implementation was ineffective due to gap in commitment and knowledge of employees (Regattieri *et al.*, 2018). In Case study of the implementation of kanban (lean and JIT techniques) in pharmaceutical supply chain, it was found that the adoption of these tools provided a strategic benefit, yet full application wasn't possible due to unfamiliarity of the techniques to the employees and lack of readiness for change. Majority of the employees were worried about the potential risks associated with kanban implementation (Papalexi *et al.*, 2016).

In similar manner, review on success and challenges of health supply chain in pharmaceutical procurement under supply chain and lean supply chain integration identified key challenges in lean implementation. These included issues related with communication, cooperation, top management commitment, project management skill, training and resistance to change (Ageron *et al.*, 2018). On the same note, an analysis of supply chain constraints conducted using the Lean Six Sigma DMAIC method in the Ethiopian Pharmaceutical Supply Service identified procurement challenges such as lack of automation of procurement activities and performance issues due to skill gaps at various levels of professional activities (Abrham Bongasse *et al.*, 2020).

2.8 Conceptual framework

The conceptual framework of this study is constructed based on the review of the literature about the lean procurement practices and tools in procurement function, how their implementation relates to efficiency metrics of pharmaceutical procurement and what are the challenges in real world for effectively implementing the lean concept in procurement, particularly in the context of the pharmaceutical supply chain.

Lean procurement practices and tools such as the SRM, JIT, E-procurement etc. constitute the independent variables whereas the procurement efficiency measured by the cost, quality, time and inventory defined the dependent variable of this study as depicted in the conceptual framework. As literature review demonstrated, there are wide variety of lean practices and tools that are applied in different sectors according to the context and perceived contribution to performance efficiency.

The following conceptual framework is drawn as a result of the deep literature review and adaptation of the contents of conceptual frame work from similar studies around lean procurement, lean practice/tools and procurement efficiency as well as based on articles that looked the challenges in lean implementation.

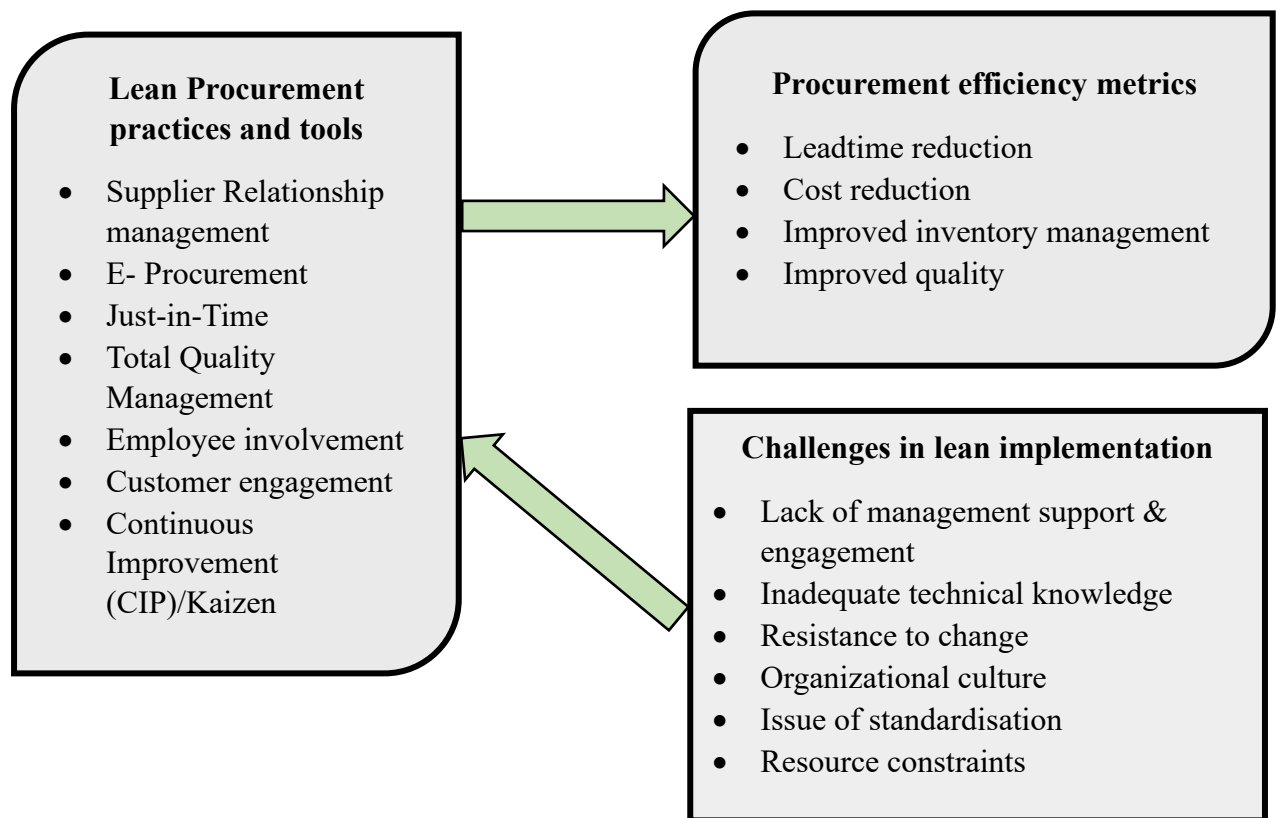


Figure 4: Conceptual framework

Sources: Adapted and modified from studies by (Osodo and Onjure, 2019), (Argiyantari *et al.*, 2020), (Macharia, 2014)

2.9 Conclusion

Literature review concerning lean procurement practices and tools showed that there are adequate research articles around lean thinking, principles and tools in automobile industry, construction and other manufacturing sectors. Numerous research publications, systematic reviews, and meta-analyses are available on lean principles and their applications in general. But relatively limited information and research is done on lean application in supply chain management and the service sectors. Besides, the lean aspect in SCM particularly in pharmaceutical supply chain management is not explored enough.

According to the literature review, it is found different lean tools and practices are used for SCM performance improvement including procurement efficiency. The influence of lean tools & practices on pharmaceuticals procurement has been explored and the use of these lean tools/practices such as SRM, E-procurement, JIT, TQM etc. have been found influencing the procurement efficiency of pharmaceuticals.

Although, the lean tools/practices found contributing for efficiency of performance, their implementation is affected due to different challenges. These challenges include, issues of organizational management support, inadequate technical knowledge & skill about lean, the organizational culture, resistance to change and resource constraints among others.

Generally, based on the comprehensive review of the literatures on this specific topic area, it is evident that there are potentially enormous study areas that can be explored to bridge the gap in understanding of lean in the context of PSCM. A more detailed exploration of how lean procurement influence efficiency of pharmaceutical procurement could offer better insight and understanding.

3. METHODOLOGY AND RESEARCH DESIGN

3.1 Overview

In the methodology and research design part of this document, all the details related to the research philosophy, the approach, strategy, the choice, time frame, ethical issues, data collection and analysis of this study are addressed in detail. This research assesses the use of lean procurement practices and tools and their influence on procurement efficiency of EPSS. Referring to research onion by Saunders *et al.*,(2019), the specific research philosophy applied in this research, it's relevance for the context of this study together with the approach is covered in the first sub-section of this chapter.

The strategy and the choice of this study are discussed with due explanation following the concepts of research strategy and choice included in research onion. Then, the collection of primary data which entails, how primary data was obtained, from what source and population data was collected and how ethical issues were handled in conducting the research are explicitly elaborated.

Finally, the data analysis approach sub-section is discussed covering how the raw data is managed to give a meaningful interpretation without any bias to the finding. In addition to this, the presentation of the analysed data is explained giving the overall picture on data analysis and presentation.

Each sub-sections following this overview provide a detail of the research method and design of this study following the research onion principle. The research onion below is an adaptation from the original research onion diagram showing what specifically is applied in this study from the available alternatives.

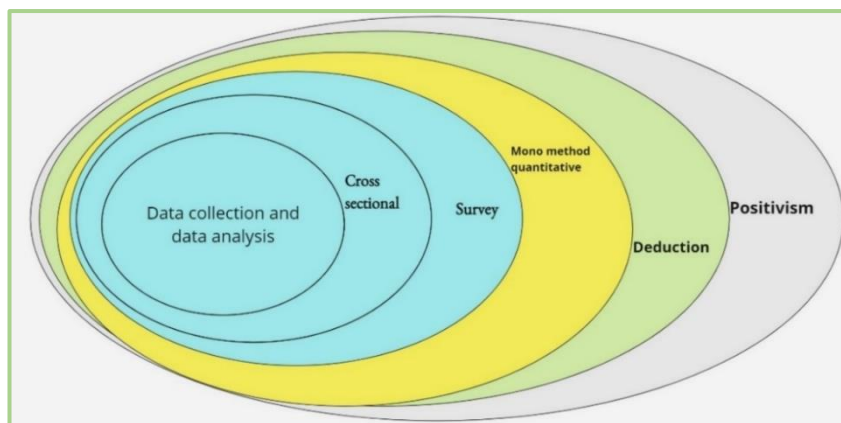


Figure 5. An adaption of research onion (Saunders et al., 2019)

3.2 Research Philosophy and Approach

Research philosophy refers the systematic way of belief and assumption on the development of knowledge. It is about what is going to be done in the research that is developing knowledge in specific field of study. The knowledge generation doesn't have to be always dramatic one rather addresses a specific problem in particular organisation or situation (Saunders *et al.*, 2019).

There are different worldviews or paradigms in research philosophy. Although there is disagreement on what worldview or paradigm researchers should bring to inquiry , there are four paradigms that are widely found and used in literatures (Creswell and Creswell, 2018).

Table 1. four world views in research philosophy

Positivism *	Interpretivism/Constructivism
Determination Reductionism Empirical observation and measurement Theory Verification	Understanding Multiple participant meanings Social and historical construction Theory generation
Transformative	Pragmatism
Political Power and justice oriented Collaborative Change oriented	Consequences of action Problem-centred Pluralistic Real- world practice oriented

In this research, a positivism philosophy is applied to answer the research questions. In this philosophy, use of existing theory is applied to develop hypothesis or research questions. These hypotheses or questions are tested and confirmed, partially or wholly or disproved, leading to further development of theory which then may be tested by further research (Saunders *et al.*, 2019). Accordingly, positivism is based on the belief of objective reality that can be measured and quantified. This worldview is sometimes called the scientific method or doing scientific research. It is also referred as positivist/postpositivist, empirical and post-positivism (Creswell and Creswell, 2018).

By its nature the positivism reflects a deterministic philosophy about research in which causes probably determine effects or outcomes. Problems studied by this philosophy reflect issues that need to identify and assess the causes that influence the outcomes (Creswell and Creswell, 2018). This approach is appropriate for this research since it allows to look in to the existing

facts and objective realities on the utilization and the influence of lean procurement practices and tools on procurement efficiency.

Accordingly, following the positivism worldview and basing on the lean theories and practices out in the world, this present study addressed the objectives of the research about what lean procurement practices and tools are applied in EPSS, how procurement efficiency is influenced due to the use of lean tools/practices together with the challenges in implementation of lean in this specific organization.

Concerning the research approach, three known approaches exist; deductive, inductive, and abductive. Among these, the inductive and deductive are the commonly used ones (Saunders *et al.*, 2019). Inductive approach involves emerging questions, data collected typically in participants' setting and analysis of data building from the specific to the general. Following that, the researcher interprets the meaning of the data and generate report which is flexible in structure. Whereas the deductive approach, engages in form of inquiry with an assumption of testing theories deductively, considering protection against bias, controlling alternative and contrary explanations and able to generalize and replicate findings of the study (Creswell and Creswell, 2018).

In this research, deductive reasoning is applied to assess the influence of lean procurement practices and tools on procurement efficiency. This answered the research questions derived from the theories on lean procurement practices and their influence on efficiency of procurement. Based on the existing theories around lean procurement use and its influence on performance efficiency, this research tested the theory taking the pharmaceutical sector and looking the specific context of EPSS.

3.3 Research Strategy and Choice

The strategy for this study followed survey research strategy focusing on the case of EPSS to assess the influence of lean procurement practices and tools on the organization's procurement efficiency. A quantitative, mono-method approach is utilized to obtain data to answer the research questions.

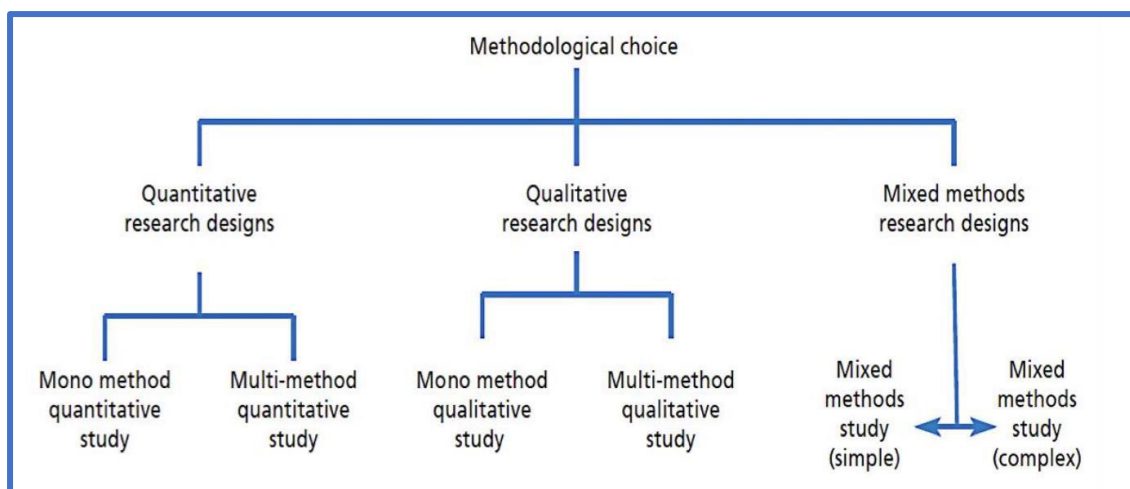


Figure 6. Alternative methodological choices in undertaking research

Commonly in quantitative, qualitative or mixed methods research design, one means of differentiating quantitative research from qualitative research is to distinguish between numeric data and non-numeric data. Quantitative mostly used for data collection techniques using questionnaires and analysis such as graphs and statistics. Whereas qualitative majorly used as a synonym for data collection using interview and analysis like categorising data. However, this distinction is both problematic and narrow since in practices their application crosses these borders (Saunders *et al.*, 2019).

The quantitative design could be experimental or non-experimental. In this research the non-experimental quantitative design is applied. Non-experimental quantitative research is a correlational design that researcher use the correlational statistics to describe and measure the degree or association (or relationship) between two or more variables (Creswell and Creswell, 2018). This study uses the non-experimental quantitative method for obtaining data to understand the case study of EPSS on the use and influence of lean procurement practices and tools including the implementation challenges.

Accordingly, the quantitative design in this research is justifiable as it helps to establish numerically the extent of utilization of lean practice and tools in the organization. Besides, this approach allows to measure the relationship between lean tools and practices in procurement and their influence on procurement efficiency.

3.4 Collection of the primary data

In this research where a mono method is used as research choice, quantitative data was collected from the research participants to answer the research questions. A survey questionnaire was used to obtain data from the study participants. The survey questionnaire was developed in alignment with the research questions, after looking across literatures in the area and referring relevant materials to obtain additional inputs. The developed questionnaire is organised in Google form and shared with the study participants.

In this study, the quantitative survey type data collection is chosen as it's logically justifiable to answer the research questions and also mitigates the language barrier challenge that could be encountered if interview was applied as a means of data collection. Since the working language of the study area is a local language and it's not customary to use English for routine communication, choosing an interview as a means of data collection would be challenging from the perspectives of both reaching the depth of information and respecting participants choice.

The survey questionnaire is consisted of questions that are developed in alignment with the research objectives and inquiries. The questionnaire is organised in to five sections to gather data that enables answering the research objectives.

Table 2. Summary of the survey questionnaire

Section number	Section heading	Number of questions per section	Source references
1	General information and demographic background of respondent	5	(Masheti, 2016)
2	Lean procurement practices/tools use and extent of utilization	15	(El-Khalil, 2022), (Kimari and Muli, 2022), (Osodo and Onjure, 2019)
3	Lean procurement practice/ tools and procurement efficiency	9	(USAID,2013), (Barrington,2019), (Osodo and Onjure, 2019)
4	Challenges in the implementation of lean procurement practices/tools	12	(Takeda-Berger <i>et al.</i> , 2021), (Khorasani <i>et al.</i> , 2019), (Argiyantari <i>et al.</i> , 2020), (Rossini, 2019)
5	Overall procurement efficiency of EPSS	5	(Macharia,2014), (USAID,2013), (Barrington, 2019)

3.4.1 Sources and sampling

The target population for this specific study are staffs from EPSS. Staffs from the three directorates (Quantification and market shaping directorate, Contract management directorate, and Tender management directorate) are source population for the study. The study populations are the technical staffs that are working in these three directorates. The non-technical (support staffs) are excluded from the study. The total number of staff members in these directorates are 93 in total (Tilahun, 2023). Among which 72 of them are technical staffs and these are purposively selected based on their relevance to answer the research questions of the study.

In undertaking research, whatever research questions and objectives we have, it is a requirement to consider the sampling perspective. In some instances however it may be possible to collect and analyse data from every possible case or group members termed as census (Saunders *et al.*, 2019). Accordingly, when data for small areas are available and we want to get an accurate data, we use census. In this study, a census is applied to collect data from all the technical staffs working in pharmaceutical procurement function in the three directorate under in-bound section of EPSS using the survey questionnaire.

3.4.2 Access and Ethical issues

Obtaining quality primary data is considered critically important in pursuing this study. As per the plan, preliminary preparatory activities were undertaken before the period of the data collection to ensure access to primary data. The first task was to duly prepare the ethical declaration form which is the most important document to make a communication with the relevant data collection site to proceed with the data collection.

Ethical consideration has a paramount importance not solely in data collection but in the whole process of the research journey. Ethical issue are concerns prior to conducting research, beginning of the study, in collecting data, analysing, reporting, sharing and storing data all the way (Creswell and Creswell, 2018). The conduct of a research is likely to be guided by the university's code of ethics or ethical guidelines. A code of ethics provides a statement of principles and procedures for the conduct of a research highlighting what is and what is not considered ethical (Saunders *et al.*, 2019). In this study, prior to the data collection the ethical form is prepared, reviewed and then signed by the supervisor to avoid ethical breaches in undertaking the research.

The data collection survey tool contained a brief informative explanation (participant information letter) about the aim of the study, its objective and purpose. At the end of the

information page, participant consent is requested for their participation. Following the data collection, the data is handled ethically and will be handled ethically in the future as well. The response of the participant will be kept anonymous and access to data is granted only for relevant bodies.

The ethical consideration extends up to the data analysis, reporting and storage of the raw data. The finding of the data is presented without any bias that is in favour of the prior assumption around the study topic. All the findings are presented as indicted in the output of the analysis. Finally, the raw data will be secularly kept for a period of 2 years and will be discarded afterwards.

3.5 Approach to data analysis

Quantitative data in its raw form before data have been processed and analysed convey very little meaning to most people. These data, therefore, need to be processed to make them useful, that is, to turn into information. Quantitative analysis techniques such as descriptive and inferential statistics allow us to do this by helping to explore, present, describe and examine relationships and trends within our data (Saunders *et al.*, 2019).

The collected primary data using the Google form was transferred directly to Microsoft excel to check each of the data set in rows and columns for data completeness. According to (Samuels), 2020 on simple guide on quantitative data analysis, it was mentioned that looking in to the raw data in rows and columns should precede the summary statistics, especially for data collected using an online questionnaire.

In analysing a quantitative data, multiple interconnected processes are taken place whereby organising the data takes the first place (Ghanad, 2023). In this study, the raw data was cleaned using Microsoft excel and transferred to Statistical Package for Social Science (SPSS) for data analysis. Following this, a descriptive analysis of the study is presented with frequencies, central tendency and variance. Descriptive analysis should indicate the mean, standard deviation and range of scores for the dependent and independent variables (Creswell and Creswell, 2018).

Following the descriptive analysis, correlational and inferential analysis has followed. The explanatory variables of both the dependent and independent variables were computed to calculate their composite mean and changing the ordinal data of the Likert type to Likert scale

interval data. According to Alkharusi, (2022), data from individual Likert-type items might arguably be ordinal level of measurement whereas data from Likert scales are interval level of measurement. Similarly, a review on Likert scale analysis concluded Likert scale is a total of multiple Likert items and can be treated as continuous (Tanujaya *et al.*, 2023).

Accordingly, Likert scale produces interval data when the data generated are composite scores derived from multiple items (Tanujaya *et al.*, 2023) and can be analysed by calculating the means and SD as well as applying parametric data analysis approaches (Alkharusi, 2022). In this present study, to see the relationship between the lean procurement practices/tools with pharmaceuticals procurement efficiency a parametric correlational analysis is conducted after checking the required preconditions to undertake the parametric analysis.

Then simple linear regression analysis was conducted to see the influence of the lean tools and practices on the procurement efficiency of the organization. Finally, all the descriptive and inferential analysis results are presented by tables, figures and discussing the finding with prior similar relevant studies in the area.

3.6 Conclusion

The methodology and research design part has been detailed in this section following research onion. The positivism research philosophy is used with the deductive approach to evaluate the existing lean practices/tools in the context of the research topic of the study by applying the quantitative mono-method strategy as a means for obtaining data. Accordingly, quantitative method is chosen to collect primary data in cross sectional time frame.

The primary data is collected from experts working in pharmaceutical procurement function at EPSS using structured-survey questionnaire organized in Google form. The collected raw data is then cleaned and organized using Microsoft excel. Following that the data is analysed using SPSS to give meaningful interpretation. Descriptive and inferential analysis is applied and the findings are presented using tables, figures and explanatory discussion.

4. PRESENTATION AND DISCUSSION OF THE FINDING

4.1 Overview

This section on the presentation and discussion of the finding presented the result of this study as obtained from the analysis of the data, followed by the discussion of the finding comparing and contrasting it with other related studies.

The first part is about the finding of the study. It starts with the sociodemographic characteristics of the study participants followed by each of the findings around the research questions. The result presentation started with descriptive analysis presentation. Accordingly, the lean procurement practices/tools use and their extent of utilization in EPSS is addressed. This part is followed by the lean procurement practices/tools and procurement efficiency which looks at the efficiency matrices in pharmaceutical procurement. Then, the challenges in implementing the lean tools and practices in EPSS is covered. The descriptive part is presented with percentage figures, mean and standard deviations and correlation analysis of the variables.

Following the descriptive statistics presentation, the inferential statistics of simple linear regression is presented to show the influence of lean procurement practices and tools on the procurement efficiency of the organization.

Then, the next part covered the discussion of the finding of this study comparing and contrasting it with other relevant research articles. Finally, this section is concluded summarizing the areas covered by the presentation and discussion of the finding.

4.2 Findings

4.2.1 Socio Demographic Characteristics of Study Participants

The background information of the participants includes their work experience, educational attainment, the specific directorate they are working in under the in-bound section and their responsibility or position within the directorates. It is considered important to obtain background information for understanding the response of the participants and establish trust on the finding of the study given the background of the respondents is known.

Among the seventy-two (72) eligible study participants enrolled in the study, sixty-three (63) participants filled out the survey questionnaire. None of the responses were rejected as all the questionnaires were filled out appropriately. Accordingly, the response rate was found 87.5%.

Among the respondents' half (50.8%) of them have a qualification in Bachelor's degree and the rest have attained post graduate degree. Majority of the respondents (41.3%) have more than ten years of relevant work experience in pharmaceutical procurement area.

The study participants are from the three directorates under the in-bound section who are involved in pharmaceutical procurement function under EPSS. Some of them are not specifically working for only one of the directorates rather provide a technical and an overall procurement advisory support in procurement related functions undertaken in all the three directorates. The overall sociodemographic characteristics of the study participants is summarised in the table below.

Table 3. Sociodemographic characteristics of the study participants

S. N	Question	Categories	Frequency	Percent
1	Educational qualification	Bachelor's Degree	32	50.8%
		Post graduate Degree	30	47.6%
		Above Post graduate degree	1	1.6%
2	Relevant work experience	Less than 2 years	7	11.1%
		2-5 years	13	20.6%
		5-10 years	17	27.0%
		More than 10 years	26	41.3%
3	Directorate they are currently working in	Tender Management Directorate	16	25.4%
		Contract Management Directorate	17	27.0%
		Quantification and Market Shaping Directorate	19	30.2%
		Other	11	17.5%
4	Position within the directorates under in bound section	Coordinator	10	15.9%
		Senior expert	23	36.5%
		Junior staff	15	23.8%
		Technical Advisor	11	17.5%
		Other	4	6.3%
	Total number of participants		63	100%

4.2.2 Reliability Test

In both adopting questionnaires as well as designing a new one for data collection, we need to ensure that the scales are valid and reliable. The reliability is about ensuring the variables are measuring what they are supposed to measure accurately. Questionnaire often consists of group

of questions designed to measure the same thing, known as scales. In this sense to make the analysis easier and accurate, we analyse the values of the scales that are numeric rather than each of the individual question (items) that are often ordinal (Samuels, 2020).

A reliability analysis was made to ensure the questions in the survey questionnaires are reliable to measure what they are intended to measure. The following result was obtained from the reliability analysis for four of the sections in the questionnaire using Cronbach’s alpha statistics.

Table 4. Reliability test results: Cronbach’s Alpha values

Variables	N items	Cronbach’s Alpha
Extent of use of the lean tools/practices	7	0.769
Lean tools/practices on procurement efficiency	7	0.922
Overall procurement efficiency	5	0.780
Challenges	11	0.789

The value for Cronbach's Alpha is generally considered acceptable when it’s between 0.7-0.95 (Tavakol and Dennick, 2011). Accordingly, the values obtained for the scale questions for this research fall under the acceptable range of the Cronbach's Alpha.

4.2.3 The use and extent of utilization of lean procurement tools/ Practices

This section presents the descriptive result finding on the use and the extent of utilization of lean procurement tools and practices in procurement task of EPSS. Response was sought from the staffs involved in pharmaceutical procurement function on the use and the extent of utilization of each of the tools/practices in their organization. As the first objective is about assessing which lean tools/practices are used in EPSS, response was sought on that and the extent of use was then evaluated following it. The figure below summarizes the use of lean procurement tools/practices as reported by the study participants.

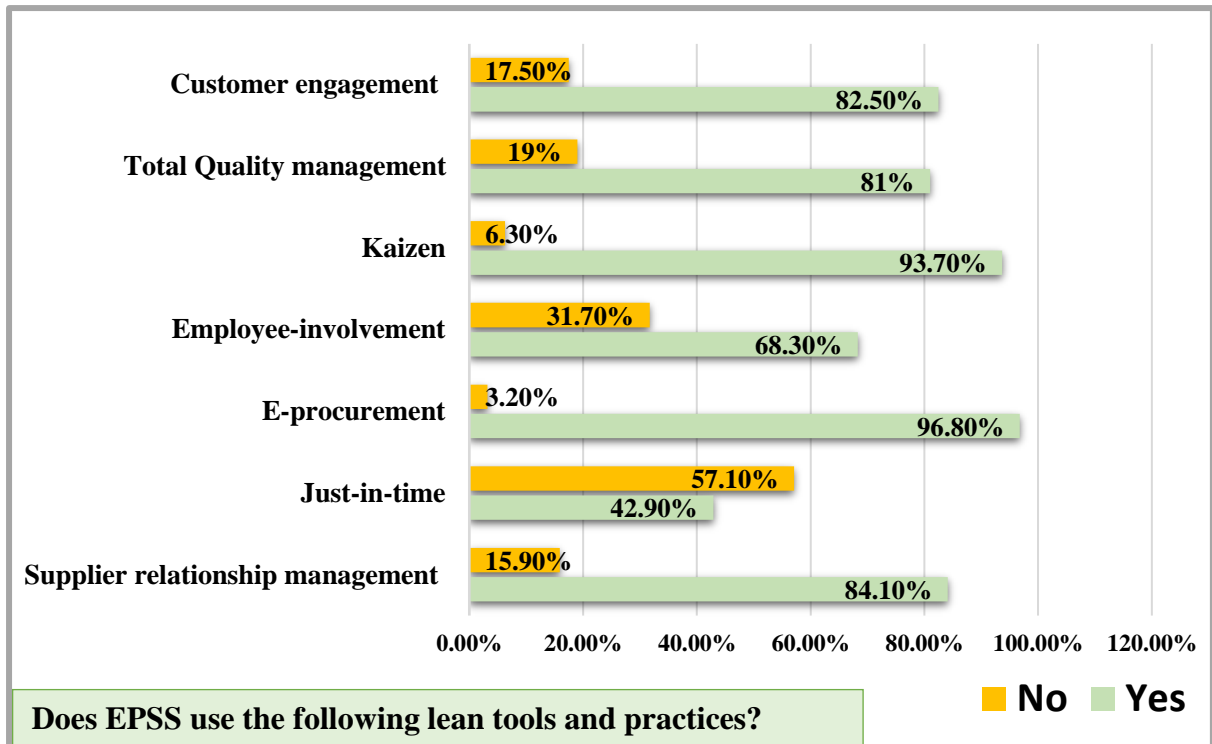


Figure 7. Use of lean procurement tools/practices

Higher percentage of the participants responded the organization use E-procurement (96.8%), Kaizen (93.7%) and supplier relationship management (84.1%) in their procurement function. In the contrary, the response on the use of Just in time in procurement was found low as indicted by only 42.9% of the participants. In addition of the above-mentioned tools, the respondents were asked to mention any other lean tools/practices they use in procurement functions. Accordingly, most of the tools they mentioned fall under the category of electronic recording and reporting such as Health Management Information System, E-procurement specifically Enterprise Resource Planning (ERP) and the long-term framework agreement as part of the SRM.

Following the questions to assess the use of lean procurement practices and tools, the extent of utilization of each of the tools were assessed using a Likert extent scale of five ranging from very low extent to very great extent. Accordingly, the respondents indicted almost all of the lean tools/practices are used in moderate extent in their organization as indicted by the mean and standard deviation values of the analysis. Among which, the extent of utilization of supplier relationship management takes the first place with (M= 3.28, SD=0.662), followed by TQM (M=3.12, SD=0.739), while kaizen was found to have slightly lower value (M= 2.98, SD=0.629). The table below presents the summary of the response concerning the extent of

utilization of each of the lean tool/ practices in EPSS as summarised response using mean and standard deviation values.

Table 5. Extent of the utilization of lean procurement tools/practices in pharmaceutical procurement function at EPSS

Extent of use of lean procurement tools/practices	Mean	Std. Deviation	Minimum	Maximum
Supplier Relationship management	3.28	0.662	2	5
Just-in-time	3.11	0.892	1	5
E-procurement	3.08	0.737	1	5
Employee-involvement/engagement	3.07	0.593	2	4
kaizen	2.98	0.629	2	5
Total quality management	3.12	0.739	2	5
Customer engagement	3.08	0.763	1	5

4.2.4 Procurement efficiency and lean procurement tools/practices

The study participants were asked to rate to what extent the utilization of those lean procurement tools/practices have positively changed the procurement efficiency of pharmaceuticals. Seven explanatory variables were used to evaluate the procurement efficiency of pharmaceuticals. Accordingly, the table below shows the descriptive analysis on the procurement efficiency gains as a result of lean procurement tools/practices.

Table 6. Procurement efficiency due to lean tools/practices

Procurement efficiency	Mean	Std. Deviation	Minimum	Maximum
Reduction in lead time	3.41	0.909	2	5
Improvement of the overall procurement cycle time	3.57	0.797	2	5
Procurement cost savings	3.46	0.895	1	5
Optimization of inventory turnover rate	3.54	0.895	1	5
Reduction of inventory holding (excess product stock in store)	3.49	0.878	2	5
Elimination of non-value adding activities	3.68	0.758	2	5
Increase product quality	3.33	0.803	2	5

The results showed that lean tools/practices have improved procurement efficiency as measured by the efficiency metrics as indicated in lead-time reduction (M= 3.41, SD= 0.909), optimization of inventory turnover rate (M=3.54, SD=0.895), procurement cost-saving (M=3.46, SD=0.895) and all the other metrics. Slightly higher value was obtained with improvement in procurement cycle time (M=3.57, SD=0.797) and elimination of non-value adding activities (M=3.68, SD=0.758). However, in general, the mean values for all the metrics were found very close to each other. Hence, the result implies lean procurement practices/tools helped to reduce the lead-time & cycle time in procurement, save cost, and manage waste together with increasing quality.

4.2.5 Evaluation of the overall pharmaceutical procurement efficiency

The overall pharmaceutical procurement efficiency of EPSS was assessed using five explanatory variables related to time, cost, quality and inventory management parameters. The study participants were requested to assess the procurement efficiency of the organization generally based on the given procurement efficiency metrics.

Among the metrics of the procurement efficiency the cost and quality parameters were found to have higher value compared to the time and inventory management parameters. The procurement performance is good in cost saving (M=3.14, SD=1.060) and supplier performance (M=3.10, SD=0.875) as observed from the mean and standard deviation values of the given procurement efficiency metrics.

This was undertaken to see the overall procurement efficiency of the organization in general for understanding the current status of the organization's procurement performance efficiency.

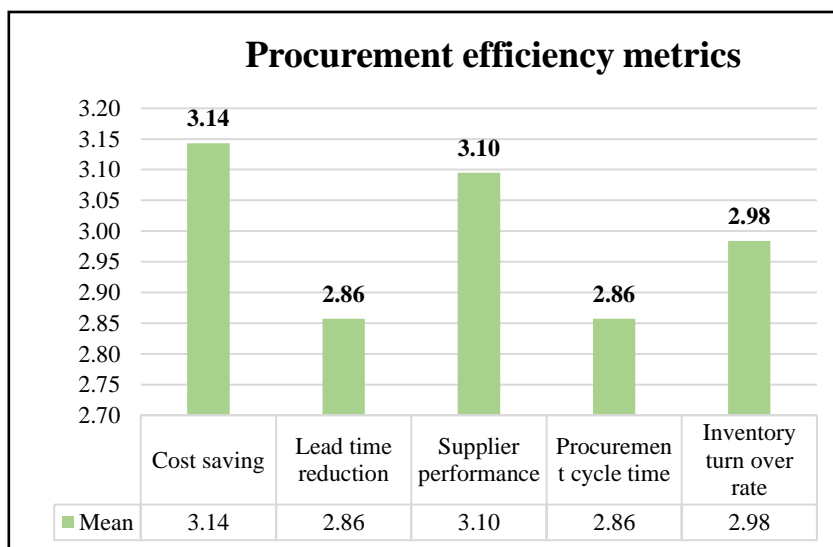


Figure 8. Procurement efficiency of EPSS

The time metrics of the procurement performance were found to have a lesser value comparatively as indicated by the mean and standard deviation values of (M=2.86, SD=0.759) and (M=2.86, SD=0.913) for procurement cycle time and lead time respectively.

4.2.6 Challenges in implementing lean procurement tools/practices

Following the use and extent of utilization of lean tools/practices in the organization, the procurement efficiency of pharmaceutical was explored in this study. An equally important perspective addressed in the study was the challenges faced while implementing lean in procurement function of the organization. Having gaps in skills and expertise to use lean practice and tools (M=3.81, SD=0.715) and lack of employee training on those tools/practices (M=3.78, SD=0.832) were found the leading challenges in the implementation. The following table summarises the list of challenges in implementation of lean procurement practices/tools which is then followed by a synthesis of challenges mentioned by the respondents as obtained by the open-ended question.

Table 7. Challenges in implementing lean procurement tools and practices

Challenges in implementing lean tools/practices	Mean	Std. Deviation
Lack of employee training on lean practices and tools	3.78	0.832
Employees' resistance to new tools and practices	3.19	0.948
Lack of adequate financial resources to implement lean practices and tools	3.43	1.103
Lack of adequate human resource to implement lean practices and tools	3.06	1.230
Lack of communication among the teams	3.40	1.086
Lack of understanding of the lean concepts	3.59	0.927
Gap in skills and expertise to use lean practice and tools	3.81	0.715
No planning for proper implementation of lean in procurement	3.71	0.831
Lack of standardization	3.38	0.974
Lack of management support & engagement	3.56	0.963
Lack of system thinking as an organization to adequately implement lean in procurement	3.78	0.851

In addition to the above challenges, most of the respondents mentioned the following as a challenge in the implementation of lean tools/practices in the procurement function of their organization. On top of resistance to changes, the lack of motivation of staffs and leaders to

sustain implemented initiatives was mentioned boldly. Other raised implementation challenges included lack of prioritization of systemic approach, inefficient alignment of organizational priorities & objectives and the burden of routine work.

Moreover, the absence of long term and short-term skill development trainings towards the tools, practices and the initiatives were repeatedly mentioned by the study respondents as a challenge in properly implementing the lean tools and practices.

4.2.7 Correlation Analysis

One of the objectives of this study was to evaluate the influence of lean procurement practices and tools on efficiency of the procurement function. This section presents the result finding of correlation analysis showing the relationship between the lean procurement practices/tools and procurement efficiency.

For measuring the relationship between the lean procurement tools/practices and pharmaceutical procurement efficiency of the EPSS, the Pearson correlation was used. The Pearson correlation coefficient, r can have a value between -1 to +1. A value of +1 represents a perfect positive correlation and in contrast to this -1 represents a perfect negative correlation while zero denotes the perfect independence of variables (Saunders *et al.*, 2019).

Before choosing the correlation analysis method, the normality of the data distribution was checked and the data was found normally distributed as proved by the value of the Shapiro-Wilk with a p -value=0.111, which is $P < 0.05$ telling the normal distribution of the data. Accordingly, the relationship/association between the lean procurement tools/practices and procurement efficiency is analysed using the Pearson correlational analysis.

Table 8. Correlation output of lean procurement tools/practice and procurement efficiency

		Lean tools/practices	Procurement efficiency
Lean tools/practices	Pearson Correlation	1	.423**
	Sig. (2-tailed)		.000
	N	63	63
Procurement efficiency	Pearson Correlation	.423**	1
	Sig. (2-tailed)	.000	
	N	63	63

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

As the result of the correlation showed there is a positive association or relationship between the lean tools/practices and pharmaceutical procurement efficiency as it is supported by the

correlation coefficient ($r=0.423$, $p< 0.001$). Hence, we can conclude both the use of the lean procurement tools/practice and procurement efficiency change in the same direction.

4.2.8 Inferential statistical analysis

Simple liner regression was used to evaluate the influence of the use of the lean tools/practices (independent variable) on the dependent variable that is procurement efficiency. The model summary below indicates (R-square) of 0.179 that can be interpreted as the independent variable constituted the 17.9 % the change or variance in the dependent variable.

Accordingly, based on the finding the rest of the percentage could be explained by other predictors which are outside the scope of this research study. In regression analysis, an R-squared that is falling between 0.10 and 0.50 (10-50%) expressed in percentage is deemed acceptable given most of the explanatory variables are statistically significant (Ozili, 2023).

Table 9. Regression analysis model summary

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.423 ^a	.179	.165	.61192	1.539

a. Predictors: (Constant), Lean tools/practices

b. Dependent Variable: Procurement efficiency

Among the most important consideration is examining the model fitness test while running the regression. The ANOVA showed the data is good fit as tested with 5% significance level. The below table shows, $p=0.001$ that means the regression model is fit for the analysed data.

Table 10. ANOVA for model fitness test

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.892	1	4.892	13.063	.001 ^b
	Residual	22.467	60	.374		
	Total	27.358	61			

a. Dependent Variable: Procurement efficiency

b. Predictors: (Constant), Lean tools/practices

In addition to ANOVA for model fitness test, other assumption tests like the normal distribution of residual (error) of the regression line is made and the distributions is normal as shown in the Histogram below.

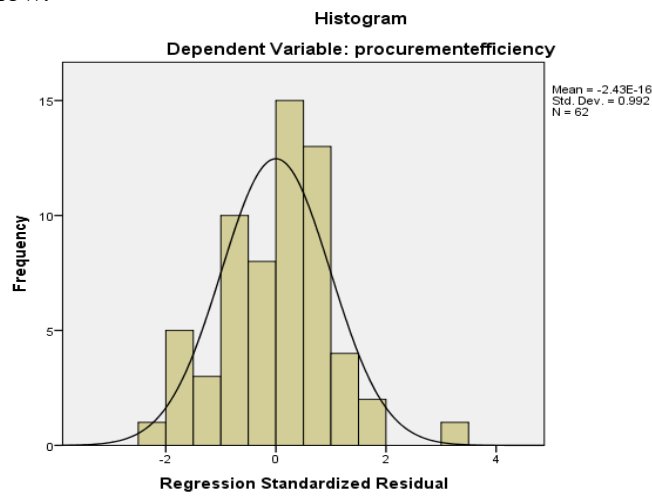


Figure 9. Normal distribution of residual

Accordingly, from the ANOVA results, since p-value ($0.001 < 0.05$), we reject the null hypothesis that states lean procurement practices and tools have no influence in the procurement efficiency of the Ethiopian Pharmaceutical Supply Services and conclude at 5% significance level, lean procurement practices and tools influence in the procurement efficiency of the Ethiopian Pharmaceutical Supply Services. Based on results, the regression coefficient ($\beta=0.600$, $p=0.001$) from the SPSS output as shown in Table 9 below, we can imply that for a unit increase of lean procurement practices/tools with the other variables left constant would lead to a 0.6 increase in efficiency of procurement function.

Table 11. Regression coefficient

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	1.725	.511		3.375	.001	.703	2.747
Lean tools/practices	.600	.166	.423	3.614	.001	.268	.932

a. Dependent Variable: procurement efficiency

4.3 Discussion

This study was undertaken with the aim of assessing the use, influence and implementation challenges of lean procurement practices and tools in the pharmaceutical procurement function of Ethiopian Pharmaceutical Supply Services. The following discussion section elaborates, compares and contrasts the finding of this study with other relevant studies. It covers all the aspects addressed by the finding of the study around the use of lean tools/practices in the pharmaceutical procurement function, how lean has influenced the pharmaceutical procurement efficiency and what practical challenges are faced in implementing lean in the procurement function of EPSS.

4.3.1 Lean procurement practices/tools utilization

According to the finding of this study, different lean procurement tools and practices are used in EPSS as an improvement means for achieving better procurement efficiency. SRM, Just-in-time, E-procurement, employee involvement, kaizen, TQM and customer engagement all are used in the organization. Comparing the use of lean tools/practice in EPSS with other organizations, more lean tools and practices are used in EPSS than the Unilever Ltd in Kenya, that implements only JIT, six sigma and TQM for enhancing performance (Kimari and Muli, 2022). A meta-analysis of lean supply chain in health context indicted there is a use of different lean techniques and tools, such as Kaizen, VSM, 5s and kanban in improving the health care supply chain performance (Khorasani *et al.*, 2019).

In this study, the utilization extent of SRM was found slightly higher ($M = 3.28$, $SD = 0.662$) compared to the other lean tools and practices. This could be explained by the focus given to SRM by the organization as a key strategy for enhancing the procurement process. According to the Pharmaceutical Supply Transformation Plan II of the organization, the benefits of adopting a more strategic approach to supplier relationships is thoroughly emphasized (EPSA, 2020). However, when compared to Macharia, (2014) a study on lean procurement and supply chain performance, the utilization extent of SRM by EPSS is lower; Macharia's study reported a higher extent of SRM use as indicted by the mean value ($M = 4.342$, $SD = 0.905$).

The findings of this study indicated only 42.9% of the respondents agreed on presence of JIT practice in EPSS. This result aligns with Balkhi *et al.*, (2022), who found implementing JIT in healthcare systems is low and challenging due to the unpredictability of healthcare demands and the risk of stockouts. These challenges are compounded by the reliance on overseas procurement, which is susceptible to unexpected disruptions. Similarly, vast majority (77.7%)

of EPSS pharmaceutical procurement is sourced from overseas (EPSSA, 2020) which could explain the low level of JIT implementation in the organization.

In addition, the low use of JIT procurement by EPSS is found consistent with the finding of Oloo, (2021), who observed that healthcare systems often prefer slight overstocking rather than JIT procurement for mitigating uncertainties and prevent stockouts between deliveries. A finding around public health supply chain in Ethiopia identified delays in pharmaceutical deliveries and a lack of prior information on incoming supplies as key bottlenecks (Abrham Bongasse *et al.*, 2020). Similarly, Boche *et al.*, (2022) reported an average supplier lead time of approximately 137.3 days for EPSS. These all factors could explain the lower implementation of JIT in EPSS's procurement function.

E-Procurement is used in EPSS pharmaceutical procurement and almost all of the respondents (96.8%) mentioned their organization uses E-procurement and the extent of use is moderate as indicated with value of (M=3.08, SD=0.737). This finding is lower than Masheti, (2016) about the E-procurement practice of pharmaceutical sectors in Kenya where the use was slightly higher as explained by E-procurement variables of E-sourcing (M=3.85), E-tendering (M=3.80), E-supplier selection (M=3.75) and E-planning (M=3.74). The moderate extent of E-procurement use in EPSS can be explained by the fact that this initiative is relatively recent undertaking in the organization procurement system (EPSSA, 2020). In addition to this, Hailu *et al.*, (2023) finding has showed, although ICT implementation which is the backbone of E-procurement in EPSS has impacted supply chain performance, issues with internet access & equipment, shortage of skilled workers, and electric power outage are challenging for its proper use.

In comparison, the E-procurement practice of the Zambian pharmaceutical procurement organization (Nat-pharm), was found to have a very low implementation status. As the study indicated, although the practice was implemented in the organization, challenges were there that hampered its proper application such as lack of ICT infrastructure, inadequate funding, lack of ICT skills and training (Chilunjika *et al.*, 2023) that are similar challenges in the context of EPSS (Hailu *et al.*, 2023).

Looking the use of continuous improvement tools, kaizen is indicated among the lean tools that are implemented in EPSS, but relatively in lower extent compared to the other tools as mean value showed (M=2.98, SD=0.629). This finding is lower than that of Macharia,(2014) where

the extent of kaizen implementation was found relatively higher ($M= 4.200$, $SD= 0.719$). As explained by a review article on kaizen and lean implementation in pharmaceutical sectors, it was discussed that kaizen and its long term effect is overlooked as it requires continuous effort (human effort, communication, training, teamwork etc.) and considered less fascinating as compared to innovative approaches (Srinivasan and N, 2018). Similarly, in the context of EPSS, as the participants have mentioned the focus on routine urgent tasks and lack of priority for operational performance might have impacted the extent of use of kaizen in the organization.

In addition to Kaizen, TQM is among the continues improvement lean tools used in EPSS. Eighty-one percent of the respondents' indicated TQM is used in their organization with moderate extent ($M=3.12$, $SD=0.739$). This finding is higher than Hussein and Tantry, (2023), where the use of TQM was found only 26.7% in pharmaceutical drug distribution company. In contrast, the use of TQM was reported being exercised robustly by the Jordan pharmaceutical companies to improve their supply chain performance (Alkhaffaf *et al.*, 2024).

Customer engagement is practiced in EPSS procurement as indicted by the mean value of the extent of use ($M=3.08$, $SD=0.763$) as indicted by the respondents. This finding is lower compared to the finding by (Aboneh, *et al.*, 2017) in pharmaceutical firms, where the interaction with customers to set reliability, responsiveness, and other standards were found higher ($M=3.90$, $SD= 0.858$). Similarly, the study about challenges of PSCM in Ethiopia, in one of the branch of EPSS showed better customer engagement ($M=3.63$, $SD=1.235$) as compared to this current study (Adem, 2020). The relatively moderate extent of customer engagement in EPSS might be explained by the focus of the organization on routine technical endeavours rather than following an integrated standardized approach in their procurement process as mentioned by the participants in their response to the open-ended questions.

4.3.2 Lean procurement practices/tools influence on procurement efficiency

The finding of this study showed lean procurement tools having influence on lead time ($M=3.41$, $SD=0.909$), procurement cycle time ($M=3.57$, $SD=0.797$), cost saving ($M=3.46$, $SD=0.895$), eliminating non-value adding activities ($M=3.54$, $SD=0.895$) and other procurement efficiency metrics. These findings are lower compared to the finding of Macharia, (2014), as the influence of lean procurement was high in reducing lead-time ($M=4.34$, $SD= 1.113$), waste reduction ($M=4.114$, $SD=1.182$), time and cost expenses ($M=4.371$, $SD= 1.190$). The difference could be explained by the relatively recent evolvement

of lean in pharmaceutical setup compared to other manufacturing and service sectors which could reduce the level of influence on efficiency optimization.

The correlation analysis results of the present study showed lean procurement practices and tools have relationship with procurement efficiency as correlation coefficient ($r=0.423$) indicated. The result is comparable with the finding of Osodo and Onjure, (2019), that assessed the influence of different lean tools on procurement showing lean tools such as E-procurement ($r=0.497$, $P=0.000$), SRM ($r=0.347$, $P=0.000$) and JIT ($r=0.526$, $P=0.000$) having an influence on procurement efficiency. Similarly, the finding of a study about lean procurement initiatives on supply chain showed relationship exists between them as the coefficient of correlation ($r = 0.511$, $p=.000$) evidenced (Omwoyo *et al.*, 2019).

In contrast, another study looking at the relationship of lean and performance found, insignificant weak positive correlation between JIT and performance ($r= 0.011$) meaning the more the JIT was practiced the slight it had an influence on organizational performance and vice versa and also weak positive association was found between TQM and performance ($r= 0.068$) (Kimari and Muli, 2022).

Looking at the regression coefficient of this study to see the influence of lean procurement practices/tools on procurement efficiency, the value of regression coefficient of ($\beta=0.600$, $p=0.001$) indicated procurement efficiency is influenced by the use of the lean tools and practices. The finding is higher compared to the finding of Omwoyo *et al.*, (2019) that showed the influence of lean procurement on supply chain performance by regression coefficient ($\beta= 0.358$, $p=0.001$).

In addition, the finding of this present study was also higher as compared to Osodo and Onjure, (2019), where the influence of JIT, E-procurement, SRM, continuous improvement on procurement performance were found having lower value comparably as evidenced by regression coefficient values of ($\beta= 0.279$, $p=0.035$), ($\beta= 0.255$, $p=0.024$), ($\beta= 0.257$, $p=0.047$), ($\beta= 0.193$, $p=0.042$) respectively. In contrast, the beta coefficient of this study is lower than the finding obtained from the research on the lean procurement and supply chain performance where beta coefficient was found higher ($\beta=1.539$, $P=0.000$) (Macharia, 2014).

The differences among the findings can be explained by the fact that the impact of lean tools and practices on procurement efficiency could differ according to the context where they are implemented and the specific factors that could facilitate or hinder the contribution of the lean tools/practices for procurement efficiency.

4.3.3 Lean procurement practices/tools implementation challenges

After looking the utilization of the lean tools and practices and their influence on procurement efficiency, the study also identified implementation challenges in lean tools and practices in the organization. Among which, gap in skill and expertise ($M=3.81$, $SD= 0.715$) and lack of employee training ($M=3.78$, $SD=0.832$) were the leading challenges in the implementation of lean tools and practices. In agreement with this finding, a review of lean transformation in PSC identified competence of human resource as a critical factor in effectively executing the lean framework in the actual setting of the PSCM (Argiyantari *et al.*, 2020).

Similarly, a research on introducing lean concept into the internal drug supply chain of a hospital using an innovative approach showed the implementation was ineffective due to gap in commitment and knowledge of employees (Regattieri *et al.*, 2018). Additionally, a case study on the implementation of kanban in PSC highlighted full application of this lean tool wasn't possible due to unfamiliarity of techniques to the employees and lack of readiness for change (Papalexi *et al.*, 2016).

Moreover, the present finding showed lack of adequate financial resource ($M=3.43$, $SD= 1.103$) among the challenges affecting the proper implementation of lean tools and practices in the organization. Likewise, meta-analysis on LSC implementation in health care concluded complexity of health SCM, leadership, cost and funding issues among the major constraints in lean implementation (Khorasani *et al.*, 2019).

Generally, the finding of the current study showed fairly similar challenges as observed in the review of the findings across other studies. Implementation challenges are attributed to organizational culture, level of leadership support, understanding of the tools/practices and the knowledge, skills and willingness of employees to embrace changes.

4.4 Conclusion

The study found out various lean procurement practices and tools are utilized in EPSS pharmaceutical procurement function. E-procurement, Kaizen, SRM, Just-in-time, TQM, employee involvement and customer engagement are used in the organization. The extent of use of SRM is relatively higher among the other lean tools/practices utilized in the organization.

The correlation analysis result showed there is a positive significant relationship between the lean procurement practices/tools and procurement efficiency as evidenced by the correlation coefficient ($r=0.423$, $p< 0.001$). In addition, the simple linear regression has proved the

alternative hypothesis that stated lean procurement practices/tools (independent variable) influence procurement efficiency (dependent variable) as the regression coefficient ($\beta=0.600$, $p=0.001$) demonstrated.

Moreover, the study has identified different challenges that are affecting the lean implementation in the procurement function of the organization. Among them, gaps in skills and expertise around lean and lack of employee training about the tools/practices were found the leading challenges in lean implementation.

The use of lean procurement practices/tools, their influence in procurement efficiency and the challenges around their implementation differ across different sectors and organization according to the specific context or condition as highlighted in the discussion sub-section.

5. CONCLUDING THOUGHTS ON THE CONTRIBUTION OF THIS RESEARCH, ITS LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.1 Implication of findings for the research questions

In this section the conclusion of the research is presented looking back to the research questions, its aim and the objectives. Accordingly, through comprehensive literature review and exploring the specific context of EPSS, this study assessed the use of lean tools and practices in PSCM, with a particular focus on the procurement function. Additionally, evaluated how lean tools and practices have influenced efficiency and identified the challenges in their implementation.

Literature review of the study has showed the adaptation of lean concept, principles and the use of different lean tools and practices are getting attention in the pharmaceutical sector. Compared to other manufacturing and service sectors, the implementation of lean is found a recent evolvement in the pharmaceutical sector particularly in pharmaceutical supply chain management.

The finding of this study has showed the lean tools and practices are used in the procurement function of PSCM. As a mechanism for managing the suppliers of the pharmaceuticals, supplier relationship management is used in EPSS. Other tools and practices such as E-procurement, Kaizen, TQM, customer engagement, employee involvement and JIT in procurement are used in the organization as means of performance improvement. This finding has answered the research question on what lean procurement practices/tools are currently utilized in EPSS.

As it is evidenced from the statistical analysis of the finding the use of the lean tools/practices in the organization procurement has positively influenced the procurement efficiency as measured by efficiency metrics of time, cost, quality and inventory management. Similarly, as most of the research articles and review papers indicted the use of different lean tools and practices have contributed for the improvement of procurement efficiency and supply chain performance at large. This has addressed the research question on the influence of lean tools/practices on pharmaceutical procurement efficiency.

Although the finding implied the use of lean tools and practices draw an improvement in efficiency, factors associated with skill gaps, lack of training & capacity building, gaps in standardizing of operations & system thinking have affected the proper implementation of lean

tools/practices in EPSS. Through identifying these prevailing challenges, the research question on the implementation challenges of lean procurement practices/tools has been answered by the study.

Generally, the findings of this study have comprehensively addressed all of the research questions. The analysis of the result has showed the research questions are answered providing insight on the use of lean tools and practices, their influence and implementation challenges specifically in procurement function of EPSS.

5.2 Contributions and limitations of the research

The finding of this study serves as an input for the stakeholders in PSCM sector and academic area by addressing the existing gap in knowledge around lean in PSCM. As evidenced from the literature review, enormous research articles exist around lean yet the vast majority of them are conducted in the setup of industrial sectors other than the pharmaceutical.

This study aimed and addressed the current use of the lean tools and practices in pharmaceutical procurement with a case study of an organization. It provides a better understanding about utilization of lean and its influence on efficiency looking to an actual experience and a practical perspective. Not only these, the identified challenges by this study on the implementation of lean procurement practices and tools provide an actionable insight for improvement and interventions while implementing lean in PSCM.

Particularly looking the academic perspective, the study adds for knowledge and understanding of lean practices within the specific context of PSCM, an area that is relatively understudied. By providing theoretical insights in general and empirical evidence from the case of EPSS, this research significantly contributes to the existing body of knowledge. It offers a valuable resource for future researches to be undertaken on lean practices and tools in PSCM.

Furthermore, similar sectors within PSCM can utilize the finding of this current study as benchmark to explore and understand how lean practices and tools are perceived in their specific context. Through examining the literature review, method and findings of this study, the sectors can evaluate how lean implementation influence performance efficiency.

Moving to the limitation of the study, its limitation primary comes from its focus on the case study of Ethiopian Pharmaceutical Supply Services, that may limit the generalizability of the findings to other pharmaceutical supply chain organizations. In addition, as the focus of this research is narrowed to see the use of the lean tools and practices specifically within the

procurement function other supply chain functions, such as forecasting/quantification, inventory management, and distribution, were not included in the scope of this study.

Lastly, the use of a survey questionnaire for the data collection may have opened some room for the possibility of self-serving bias where respondents tend to externalise challenges associated with implementation of lean procurement practice and tools. However, in spite of the limitations, the insight obtained from this specific case study can serve as relevant reference in academic inquiry and for similar organizations looking to implement lean procurement practices and tools in their specific context.

5.3 Recommendation for practice

Based on the findings of this present study and insights gained from an extensive literature review, it is recommended that the undertaking of pharmaceutical procurement, particularly in developing countries, has to prioritize lean in the procurement function. Through eliminating waste in the process and adding value for customers, lean ensures supply chain responsiveness and better resource management, thereby yielding substantial benefits.

As witnessed from the findings, lean procurement practices and tools have been proved advantageous in procurement efficiency in improving performance outcomes in cost, time, waste management and quality perspectives. Hence, it's recommended to continue with lean implementation and ensure its proper utilization in envisioning performance improvement in procurement function of the supply chain management.

Moreover, as lean requires resilience for its sustainability, it is beneficial to fully embrace the continuous improvement aspects by addressing the challenges rather than focusing only on innovative approaches for optimizing efficiency. Practicing an ongoing and incremental improvements is recommended to achieve sustained efficiency in procurement as a result of lean implementation.

On the other side, the implementation and sustainability of the lean practice and tools require thoughtful plan of action for their optimal implementation. Hence, it is crucial to consider and systematically address the identified challenges in the study as recommended below:

- The lack of understanding, knowledge and skill gaps about the lean concept, the practices and tools shall be addressed with proper human resource development and comprehensive capacity building interventions to efficiently utilize the introduced lean tools and practices in the organization

- Through standardization of operations and fostering a culture of system thinking, properly embed the lean practices and tools in the organization procurement scheme rather than focusing on routine and redundant inefficient approaches
- Adequate allocation of the required financial resource for the implementation of the lean tools and practices in the organization to ensure the sustainability of the implementation to benefit from lean in procurement
- Promote the culture of communication, up-to-date information exchange and experience sharing to enhance the engagement of all employees in lean implementation together with top management support and active engagement

5.4 Recommendation for future research

In general, lean in pharmaceutical sectors and in particular in the context of pharmaceutical supply chain management is a less investigated and a potential area for future studies. Basing on the scope of present study which looked at the overall influence of all the lean tools/practices and procurement efficiency, future detailed studies that address each of the specific lean tools and practices is recommended. This would help to make an in-depth evaluation of the contribution of each of the tools/practices for performance improvement and investigate the unique challenges associated with each practice and tool to give a more tailored intervention for improving their implementation.

In addition, the implementation of the lean tools/ practices is not limited to the procurement function of PSCM, rather it extends in the entire supply chain functions. Hence, expanding the scope of this study to see the lean implementation across all the supply chain functions of forecasting & quantification, inventory management and distribution in addition of the procurement function would provide a valuable input for PSCM.

Moreover, further studies should be conducted involving other similar organizations engaged in pharmaceutical supply chain management to see the utilization of lean practice and tools and how lean could contribute for PSCM looking from broader perspective.

5.5 Final conclusion and reflections

The Lean concept, its principles, the practices, techniques and tools are relatively new for the pharmaceutical sector as a whole and the pharmaceutical supply chain management in particular. The study journey has showed lean in supply chain management is in its early stage of evolvement. As it's seen across the literatures, the prominent focus area in the context of

pharmaceutical sectors is the presence of stringent regulations and requirements. This draws more attention towards meeting the regulatory requirements of safety, effectiveness and quality compared to seeking process and performance efficiency. Lean on the other side, focuses on eliminating of waste and creation of value through a simplified procedure.

As the finding of this study demonstrated the utilization of the lean tools and practices in EPSS procurement function has brought positive influence in procurement efficiency. Yet, compared to other sectors the utilization of these tools/practices in the pharmaceutical procurement function is found moderate given the different challenges in lean implementation. As influence and contribution of embracing the lean tools and practices in pharmaceutical procurement is evidenced, their use shall be promoted. Moreover, the challenges hindering the proper implementation of lean in procurement have to be addressed systematically for efficiency gain from implementing lean in PSCM.

Furthermore, future researches should be undertaken building on this present study and other relevant findings to investigate more on the extent of utilization and influence of lean tools/practices in other similar pharmaceutical supply chain managing organizations and across various supply chain functions, beyond procurement. This will contribute to the body of knowledge and provide comprehensive understanding of lean practices and tools in the context of pharmaceutical supply chain management, highlighting their potential to enhance performance efficiency.

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APPENDICES

Appendix A: Ethics Application & Declaration Form



DISSERTATION TITLE: Lean procurement practices and tools on procurement efficiency of pharmaceuticals: the case of Ethiopian Pharmaceutical Supply Services

RESEARCHER'S NAME: Miraf Tesfaye Gebrewold

PROGRAMME OF STUDY: MSc. in Pharmaceutical Business and Technology

SUPERVISOR'S NAME: Dr. Alessandra Vecchi

DECLARATION:

The information in this application form is accurate to the best of my knowledge. I undertake to abide by the principles outlined by Innopharma/Griffith College ethics policy in my research dissertation. I confirm that I have completed a full ethics assessment for my research dissertation as per the college guidelines. I will not begin my primary research until such approval from my supervisor and/or ethics Committee has been obtained.

I pledge to carry out my research according to the Innopharma/Griffith College academic integrity standards. Any results presented in my dissertation will be from my own, original research, I will reference and/or acknowledge any material or sources used in its preparation and I will not plagiarise the work of anyone else.

For Student:

STUDENT SIGNATURE:

A handwritten signature in black ink, appearing to be "Miraf Tesfaye Gebrewold", written over a horizontal line.

DATE: 26/06/2024

The research contained within this research dissertation proposal has been approved.

For Supervisor:

Ethics Committee Approval Required:

Yes No x

SUPERVISOR SIGNATURE:

A handwritten signature in black ink, appearing to be "Alessandra Vecchi", written over a horizontal line.

DATE: 26/06/24

For Ethics Committee (if required):

Ethics Committee Approval Given:

Yes No

ETHICS COMMITTEE MEMBER SIGNATURE:

DATE:

Appendix B: Survey questionnaire

Survey questionnaire

Participant Information letter

Dear Respondent,

I am Miraf Tesfaye, a post graduate student at Griffith College Dublin, Ireland. I am carrying out a dissertation on Lean procurement practice and tools on procurement efficiency of pharmaceutical as part of the requirement for the degree of masters (MSc) in Pharmaceutical Business and Technology.

In the current world, the application of process optimization methods is getting attention as process optimization is taken as a means for outcome improvement in undertaking activities. Among which lean concept and principles can be mentioned as a way to do more with less and at the same time offer customers exactly what they want. Lean procurement as part of LSCM is a dynamic practice and philosophy that is concerned with eliminating waste and continuous improvement of system through the application of the principles, practices, techniques and tools behind the lean concept. It aims for reduction of cost, improved quality and efficiency with minimal effort

This study will assess the use of lean practices in procurement of pharmaceuticals together with its contribution for procurement efficiency and what challenges are faced in implementing it in the real-world context looking the case of EPSS.

Accordingly, the following questionnaire will be used to obtain as answer to address the research questions. The survey has five sections consisting of questions on the use, the influence and implementation challenges of lean practices and tools in procurement function of pharmaceuticals. Please kindly answer the questions by selecting your preferred options.

The privacy of every respondent is highly assured as no response will be traced to specific participant and will be strictly confidential. All data generated will be handled in line with the General Data Protection Regulation (GDPR).

Thank you very Much for your participation!!!

Please, kindly check the box below to give your consent to participate in this research

Yes, I do

No, I don't

Section 1: General information and demographic background of respondent

1. Gender
 - a) Male
 - b) Female
2. Relevant work experience
 - a) Less than 2 years
 - b) 2-5 years
 - c) 5-10 years
 - d) more than 10 years
3. Educational qualification
 - a) Diploma
 - b) Bachelor's Degree
 - c) Post graduate Degree
 - d) Above Post graduate degree
4. In which directorate are you currently working?
 - a) Tender Management Directorate
 - b) Contract Management Directorate
 - c) Quantification and Market Shaping Directorate
 - d) Other specify
5. Position within the directorate
 - a) Director
 - b) Coordinator
 - c) Senior expert
 - d) Junior staff
 - e) Technical advisor
 - f) Other specify

Section 2. Lean procurement practices/tools* used by your organization

A. Among the following lean practices/tools which of them are used in your organization?

S. N	Lean practices/tools	Yes/No
1	Supplier Relationship management (The organization has strategic and long-term relationship approach with the suppliers)	
2	Just-in-time (The organization procures products only when they are needed and exactly in the quantity required)	

3	E-procurement (The organization uses Information and Communication technology (ICT) in the procurement process)	
4	Employee-involvement/engagement (The organization promotes employees' engagement and their sense of ownership in implementing lean in procurement)	
5	Kaizen (The organization continually improve its own performance through kaizen implementation)	
6	Total Quality management (The organization considers the management of quality in each step of procurement process)	
7	Customer engagement (The organization considers customer involvement, satisfaction, and feedback in the procurement process)	

Apart from mentioned above, which other lean procurement practices/tools does your organization use?

B. To what extent does your organization use the following lean procurement practices/tools in workplace, using a five-point scale below? The scale stand for the following: 1 = Very small Extent; 2= Small Extent; 3= Moderate Extent; 4= Great Extent; 5= Very Great Extent

S. N	Lean procurement practices/tools	Very small extent	Smaller extent	Moderate extent	Great extent	Very Great extent
		1	2	3	4	5
1.	Supplier Relationship management (The organization has strategic and long-term relationship approach with the suppliers)					
2.	Just-in-time (The organization procures products only when they are needed and exactly in the quantity required)					
3.	E-procurement (The organization uses Information and Communication technology (ICT) in the procurement process) Eg. e-GP					
4.	Employee-involvement/engagement (The organization promotes employees' engagement and their sense of ownership in implementing lean in procurement)					

5.	Kaizen (The organization continually improve its own performance through kaizen implementation)					
6.	Total Quality management (The organization considers the management of quality in each step of procurement process)					
7.	Customer engagement (The organization considers customer involvement, satisfaction, and feedback in the procurement process)					

Section 3. Influence of lean procurement practice/ tools on procurement efficiency

To what extent do the implemented lean procurement practices/tools (Supplier relationship management, Just-in-time, Kaizen, Total quality management, etc.) influence procurement efficiency of your organization? (1 = Very Small Extent; 2= Small Extent; 3= Moderate Extent; 4= Great Extent; 5= Very Great Extent)

S. N	Influence of Lean procurement practices/tools on procurement efficiency	Very small extent	Smaller extent	Moderate extent	Great extent	Very Great extent
		1	2	3	4	5
1.	Lean procurement practices/tools influence reduction in lead times					
2.	Lean procurement practices/tools influence the improvement of the overall procurement cycle time.					
3.	Lean procurement practices/tools influence procurement cost savings					
4.	Lean procurement practices/ tools influence optimization of inventory turnover rate					
5.	Lean procurement practices/tools influence reduction of inventory holding (excess product stock in store)					
6.	Lean procurement practices/tools influence the elimination of non-value adding activities in procurement					
7.	Lean procurement practices/tools influence the increase in product quality					
8.	Lean procurement practices/ tools influence the overall procurement efficiency					

9. In your experience, what specific lean practice or tool has had the most significant influence on improving procurement efficiency? Please explain why

Section 4: Challenges in the implementation of lean procurement practices/tools (such as SRM, JIT, kaizen, etc.) in your organization

Please indicate the level of your agreement to which the following challenges affect implementation of lean procurement practices/tools (Supplier relationship management, Just-in-time, Kaizen, Total quality management, etc.) in your organization (Key: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

S. N	Critical challenges	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
1.	Lack of employee training on lean practices and tools					
2.	Employees' resistance to new tools and practices					
3.	Lack of adequate financial resources to implement lean practices and tools					
4.	Lack of adequate human resource to implement lean practices and tools					
5.	Lack of communication among the teams					
6.	Lack of understanding of the lean concepts					
7.	Gap in skills and expertise to use lean practice and tools					
8.	Poor planning for proper implementation of lean in procurement					
9.	Lack of standardization					
10.	Lack of management support & engagement					
11.	Lack of system thinking as an organization to adequately implement lean in procurement					

12. Apart from mentioned above, what other challenges is your organization facing in implementing lean procurement practices/tools?

Section 5: Procurement efficiency of the organization

How do you generally rate your organization based on the following measures of procurement efficiency? (Key: 1= Poor 2=Bad, 3= Moderate, 4=Good, 5=Excellent)

S. N	Measures of procurement efficiency	Poor	Bad	Moderate	Good	Excellent
		1	2	3	4	5
1.	Lead time reduction					
2.	Cost saving					
3.	Supplier performance					
4.	Inventory turnover rate					
5.	Procurement cycle time					

6. Please provide further explanation on procurement efficiency of your organization
