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**Lean Sourcing and Performance of Manufacturing Firms in
Kenya**



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Lean Sourcing and Performance of Manufacturing Firms in Kenya

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ABSTRACT

Purpose: This study sought to examine the influence of lean sourcing on performance of manufacturing firms in Kenya. The study also sought to find out the moderating effect of ICT adoption on the relationship between lean sourcing and performance of manufacturing firms in Kenya. The agency theory anchors these concepts. The information theory explains the role of ICT as a moderating variable.

Methodology: The study adopted the cross-sectional research design since it's interested in establishing relationships without interfering with variables. In this study the unit of analysis was the 46 registered manufacturing firms while the unit of observation in this study was management employees in the supply chain department, procurement department, IT department and finance department. The total target population was 1,104 respondents. The sample size was determined using the Taro Yamane Formulae which was formulated by Tara Yamane in 1967. Therefore, the sample size was 294. The study used purposive sampling to select the respondents. Data was collected using a structured questionnaire administered both on the online platforms and also face to face. The reliability of these instruments was assessed during the pilot study. A review by professionals helped in refining the instruments to make the results reliable and valid. The data was analyzed using the SPSS software. The analytical model included descriptive statistics, correlation analysis, regression analysis and moderation analysis using the SPSS software.

Findings: The study found that lean sourcing has a positive and significant effect on performance of manufacturing firms in Kenya. The study also found that ICT adoption has a positive and significant moderating effect on the relationship between lean sourcing and performance of manufacturing firms in Kenya.

Unique Contribution to Theory, Practice and Policy: From the findings the study recommends that the management of manufacturing firms in Kenya to provide comprehensive training on lean sourcing principles and methodologies across all levels of the organization. Actively implement lean sourcing practices, with a specific focus on bulk sourcing, item categorization, and supplier development.

Key Words: *Lean Sourcing, ICT Adoption, Performance, Manufacturing Firms*

Background of the Study

Supply chain management is a business service which assist the organizations to source for goods and services. The information gathering is a critical component of the process and it makes a deference wealth (Abushaikha, Salhie & Towers, 2018). The main goal is to optimize the possibilities and come up with advisories which can maximize the shareholders in order to succeed key business processes must be integrated from customers to organizations to suppliers and then finally to the manufacturers. These business stakeholders must work together to achieve the goal (Rodrigues, 2019). The supply chain function must coordinate these actors in order to achieve the maximum benefit. The system must work together to ensure that the procurement of services and goods meet the desired criterion. A properly managed system will impact the product development in order to maximize the customer experience (Susilawati, Tasri, & Arief, 2019).

Other commentators view supply chain as the process of managing and planning all the activities involved in the procurement and sourcing of the goods and services. It transcends the process of just buying but involves coordinating with customers, suppliers and even the manufacturers in order to receive the right goods at the right time. It is therefore a middle office function; it sits between the various stakeholders and its main aim it to ensure that all the stakeholders are happy. It is noteworthy to mention that logistics management is a subset of supply chain management which enables the goods to move within the stakeholders (CSCMPs, 2018). To achieve better results there must be efficient flow of information from all the stakeholders. This will enable the organization to plan their deliveries based on production runs and customer request. A properly managed system should lead manufacturing. This will not only help the manufacturers also the consumers to manage their inventory properly.

The modern business is becoming complex, customers' demands are fast changing. The organization has to innovate and develop relationship with its suppliers and manufacturers to keep pace with competition. There is need for greater involvement in the process of designing and producing goods. The sourcing of raw materials and transportation of the goods are equally important in the process. The feedback mechanism which enables both the stakeholders to engage in meaningful conversations about how the process can be improved is equally an important function (Stehn, 2018). Therefore, supply chain can be viewed as a synchronization function, the element which coordinate plans and links the stakeholders to ensure that the customer is happy. A lean supply chain system does not only shorten the time to delivery but also reduces the cost of manufacturing and transportation.

The manufacturing sector contributes 25% of the GDP in Kenya, this is expected to increase to 45% by 2030 to achieve the industrialization goal (KNBS, 2016). The economic development and attainment of suitable economic goals require that a nation

produces most of its resources. In Kenya manufacturing has not only helped the industrialization process but also contributed to the increase in employment. On the investment side manufacturing has contributed immensely to the wealth creation for the investors. Additionally, this sector contributes immensely to the exports since some of the goods produced locally are exported to the neighboring countries and to the globe at large. Consequently, this contributes to the stabilization of the Kenya shillings against the foreign currencies (Mwangi, & Kitheka, 2018).

In Kenya the manufacturing firms are both locally owned and foreign owned, however the small manufacturing firms are predominantly owned by the locals. The distribution of these firms are however concentrated in Nairobi, Machakos and Thika. The KAM (2019) Report indicates that 80% of the firms are in Nairobi and its environs. The Kenyan manufacturers mainly manufacture semi processed goods such as coffee, tea and soda ash. On the contrary the manufacturing firms import raw materials such as steel, clinker and iron (Kenya Economic Sector Survey, 2017).

Statement of the Problem

Most developing countries rely on the manufacturing sector to contribute to their growth in GDP. A well-functioning manufacturing sector should contribute about 20% of the GDP in order to impact the socio-economic development of a nation (Hallward & Navyar, 2018). However, in the recent past Kenyan manufacturing has experienced a sharp decline in growth. The sector's contribution to the GDP continues to be below the expected average for a growing nation. For instance, in 2018 the sector contributed 12.5% while in 2019 the sector contributes 12.8% (RoK, 2019). This is below the target contribution of 20%. The dismal performance of the sector continues to affect the aggregate supply, job creation, and return on investment from the suppliers. The decline in productivity can be blamed on the constrained supply chain due to covid 19. The prices of key elements have not only increased but also have become unavailable. This has negatively impacted the lead time and consequently affected the performance and customer experience.

There is a need for stakeholders to devise methods that can be used to strengthen the manufacturing sector. A mix of policy interventions and internal management brilliance can resuscitate the sector. One of the opportunities available for internal management is to optimize supply chain practices. They can leverage modern ICT to support the lean supply chain philosophy. This strategy can augment the other concepts such as quality assurance, and total quality management which have not yet been helpful in the absence of lean supply chain management. Empirical literature shows that lean supply chain management leads to increased efficiency (Panwar, Nepal, Jain & Rathore, 2015). Additionally, the use of information communication technology improves the success rate of lean supply chain management (Nallusamy, 2016). The use of technology enhances the collaborations between the supplier's manufacturers and clients. A shared technology can

enhance communications within the value chain while reducing costs. Technology also helps to improve accountability; management can see when the orders were placed and when they were successfully delivered. Therefore, technology enables the management to identify and take corrective action thus leading to improved productivity.

In order to address the gaps in manufacturing, most companies have adopted lean manufacturing practices. However, little is known about them because most studies linking lean supply chain and performance have been done in developed countries. Even so, these studies have provided inconclusive evidence. Some studies aver that lean supply chain management increases performance while other studies found no statistical relationship yet other studies found a negative relationship. There is therefore a need to investigate if there are moderating variables that affect the relationship between lean supply chain practices and performance. ICT is one of those variables and therefore this study is desirous of investigating the moderating role of ICT on the relationship between lean supply chain practices and performance. As a result, this study sought to establish the effect of lean supply chain practices on performance of manufacturing firms in Kenya.

Specific Objectives

The study was guided by the following specific objectives

- i. To examine the influence of lean sourcing on performance of manufacturing firms in Kenya.
- ii. To find out the moderating effect of ICT adoption on the relationship between lean sourcing and performance of manufacturing firms in Kenya.

Theoretical Framework

Agency Theory

The seminal works of Eisenhardt (1989) form the basis of this theory, it avers that the separation of ownership from management creates an inherent conflict of interest between the principal and the agents. This theory assumes that profit maximization for the owners is the main reason behind the existence of the business. Managers should therefore expend their efforts to maximize the shareholder's value however agents also have their own wealth maximization objectives which clash with the shareholders. It is obvious therefore that managers will attempt to pursue their own goals. The other principal agency problem relates to the incompetency of managers, a manager may fail to maximize the shareholder's wealth because they do not understand how to manage the organization. This sometimes occurs because the principal could not select the right candidate for the job or the managers misrepresented themselves in the selection process thus leading to adverse selection.

The theory further assumes that the human race is naturally indolent and would choose to deliberately do less where they could do more. It is noteworthy to mention that the

principal agency relationship transcends the managers and shareholders. The suppliers and the organization also have an agency relationship, the suppliers are supposed to act in the best interest of the organization to support them to maximize the shareholder's wealth. Therefore, the selection of the suppliers and the design of the service level agreements must be aligned to the overall objective of the organization. This theory helps to analyze the conflicts between the suppliers and their customers and how they affect the overall attainment of the goals. These conflicts oscillate around the quality of goods, the lead time, and inefficient distribution strategies. Obviously, this will increase the costs and reduce the profits of the company (Fleishar, 2016).

Information Theory

Information theory was proposed through the seminal works of Shannon (1948) as a mathematical theory of communication. The theory explains how messages can be passed from the sender to the receiver efficiently. The theory assumes that the sender has more information than the receiver and that they can choose what to share. This theory has been extended to include the economic sense of information. This theory assumes that information is a strategic resource which can be used to gain competitive advantage. Therefore, the economic benefit of information is lost when it is shared. In supply chain management information sharing is considered strategic to the extent that the stakeholders in the value chain have to share crucial information in order to achieve the best results (Agrawal, & Narain, 2018).

The design of customer centric products is enhanced by information sharing, information oils the relationship between the partners striving to achieve the ultimate goal of waste elimination. The suppliers must share the information about the buyers' desires with the manufacturers. The lean operations require that the employees share the information about the processes with colleagues to enable them perform multiple tasks. In the same strength strategic integration is all about information sharing. Partners share their technologies and process in order to extract information seamlessly. The lean distribution is also dependent on the information sharing between the parties involved. Based on the assumptions of this theory it is expected that the ICT will have a significant positive impact on the relationship between supply chain management and performance of organizations (Farahani, Meier, & Wilke, 2017).

Conceptual Framework

The relationship between the variables is shown in a pictorial presentation through a conceptual framework (Yarkoni, & Westfall, 2019). This framework shows how the predictor, variables relate with the dependent variables. The independent variable in this study include lean sourcing, the moderating variable is ICT adoption while the dependent variable is performance of manufacturing firms in Kenya. Figure 2.1 represent this relationship.

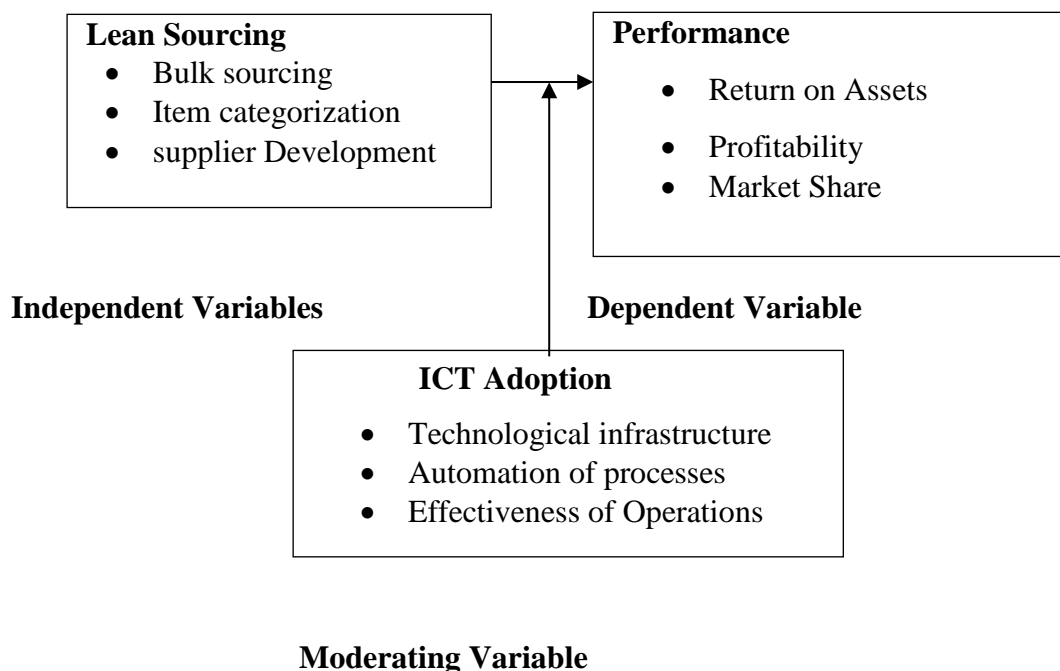


Figure 2. 1: Conceptual Framework

Lean Sourcing

Lean Sourcing is a procurement strategy that focuses on maximizing value while minimizing waste in the sourcing process. It involves streamlining supplier selection, reducing unnecessary costs, and improving operational efficiency by emphasizing continuous improvement, collaboration, and long-term partnerships with suppliers (Womack *et al*, 2022). By applying lean principles, companies aim to reduce excess inventory, shorten lead times, and enhance product quality. Bulk sourcing is a strategic procurement method in which an organization acquires large quantities of products, goods, or raw materials in a single order or over a series of bulk purchases. This strategy is frequently employed to reduce unit costs by taking advantage of economies of scale, which occurs when the per-unit price of an item decreases as the quantity purchased increases (Rajput, Gulzar & Shafi, 2021). For businesses that require consistent supplies of certain materials or components, bulk sourcing ensures a steady and predictable

inventory flow, which can lead to significant cost savings.

Item categorization is a systematic process of classifying procurement items based on shared attributes, such as their function, usage, value, or criticality to the business. This classification allows businesses to apply differentiated sourcing and management strategies for each category of items, improving the overall efficiency and effectiveness of the procurement process (Keitany & Riwo-Abudho, 2023). For instance, high-value or mission-critical items—such as raw materials for production or specialized machinery—might be placed in a "strategic" category that calls for careful vendor selection, long-term partnerships, and rigorous quality standards. Supplier development is a collaborative approach between a company and its suppliers, aimed at enhancing the supplier's capabilities, improving their operational efficiency, and building stronger, more strategic relationships. The goal of supplier development is not only to ensure that suppliers can meet the organization's quality standards and delivery schedules but also to foster long-term partnerships that benefit both parties (Womack *et al*, 2022). This process may involve a variety of initiatives, such as providing training to improve the supplier's production processes, sharing best practices to enhance their operational efficiency, or offering access to new technologies or tools that can help improve quality and reduce costs. Supplier development can also involve joint efforts to innovate new products or refine existing ones, which can lead to competitive advantages for both the buyer and the supplier (Grabau, 2020).

ICT Adoption

ICT (Information and Communication Technology) adoption refers to the process by which an organization or individual integrates and utilizes various technological tools, systems, and infrastructure related to information and communication into their daily operations or personal activities. This can include adopting technologies such as computers, software applications, the internet, mobile devices, cloud computing, and data management systems (Agrawal, & Narain, 2022). Technological infrastructure refers to the foundational technology systems, hardware, software, and networks that support and enable the operations of an organization. It encompasses everything from servers, databases, and networking equipment to cloud platforms, cybersecurity systems, and enterprise software (Farahani, Meier & Wilke, 2023). A robust technological infrastructure is essential for the smooth operation of digital tools, ensuring that information can be efficiently stored, processed, and accessed by the organization. This infrastructure also supports communication and collaboration across departments and locations, and facilitates integration with external systems such as suppliers or customers (Kanyamuhanda & Shale (2023).

Automation of processes involves the use of technology to perform repetitive tasks with minimal human intervention, improving the efficiency and consistency of business operations. This can include automating tasks such as data entry, invoicing, inventory

management, customer service inquiries, and even production processes. By implementing automation, organizations can reduce human error, lower operational costs, and free up employees to focus on more value-added activities such as strategic decision-making, innovation, and customer relationship management (Wanjiru & Abdalla, 2021). Factors that contribute to operational effectiveness include process optimization, efficient resource allocation, skilled employees, and the ability to respond quickly to changes in demand or market conditions. Organizations that focus on improving the effectiveness of their operations typically invest in continuous improvement practices, such as Lean and Six Sigma, to eliminate inefficiencies and drive innovation (Chaudhary *et al*, 2021).

Empirical Review

Lean Sourcing

Rajput, Gulzar and Shafi (2021) assessed on the impact of supplier development on supplier performance: mediating role of trust. This study utilized questionnaire survey to collect data from 345 textile firms. The study found that indirect supplier development is significantly and positively related to supplier performance improvement. Buying firms' trust is positively related to supplier performance improvement. Furthermore, it mediates across supplier development dimensions and supplier performance improvement. The study concluded that supplier performance improvement is positively and significantly related to dimensions of supplier development.

Mwangi and Kitheka (2020) looked at the lean practices deployed y manufacturing concerns in Nairobi, cross-sectional data were collected and analyzed using the ordinary least square regression methodology. The exploratory study found that most firms practice lean manufacturing, the concept of supplier engagement, customer involvement, waste elimination, and continuous improvement were practiced in the manufacturing sectors. This study however did not link the lean practices to performance. It just explored the industry practices; the current study will address this gap by linking the various elements of lean practices to performance. It is important to link the two concepts because most manufacturing companies have been making losses. Therefore, a study that provides the direction on how performance can be improved is important for the industry stakeholders.

Lubale and Kioko (2022) conducted a study on the effects of supplier development on organizational performance at Kenya Power and Lighting Company Limited. The study adopted a descriptive research design. The study's target population was 474 members. The researcher employed the cluster sampling procedure and a sample size of 142 respondents. The study found that supplier development has a positive relationship with organizational performance at Kenya Power and Lighting Company Limited. The study concluded that supplier evaluation, supplier incentives and supplier partnership have significant and positive effects on Kenya Power's organizational performance.

Wachiuri, Waiganjo and Oballah (2020) investigated on the role of supplier development on organizational performance of manufacturing industry in Kenya; a case of East Africa Breweries Limited. A descriptive case study design was used. The target population was the manufacturing industry in Kenya. Out of target population of 150 a sample size of 50 respondents were selected from 4 categories: Senior managers, Middle managers, junior managers, and procurement officer. The sampling technique used in this study was stratified random technique. The study revealed that rewards, financial support and firm involvement have a great role in the performance of EABL. The study concluded that there is a significant positive relationship between three elements of supplier development namely financial support, rewards and firm involvement and organization performance.

ICT Adoption

Kanyamuhanda and Shale (2023) investigated on the effects of ICT adoption on procurement performance in government ministries in Rwanda. case of ministry of health. This study adopted a descriptive research design. Both primary and secondary data was used in the study. A total of 472 employees of the Ministry of Health formed the target population. Though stratified random sampling a sample size of 218 respondents was determined using Yamane's formula. The study found that there is a positive significant relation between procurement performance and ICT adoption. The study concluded that ICT adoption lead to a significant improvement in procurement performance in the ministry of health.

Agha and Ndukwe (2022) assessed on ICT adoption and employee performance in drug manufacturing companies in Enugu State. This study used survey research design. Data for this study were obtained from primary source of data. The population of the study was 375 while the sample size of 194 was determined using the Taro Yamane's formula. The study found that the use of ICT has significant positive effect on employees' commitment in the studied organizations. The study concluded that without proper use of ICT applications on work performance to assist in disseminating information to users, employees in drug manufacturing companies will be unable to function effectively and efficiently and the low use of ICT to drive operations in such organizations would result in inefficiency and ineffectiveness of the company's operations and job performance.

Wanjiru and Abdalla (2021) researched on the effects of information communication technology adoption on procurement process in Kenya's oil industry: a survey of Total Kenya Limited Mombasa County. The population of study comprised of 300 employees of Total Kenya Limited. Stratified random sampling technique was used to select the sample. The sample size for this study was 45 respondents. The study found that perceptions regarding the benefits, costs and risks of e-enabled procurement systems significantly affect its adoption. The study concluded that the adoption of ICT applications is not exclusively a matter of resources. On the contrary, operational compatibility and the level of collaboration are two of the factors that play a determinant

role in increased ICT adoption and impact.

Atisa and Mose (2024) examined on ICT adoption and procurement performance of large manufacturing firms in Nairobi City County, Kenya. This study used a descriptive research design. The study targeted 630 management employees working in 105 large manufacturing firms. Stratified random sampling technique was used to select a sample of 239 respondents from the target population. The study found that perceived cost of ICT adoption and ICT technical capacity has a positive and significant effect on procurement performance of large manufacturing firms in Nairobi City County, Kenya. The study concluded that implementing intuitive and easy-to-use procurement tools enhances user adoption and efficiency, leading to improved overall procurement performance.

Research Design

The study used cross-sectional survey design. A cross-sectional survey research design enables collection of data about a given phenomenon within a limited time horizon which can help describe incidences of events or provide an explanation of factors related to an organization or industry (Saunders, 2013; Theuri 2015).

Positivism has been selected because the variables under the study are objectively quantifiable and the relationships are anchored on theories (Crowther & Lancaster, 2012). The research took a deductive approach where facts are verified in a systematic manner without interference from the researcher.

Target Population

The target population comprises all the possible companies and the individuals to be studied (Kothari, 2019). The unit of analysis in this study was all the manufacturing companies in Kenya. The estimates of the Kenya Association of manufacturers indicate that there are 46 registered manufacturing concerns. In this study the unit of analysis was the 46 registered manufacturing firms while the unit of observation in this study was management employees in the supply chain department, procurement department, IT department and finance department. In each department, the study targeted 1 top manager, 2 middle level managers and 3 lower level managers. This implies that the total target population was 1,104 employees

Table 3. 1: Target Population

Category	Target Population	Percent
Top Level Managers	184	16.7%
Middle Level Managers	368	33.3%
Lower Level Managers	552	50%
Total	1,104	100%

Source: (KAM, 2018)

This study consists of 1,104 respondents from manufacturing companies. The study used purposive sampling to select the qualifying respondents. This technique has been selected to enable the researcher to select the qualifying respondents (Neetij & Bikash, 2017).

The sample size was determined using the Taro Yamane Formulae which was formulated by Tara Yamane in 1967. The mathematical illustration is as follows;

$$n = N / (1 + N(e)^2)$$

Where;

n signifies the sample size

N signifies the population under study in this case 1,104

e stands for the margin error which could be 0.10. 0.05 Or 0.01

When the margin of error is taken to be 0.05

$$n = 1,104 / (1 + 1,104(0.05)^2)$$

$$n = 293.6$$

Therefore, the sample size was 294

Table 3. 2: Sample Size

Category	Target Population	Sample Size
Top Level Managers	184	49
Middle Level Managers	368	98
Lower Level Managers	552	147
Total	1,104	294

Source (Author, 2023)**Data Collection Instruments**

The tools used by the researcher to collect data from the respondents are called data collection instruments. These tools include questionnaires and data templates, in this study the researcher used structured questionnaires to collect data about the concepts under the study. The structured questionnaire is preferred as a data collection tool because it allows the respondents to focus on the area of study and consequently this makes it easy for analysis (Saunders & Thornhill, 2012). Secondary data about the performance of the manufacturing firms will be collected from the financial statements.

Data Analysis and Presentation

The study used cross-sectional and inferential statistics to analyze the data generated from the study. Qualitative data was analyzed using cross-sectional analysis. This system allows the researcher to form meaningful themes from the qualitative data. It assists in data summarization, particularly in qualitative data. This methodology not only organized the analysis of qualitative but also eliminated researcher bias (Saunders *et al.*, 2019). On the other hand, inferential statistics was used to come up with relationships and to help other researchers to infer about the population based on the analysis from the selected sample.

These data models were developed with the help of SPSS (Statistical Package of Social Sciences) version 26. The regression model helped in establishing the effect of lean sourcing on the performance of manufacturing firms. This model provided estimates of the weights of predictor variables as provided in the regression model below.

$Y_p = \beta_0 + \beta_1 X_1 + \epsilon$ Where:

Y = Performance of manufacturing firms in Kenya.

β_0 = The constant performance which is not related to any other variable under the study

β_1 = Coefficient of independent variable

X_1 = lean sourcing X

ϵ = error term

RESULTS AND DISCUSSION**Descriptive Analysis****Lean Sourcing and Performance of Manufacturing Firms**

The first objective of the study was to examine the influence of lean sourcing on performance of manufacturing firms in Kenya. Respondents were therefore requested to

indicate their level of agreement with statements on lean sourcing and performance of manufacturing firms in Kenya. Table 4.1 presents summary of the findings obtained.

On bulk sourcing, the respondents agreed their company procures large orders of the same item to gain from quantity discount ($M= 4.218$, $SD= 0.703$). In addition, the respondents agreed that they partner with their business units and suppliers to purchase frequently used materials in bulk ($M= 3.981$, $SD= 0.905$). It was also agreed that bulk sourcing has helped reduce the cost per unit thus increasing profitability ($M= 3.854$, $SD= 1.013$). The respondents agreed that their firm enjoys economies of scale as a result of bulk sourcing ($M= 3.788$, $SD= 0.957$).

Regarding Item categorization, the respondents agreed that their company apply the standardized classification and this has increased communication effectiveness with the stakeholders ($M= 4.245$, $SD= 0.843$). In addition, they agreed that the item categorization system enables the warehouse staff to concentrate on value adding work ($M= 4.237$, $SD= 0.771$). Further, the respondents agreed that their product classification system helps to support decision making and planning ($M= 3.897$, $SD= 0.836$). The respondents also agreed that item categorization makes it easy for the warehouse staff to track and follow up on orders this improves customer experience ($M= 3.703$, $SD= 0.903$).

On supplier development, the respondents established that they build long term relationships with their suppliers and this ensures that we receive quicker responses and flexible deliveries ($M= 4.346$, $SD= 0.669$). In addition, the respondents agreed that there is a close technical corporation between us and the suppliers which has led to the production of optimal lot sizes based on our specifications ($M= 4.217$, $SD= 0.718$). Further, they agreed that the suppliers are directly involved in the engineering and design of new products. Thus, improving the implementation process ($M= 4.045$, $SD= 0.814$). The respondents also agreed that the company shares the feedback on the quality of the deliveries. This enables the suppliers to improve their service delivery ($M= 3.944$, $SD= 0.838$).

These study results are in line with the findings of Mwangi (2018) who found that most firms practice lean manufacturing, the concept of supplier engagement, customer involvement, waste elimination, and continuous improvement were practiced in the manufacturing sectors. In addition, Keitany and Riwo-Abudho (2017) found that lean production improves supplier employee and customer engagements. The study also concluded that lean production optimizes the inventory costs thus leading to improved performance.

Table 4. 1: Descriptive Statistics on Lean Sourcing

Statements.	Mean	Std. Dev.
Bulk sourcing		
Our company procures large orders of the same item to gain from quantity discount.	4.218	0.703
We partner with our business units and suppliers to purchase frequently used materials in bulk.	3.981	0.905
Bulk sourcing has helped reduce the cost per unit thus increasing profitability.	3.854	1.013
Our firm enjoys economies of scale as a result of bulk sourcing	3.788	0.957
Item categorization		
Our company apply the standardized classification and this has increased communication effectiveness with the stakeholders.	4.245	0.843
the item categorization system enables the warehouse staff to concentrate on value adding work	4.237	0.771
our product classification system helps to support decision making and planning	3.897	0.836
Item categorization makes it easy for the warehouse staff to track and follow up on orders this improves customer experience	3.703	0.903
Supplier Development		
We build long term relationships with our suppliers and this ensures that we receive quicker responses and flexible deliveries	4.346	0.669
There is a close technical corporation between us and the suppliers which has led to the production of optimal lot sizes based on our specifications.	4.217	0.718
The suppliers are directly involved in the engineering and design of new products. Thus, improving the implementation process	4.045	0.814
The company shares the feedback on the quality of the deliveries. This enables the suppliers to improve their service delivery.	3.944	0.838
Aggregate Score	4.108	0.812

ICT Adoption and Performance of Manufacturing Firms

The second objective of the study was to find out the moderating effect of ICT adoption on the relationship between lean supply chain management and performance of manufacturing firms in Kenya. Respondents gave their level of agreement on statements on ICT adoption on performance of manufacturing firms in Kenya. Table 4.2 presents summary of the findings obtained.

Concerning technological infrastructure, the respondents agreed that their company has purchased adequate computers for all departments (M= 3.946, SD= 1.008). In addition, the respondents agreed that computers in their company are maintained on regular basis (M= 3.900, SD= 1.030). It was also agreed that non-functioning computers in their organization are replaced immediately (M= 3.876, SD= 0.786). The respondents agreed that all the existing computers in our organization are regularly updated (M= 3.885, SD= 0.909).

Regarding automation of processes, the respondents agreed that most operations in their

organization are automated hence ensuring efficiency and effectiveness of operations (M= 3.908, SD= 1.258). In addition, they agreed that the system is capable of calculating reorder levels based on the orders received from the customers and the forecast (M= 3.881, SD= 1.177). Further, the respondents agreed that the system is capable of sending order requests to suppliers automatically based on the demand (M= 3.869, SD= 0.765). The respondents also agreed that the system is capable of processing and sending exemption alerts when an abnormal order is received. This helps the organization in demand and supply balancing (M= 3.786, SD= 0.786).

On effectiveness of operations, the respondents established that adoption of information technology has led to effectiveness of operations in their organization (M= 3.923, SD= 0.796). In addition, the respondents agreed that the quality of work done in their organization has improved as a result of IT adoption (M= 3.891, SD= 0.874). Further, they agreed that they are satisfied with the effectiveness of operations in our organization as a result of IT adoption (M= 3.863, SD= 1.129). The respondents also agreed that in their organization, manufacturing operations are effective in meeting customer demands (M= 3.815, SD= 0.983).

The study findings concur with those of Agrawal, and Narain, (2018) who established that in lean supply chain management ICT assist in order creation, order transmission, and order tracking. Additionally, the goods are tagged using a digital naming system which makes it easy to trace the defective goods. Moreover, ICT assists the partners in the supply chain to communicate promptly. Systems have also been designed to manage inventory. Technology is also used to optimize the operations, efficiency in operations can only be achieved with an optimal combination of machine and digital processes (Chaudhary *et al.*, 2018).

Table 4.2: Descriptive Statistics on ICT Adoption

	Mean	Std. Dev.
Technological infrastructure		
Our company has purchased adequate computers for all departments	3.946	1.008
Computers in our company are maintained on regular basis	3.900	1.030
Non-functioning computers in our organization are replaced immediately	3.876	0.786
All the existing computers in our organization are regularly updated	3.885	0.909
Automation of processes		
Most operations in our organization are automated hence ensuring efficiency and effectiveness of operations	3.908	1.258
The system is capable of calculating reorder levels based on the orders received from the customers and the forecast.	3.881	1.177
The system is capable of sending order requests to suppliers automatically based on the demand	3.869	0.765
The system is capable of processing and sending exemption alerts when an abnormal order is received. This helps the organization in demand and supply balancing	3.786	0.786
Effectiveness of Operations		
Adoption of information technology has led to effectiveness of operations in our organization	3.923	0.796
The quality of work done in our organization has improved as a result of IT adoption	3.891	0.874
Am satisfied with the effectiveness of operations in our organization as a result of IT adoption	3.863	1.129
In our organization, manufacturing operations are effective in meeting customer demands	3.815	0.983
Aggregate Score	3.913	0.993

Test for Hypothesis One

The first specific objective of the study was to examine the influence of lean sourcing on performance of manufacturing firms in Kenya. The associated null hypothesis was that lean sourcing has no significant effect on performance of large manufacturing firms in Kenya. A univariate analysis was conducted in which performance of food and beverage manufacturing firms in Kenya was regressed on information sharing.

The R-Squared depicted the variation in the dependent variable that can be explained by the independent variables. The greater the value of R-squared the greater the effect of independent variable. The R Squared can range from 0.000 to 1.000, with 1.000 showing a perfect fit that indicates that each point is on the line. As indicated in Table 4.3, the R-squared for the relationship between lean sourcing and performance of manufacturing firms in Kenya was 0.245; this is an indication that at 95% confidence interval, 24.5% of variation in performance of manufacturing firms in Kenya can be attributed to changes in lean sourcing. Therefore, lean sourcing can be used to explain 24.5% of changes in performance of manufacturing firms in Kenya but there are other factors that can be attributed to 75.5% change in performance of manufacturing firms in Kenya.

Table 4.3: Model Summary for Lean Sourcing and Firm performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.498 ^a	.245	.241	.67231

a. Predictors: (Constant), Lean Sourcing

The analysis of variance was used to determine whether the regression model is a good fit for the data. It also gave the F-test statistic; the linear regression's F-test has the null hypothesis that there is no linear relationship between the two variables. From the analysis of variance (ANOVA) findings in Table 4.4, the study found out that that $\text{Prob} > F_{1,} = 0.000$ was less than the selected 0.05 level of significance. This suggests that the model as constituted was fit to predict performance of manufacturing firms in Kenya. Further, the F-calculated, from the table (500.76) was greater than the F-critical, from f-distribution tables (3.876) supporting the findings that lean sourcing can be used to predict performance of manufacturing firms in Kenya.

Table 4.4: ANOVA for Lean Sourcing on Firm Performance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	45.87	1	45.87	500.76	.000 ^b
1 Residual	24.735	270	0.0916		
Total	70.605	271			

a. Dependent Variable: performance of manufacturing firms in Kenya

b. Predictors: (Constant), Lean Sourcing

From the results in Table 4.5, the following regression model was fitted.

$$Y = 0.251 + 0.431 X_1$$

(X_1 is Lean Sourcing)

The coefficient results showed that the constant had a coefficient of 0.251 suggesting that if lean sourcing was held constant at zero, performance of manufacturing firms in Kenya would be 0.251 units. In addition, results showed that lean sourcing coefficient was 0.431 indicating that a unit increase in lean sourcing would result in a 0.431 improvement in performance of manufacturing firms in Kenya. It was also noted that the P-value for lean sourcing coefficient was 0.000 which is less than the set 0.05 significance level indicating that lean sourcing was significant. Based on these results, the study rejected the null hypothesis and accepted the alternative that lean sourcing has positive significant influence on performance of manufacturing firms in Kenya.

Table 4.5: Beta Coefficients for Lean Sourcing and Firm Performance

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.251	.074		3.347	.000
1 Lean Sourcing	.431	.092	.429	4.685	.000

a. Dependent Variable: Firm Performance

Test for Hypothesis Two

The second objective of the study was to find out the moderating effect of ICT adoption on the relationship between lean sourcing and performance of manufacturing firms in Kenya. Moderation happens when the relationship between the dependent variable and the independent variables is dependent on a third variable (moderating variable). The effect that this variable has is termed as interaction as it affects the direction or strength of the relationship between the dependent and independent variable. To achieve the second research objective, the study computed moderating effect regression analysis. This (moderating effect regression analysis) also guided the study in testing the second research hypothesis. ICT adoption (M) was introduced as the moderating variable.

H₀₅: ICT adoption has no significant moderating effect on the relationship between lean sourcing and performance of manufacturing firms in Kenya.

The study combined the variable (lean sourcing) to form a new variable X. The study then used stepwise regression to establish the moderating effect of ICT adoption (M) on the relationship between independent variable (X) and performance of manufacturing firms in Kenya (Y).

From the model summary findings in Table 4.26, the first model for which is the regression between lean sourcing (X) without moderator, ICT Adoption (M) and

interaction, the value of R-squared was 0.336 which suggests that 33.6% change in performance of manufacturing firms in Kenya can be explained by changes in lean sourcing. The p-value for the first model (0.000) was less than the selected level of significance (0.05) suggesting that the model was significant. The findings in the second model which constituted lean sourcing, ICT adoption and performance of manufacturing firms in Kenya (X*M) as predictors, the r-squared was 0.568. This implies that the introduction of ICT Adoption in the second model led to a 0.232 increase in r-squared, showing that ICT Adoption positively moderates performance of manufacturing firms in Kenya.

Table 4.1: Model Summary for Moderation Effect

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.580 ^a	.336	.334	.65170	.336	386.860	1	270	.000
2	.754 ^b	.568	.564	.52727	.232	537.10	3	268	.000

a. Predictors: (Constant), lean sourcing

b. Predictors: (Constant), lean sourcing, ICT Adoption, Interaction (X*M)

From the model summary findings in Table 4.7, the F-calculated for the first model, was 795.91 and for the second model was 1,121.06. Since the F-calculated for the two models were more than the F-critical, 3.877 (first model) and 2.638 (second model), the two models were good fit for the data and hence they could be used in predicting the moderating effect of ICT Adoption on performance of manufacturing firms in Kenya.

Table 4. 2: ANOVA for Moderation Effect

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63.832	1	63.832	795.91	.000 ^b
	Residual	21.675	270	0.0802		
	Total	85.507	271			
2	Regression	107.958	3	35.986	1,121.06	.000 ^c
	Residual	8.622	268	0.0321		
	Total	116.58	271			

a. Dependent Variable: Performance of manufacturing firms in Kenya

b. Predictors: (Constant), lean sourcing

c. Predictors: (Constant), lean sourcing, ICT adoption, Interaction

Further, by substituting the beta values as well as the constant term from the coefficient's

findings for the first step regression modelling, the following regression model will be fitted:

$$Y = 1.387 + 0.608 X$$

Where X is lean sourcing

The findings show that when lean sourcing is held to a constant zero, performance of manufacturing firms in Kenya will be at a constant value of 1.387. The findings also show that lean sourcing has a statistically significant effect on performance of manufacturing firms in Kenya as shown by a regression coefficient of 0.608 (p-value=.000).

By substituting the beta values as well as the constant term from model 2 emanating from the second step in regression modeling the following regression model was fitted:

$$Y = 3.876 + 0.220 X + 0.325 M + 0.283 X * M$$

Where X is lean sourcing; M is ICT adoption and X*M is the interaction term between lean sourcing and ICT adoption.

The findings show that when lean sourcing, ICT adoption, interaction (X*M) are held to a constant zero, performance of manufacturing firms in Kenya will be at a constant value of 3.876. The model also indicated that lean sourcing had a positive and statistically significant effect on performance of manufacturing firms in Kenya as shown by a regression coefficient of 0.220 (p-value= 0.002). It is also seen that ICT adoption had a positive and significant effect on performance of manufacturing firms in Kenya as shown by a regression coefficient 0.325. On the other hand, interaction of lean sourcing and ICT adoption (X*M) also had a positive and significant effect on performance of manufacturing firms in Kenya as shown by a regression coefficient of 0.283 (p-value= 0.000).

It is therefore seen that lean sourcing on its own has 22% effect on performance of manufacturing firms in Kenya. However, when interacted with ICT adoption, it has an effect of 28.3%. This is a clear indication that introduction of ICT adoption as moderating variable has positive influence on performance of manufacturing firms in Kenya. The study therefore rejects the null hypothesis and accepts the alternative that ICT adoption has significant moderating effect on the relationship between lean sourcing and performance of manufacturing firms in Kenya.

Table 4.3: Beta Coefficients for Moderation Effect

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	1.387	.194		7.163	.000
	lean sourcing	.608	.050	.580	12.260	.000
2	(Constant)	3.876	1.009		3.841	.000
	lean sourcing	.220	.067	.782	3.284	.002
	ICT adoption	.325	.048	.310	6.748	.000
	Interaction (X*M)	.283	.065	1.661	4.357	.000

a. Dependent Variable: performance of manufacturing firms in Kenya

Conclusions

The study found that lean sourcing has a positive and significant effect on performance of manufacturing firms in Kenya. Findings revealed that bulk sourcing, item categorization and supplier development influence performance of manufacturing firms in Kenya. This implies that improvement in lean sourcing (bulk sourcing, item categorization and supplier development) would lead to improvement in performance of manufacturing firms in Kenya. The study also found that ICT adoption has a positive and significant moderating effect on the relationship between lean sourcing and performance of manufacturing firms in Kenya. Findings revealed that technological infrastructure, automation of processes and effectiveness of Operations influence performance of manufacturing firms in Kenya. This implies that improvement in ICT adoption (technological infrastructure, automation of processes and effectiveness of Operations) would lead to improvement in performance of manufacturing firms in Kenya.

Recommendations

The study recommends the management of manufacturing firms in Kenya to provide comprehensive training on lean sourcing principles and methodologies across all levels of the organization. Actively implement lean sourcing practices, with a specific focus on bulk sourcing, item categorization, and supplier development. In addition, the management should implement effective item categorization systems to optimize inventory levels and reduce carrying costs. Secondly, the study recommends the management of manufacturing firms in Kenya to invest in tailored technology solutions that align with the specific needs of the manufacturing sector. This can be achieved by providing access to affordable, scalable, and user-friendly ICT tools, such as Enterprise Resource Planning (ERP) systems, cloud-based platforms, and data analytics software.

These tools can facilitate real-time data sharing, improve communication across supply chain networks, and optimize inventory management, which in turn supports lean practices.

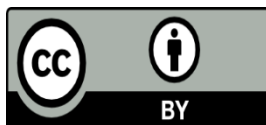
REFERENCES

- Abibal, A, Asfaw, C & Neeraj, S. (2020). The effect of lean supply chain practices on organizational performance with the mediating role of inventory management: the case of Ethiopian Pharmaceutical Supply Agency. *Kaav International Journal of Economics, Commerce & Business Management*, 7(2020), 28-32.
- Agrawal, P & Narain, R. (2022), Digital supply chain management: an overview, in IOP Conference Series: Materials Science and Engineering, IOP Publishing, Vol. 455, No. 1, p. 012074.
- AlManei, M., Salonitis, K., & Xu, Y. (2017). Lean implementation frameworks: the challenges for SMEs.
- Amrina, E., & Lubis, A. A. A. (2017). Minimizing waste using lean manufacturing: A case in cement production. In 2017 4th International Conference on Industrial Engineering and Applications (ICIEA) (pp. 71-75). IEEE.
- Barney, J. B. (1949). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120. <http://dx.doi.org/10.1177/014920639101700108>.
- Basu, P., Ghosh, I., & Dan, P. (2018). Using structural equation modelling to integrate human resources with internal practices for lean manufacturing implementation. *Management Science Letters*, 8(1), 51-68.
- Cronbach's, L.J. (1951), "Coefficient alpha and the internal structure of tests", *Psychometrika*, Vol. 16 No. 3, pp. 297-334.
- Debabrata, G., & Albert, T. (2018). A Framework for Implementing Blockchain Technologies to Improve Supply Chain Performance.
- Femi, A. B, Yemisi, O. S & Oke, J. A. (2022). Influence of supplier development on organization performance: an empirical investigation of manufacturing sector in Oyo State, Nigeria. *International Journal of Economics and Business Management*, 3(2), 29-37.
- Kasemsap, K. (2017). Lean thinking in global health care: Theory and applications. In *Handbook of research on healthcare administration and management* (pp. 120-141). IGI Global.
- Keinan, A. S., & Karugu, J. (2018). Total quality management practices and performance of manufacturing firms in Kenya: Case of Bamburi Cement Limited. *International Academic Journal of Human Resource and Business Administration*, 3(1), 81-99.
- Lukman, H., & Salim, S. (2017). Factors Influencing Implementation of Lean Manufacturing: Case on Manufacturing in Indonesia. In *Entrepreneurship in*

- Technology for ASEAN (pp. 47-58). Springer, Singapore.
- Magaireah, A. I., Sulaiman, H., & Ali, N. A. (2017). Theoretical framework of critical success factors (CSFs) for Business Intelligence (BI) System. In 2017 8th International Conference on Information Technology (ICIT) (pp. 455-463). IEEE.
- Manzor, U, Baig, S. A, Sami, A, Rehman, H & Nazam, M. (2021). Evaluating the impact of lean supply chain practices and supply chain management practices on firm performance-An empirical evidence from manufacturing factories. *Asia Proceedings of Social Sciences*, 7(1), 57-59.
- Netland, T. H., & Frick, J. (2017). Trends in manufacturing strategies: A longitudinal investigation of the International Manufacturing Strategy Survey. In *International manufacturing strategy in a time of great flux* (pp. 1-16). Springer, Cham.
- Nimeh, H. A, Abdallah, A. B & Sweis, R. (2020). Lean supply chain practices and Performance: Empirical Evidence from Manufacturing Companies. *International Journal of Supply Chain Management*, 7(1), 1-15.
- Njenga, C. K., & Moronge, M. (2018). Determinants of Integration of Lean Procurement Methodologies in Aviation Industry in Kenya: A Case of Kenya Airways Limited. *Strategic Journal of Business & Change Management*, 5(2).
- Qi, Y., Huo, B., Wang, Z., & Yeung, H. Y. J. (2017). The impact of operations and supply chain strategies on integration and performance. *International Journal of Production Economics*, 185, 162-174.
- Rajput, A, Gulzar, S & Shafi, K. (2021). Impact of supplier development on supplier performance: mediating role of trust. *Business & Economic Review*, 11(2), 45-66.
- Sahoo, S., & Yadav, S. (2022). Total quality management in Indian manufacturing SMEs. *Procedia Manufacturing*, 21, 541-548.
- Sporta, F. O. (2023). Effect of inventory control techniques on organization's performance at Kenya Medical Supplies Agencies. *The International Journal of Business & Management*, 6(3), 62-76.
- Tortorella, G. L., & Fettermann, D. (2019). Implementation of Industry 4.0 and lean production in Brazilian manufacturing companies. *International Journal of Production Research*, 56(8), 2975- 2987.
- Vitorino Filho, V. A., & Moori, R. G. (2020). RBV in a context of supply chain management. *Gestão & Produção*, 27(4), e4731. <https://doi.org/10.1590/0104-530X4731-20>
- Wachiuri, E. W, Waiganjo, E & Oballah, D. (2020). Role of supplier development on organizational performance of manufacturing industry in Kenya; a case of East Africa Breweries Limited. *International Journal of Education and Research*, 3(3), 683-694.

Yarkoni, T., & Westfall, J. (2019). Choosing prediction over explanation in psychology: Lessons from machine learning. *Perspectives on Psychological Science*, 12(6), 1100-1122.

Zhu, X., & Lin, Y. (2020). Does lean manufacturing improve firm value? *Journal of Manufacturing Technology Management*.



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