Moderating effect of environmental uncertainties on the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya

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ABSTRACT

The purpose of the study was to determine the moderating effect of environmental uncertainties on the relationship between lean supply chain strategy and the performance of manufacturing firms in Kenya. The study utilized a descriptive research design. The target population was 829 supply chain managers or directors from manufacturing firms around the country. A sample of 270 supply chain or procurement managers was selected using stratified random sampling. Results indicated that lean supply chain strategy explained 60.7% of the total variations in the performance of manufacturing firms. In addition, lean supply chain strategy had a positive and significant effect on the performance of manufacturing firms. With the introduction of moderating variables (environmental uncertainties); lean supply chain strategy explained 33% of the total variations in the performance of manufacturing firms. This denoted those environmental uncertainties had a negative moderating effect on the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya. The study concluded that lean supply chain strategy had a positive and statistically significant effect on the performance of manufacturing firms in Kenya.

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Introduction

The supply chains of today are progressively exposed to the probability of having harmful disruptions in the supply chain (Son and Orchard, 2013). Supply chain uncertainty as today's most urgent issue for companies. Recent empirical studies show that supply chains are more vulnerable to disruption (Tummala and Schoenherr, 2011). Given enhanced exposure to supply chain uncertainties, companies are increasingly focused on developing the suitable supply chain policies and strategies to address environmental uncertainties (Jüttner & Maklan, 2011).

Kenya's manufacturing sector accounts for 9.2% of GDP, 11.7% of total employment in the formal sector, and 20.4% of informal employment. The sector is one of big four government's agenda focusing on manufacturing, affordable housing, universal health care and food security as the key pillars for economic growth. However, the manufacturing sector is lagging in growth at 9% far from the expected average growth of 15% (Kippra, 2018). Further, the manufacturing sector growth in Kenya declined to 4.4% in 2011 as compared to a growth 5.8% in 2010. Similarly, the sector growth in 2014 was 3.4% compared to a 5.6% growth in 2013 (Waiguru, 2015). This slow growth in manufacturing sector performance can be attributed to several environmental uncertainties such as the general election, high production costs, supply disruptions, political stability, unavailability of raw materials or demand fluctuations, technological changes, employees' strikes, financial risk, terrorism and competition from imported goods (KNBS, 2018).

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For any firm to achieve performance, its supply chain strategies should lead to superior performance within the supply chain at firm level (Spekman, Kamauff & Salmond, 2014). The manufacturing sector in Kenya is faced by the challenges of performance and unstructured supply chain strategy (PWC, 2010). Volatility of end customers demand, short product lifecycles, price and quality fluctuations, continuous market dynamics have led to challenges in the ability of firms being responsive in the supply chains (Collichia & Strozzi, 2012).

Most of the past studies done have not looked at on relationship between supply chain strategies and firms' performance with environmental uncertainties as the moderator but have largely focused on the variables in isolation. A study by Nyaoga, Magutu and Aduda (2015) on supply chain performance and firm performance of large manufacturing firms found out that supply chain strategies explain 76.7% of firm's performance. Another study by Magutu, Mbeche and Njihia (2013) found out that supply chain strategies affect 51.3% of firm's supply chain performance. Further, the study found out a strong relationship between supply chain strategies, supply chain technology and firm's performance.

Moreover, these studies failed to look at the effect of environmental uncertainties as a moderator between the lean supply chain strategy and performance of manufacturing firms. Therefore, this study sought to create new knowledge by establishing the moderating effect of environmental uncertainties on the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya.

Literature Review

A lean supply chain produces what is needed and how much, when it is needed, and where it is needed. In lean thinking, the fundamental theme is to create more or do more with fewer resources while providing the end client precisely what they want. This implies that each item and its value stream are concentrated. To do this, organizations need to be prepared to ask and comprehend what operations are really worthwhile and what are wasteful. The most important thing to remember is that lean isn't just about disposing of waste, it's about eliminating waste and increasing value (Tompkins, 2013). Lean providers are the primary elements of the lean supply chain, lean procurement, Lean production, lean storage, lean transport and lean clients (Tompkins, 2013). Speed and client responsiveness, decreased inventories, decreased expenses, enhanced customer satisfaction, supply chain as a competitive weapon are the main elements of a lean supply chain (Schultz, 2016).

Lean supply chain literature shows the management implementation of lean methods. Organizations have reengineered their supply chains to function globally to take benefit of international product, factor, and capital markets. However, worldwide supply chain leadership may pose several uncertainties, such as variations in financial, cultural, and regulatory settings (Manuj and Mentzer, 2008). Often, lean thinking a dominant problem in modern supply chain design (Rossiter Hofer et al., 2011). In the 1990s, P&G restructured its North American supply networks to resolve the shortcomings in its legacy supply network schemes that had developed over many centuries (Camm et al., 2017).

Research has suggested conflicts between lean and global strategies, where lean and international supply chain have been studied across various sectors (Srai and Gregory, 2008), few scientists have regarded integrating worldwide supply chain and lean procedures to determine where they complement each other and where they contradict each other. Other study, however, has suggested disputes between lean and global strategies such as contributing to longer lead times and more inventories from offshore sourcing, which is contrary to lean values (Christopher and Lee, 2004).

Lean supply chain strategies focus on waste reduction, helping firms eliminate overtime, labor, equipment, space, and inventory-related non-value-adding activities across the supply chain. Such strategies allow companies to enhance quality, decrease expenses and enhance customer service as traditional mass production and supply chain methods (Larson and Greenwood, 2014). As supply chains increase in complexity and duration, lean methods are becoming increasingly hard to enforce and maintain. Cox et al. (2017) states that the lean approach can only be successful for products operating in chains characterized by regularity, high volume and standardized demand (automotive, chemical, food retail, aerospace). Lean supply chains at its core mean reducing waste to the greatest extent possible, where waste is any activity or cost that from the customer's point of view does not directly add value to the product. Lean is a process of incremental optimization. The gradual removal of more and more waste leads to more effectiveness. If lean is correctly applied, flexibility can be increased. The development of a lean supply chain requires lean application as a mechanism to the supply chain (Phelps, 2014).

Lean production is a key manufacturing philosophy whose foundation is customer-focused process improvements. The main focus is to increase value to customers while at the same time decreasing the number of resources used and cycle times through waste elimination (Ciarniene and Vienazindiene, 2012). To attain competitiveness and reduce costs, many manufacturers are engaging lean manufacturing methods to drastically reduce cycle time and enhance their competitive edge.

Hypothesis

H₀₁: Environmental uncertainties do not moderate the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya

Methodology

The study used a descriptive research survey design. The target population was 829 respondents from manufacturing firms around the country. The study used stratified random sampling in data collection. A sample of 270 respondents was randomly selected to participate in this study.

Primary data was used for the study. The data was collected using open and closed ended questionnaires. Descriptive statistics and regression analysis were used to analyze the data. Data was presented using tables.

Analysis and Discussion

Descriptive Statistics on Lean Supply chain Strategy

The respondents were asked to indicate their agreement or disagreement with the statements on lean supply chain strategy using a five level likert scale (1- strongly agree, 2-agree, 3-neutral, 4- disagree, and 5- strongly disagree). The results are shown in Table 4.10.

The findings indicate that majority of the respondents agreed with the statement that they reduce any kind of waste (58.4%), they make sure there is minimal or no idle time in machine (64.4%), their labor is fully utilized (74.7%), they keep minimum inventories as possible (54.4%), they always seek continuous improvement in our products (68.4%), and they review the manufacturing processes regularly to identify areas for improvement. However, 62.7% of the respondents disagreed that they keep zero inventories.

The aggregate mean of 2.6 indicated that majority of the respondents agreed with most of the statements about lean supply chain strategy. This implies that most of the manufacturing firms have embraced the use of lean supply chain strategy. The particular strategies include waste minimization, zero inventories and continuous improvement. Additionally, the overall standard deviation of 1.2 implied that the data was distributed around the mean. This denotes that majority of the respondents' shared similar views in regard to most of the statements on lean supply chain strategy.

Table 1: Descriptive Statistics on Lean Supply Chain Strategy

Statements	SA	A	N	D	SD	M	STD. DEV
We reduce any kind of waste	29.7%	28.7%	10.4%	25.2%	5.9%	2.5	1.3
We make sure there is minimal or no idle time in machine.	31.7%	32.7%	14.9%	16.8%	4.0%	2.3	1.2
Our labor is fully utilized.	25.7%	49.0%	10.9%	10.9%	3.5%	2.2	1.0
We keep zero inventories.	8.4%	18.8%	9.9%	40.6%	22.3%	3.5	1.3
We keep minimum inventories as possible.	17.3%	37.1%	13.9%	21.3%	10.4%	2.7	1.3
We always seek continuous improvement in our products.	23.8%	44.6%	9.4%	16.8%	5.4%	2.4	1.2
We review our manufacturing processes regularly to identify areas for improvement.	24.8%	40.6%	7.9%	20.8%	5.9%	2.4	1.2
Aggregate mean						2.6	1.2

The respondents were asked to suggest other factors that affect lean supply chain strategy in their firms. Based on the responses, the following factors were identified: demand collaboration, sales and operation planning, modern inventory management practices, waste and value-added activities. Most of the participants viewed these factors as vital in determining the success of lean supply chain strategy in the manufacturing sector.

Regression Analysis

Effect of Lean Supply Chain Strategy on Performance of Manufacturing Firms

The regressions results are presented in Table 4.33. The model summary results indicate that separately, lean supply chain strategy explains 61% ($R^2 = .607$) of the total variations in the performance of manufacturing firms. The ANOVA results reveal an F statistic of 309.110 and reported P value of 0.000. The P value being less than the alpha value ($P < .05$), the proposed model is therefore statistically significant (good fit) in predicting the dependent variable.

Further, the regression of coefficient findings indicate that lean supply chain strategy had a positive and significant effect on firm performance ($\beta = 0.583$ $P < .000$). This implied that a change in lean supply chain strategy by one unit would result to a change in performance of manufacturing firms by 0.583 units. The results were similar to Bruce, Daly, Towers (2014) conclusion that lean

approaches lead to enhanced performance. Daud and Zailani (2011) established that demand collaboration, sales and operation planning, inventory management practices, waste and value added activities are the most influence lean supply chain practices for lean performances. Afonso and do Rosário Cabrita (2015) concluded that lean supply chain measurement system increases the chance for success because it enables managers to see areas where supply chain performance can be improved, so they can focus their attention, and obtain higher levels of performance. Further, Mwangangi and Achuora (2019) established a significant positive relationship between Lean Supply chain and Organizational Performance. However, the findings disagreed with those of Cox, Chicks and Palmer (2017) who found that majority of UK pig supply chain respondents who were the first to adopt lean approaches did not receive the expected business enhancement.

Model;

$$\text{Firm Performance} = 0.883 + 0.583 \text{ Lean Supply Chain Strategy}$$

Table 2: Regression Model- Lean Supply Chain Strategy and Firm Performance

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.883	.086		10.224	.000
	X4	.583	.033	.779	17.582	.000
	R Squared	.607				
	Adjusted R Squared	.605				
	F statistic	309.110				
	P value	.000				

a Dependent Variable: Y

Following the introduction of moderating variable (environmental uncertainties); the results in 4.34 indicate that lean supply chain strategy when interacted with environmental uncertainties explains 33% of the total variations in performance of manufacturing firms. A comparison between the R square without moderation and R square with moderation reveal that the R square declined from 61% to 33%, implying that environmental uncertainties had a negative moderating effect on the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya. This means that environmental uncertainties significantly lower the effect of lean supply chain strategy on firm performance.

Model;

$$\text{Firm Performance} = 1.638 + 0.129 \text{ Lean Supply Chain Strategy} * \text{Environmental Uncertainties}$$

Table 3: Regression Model with Moderation

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	1.638	.077		21.195	.000
X4.M	.129	.013	.574	9.920	.000
R Square	.330				
Adj. R Square	.326				
F statistic	98.401				
P value	0.000				

Conclusion

According to the findings the study concluded that lean supply chain strategy had a positive and statistically significant effect on performance of manufacturing firms in Kenya. The study identified waste minimization, zero inventories and continuous improvement as vital strategies that could enhance performance of manufacturing firms. The study further concluded that environmental uncertainties moderate the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya. In particular, environmental uncertainties lower the effect of lean supply chain strategy on firm performance. The null hypothesis that environmental uncertainties do not moderate the relationship between lean supply chain strategy and performance of manufacturing firms in Kenya was rejected.

The study established that lean supply chain strategy had a positive and significant effect on performance of manufacturing firms in Kenya. The study recommends that manufacturing firms should strengthen aspects related to lean supply chain strategy specifically reducing idle machine time, full utilization of labor and applying just in time philosophy of keeping zero inventories. Other key areas manufacturing firms should improve are continuous improvement in processes, procedures and products by incorporating quality assurance, technological advancements and demand forecasting. Further, manufacturing firms should regularly scan the environment to identify likely occurrence of events and either implement adoption strategies or mitigation strategies. Also manufacturing firms can incorporate supplier collaborations to minimize supply uncertainty, adopt new technologies and regular review of customer market to align their products to changes in tastes and preferences. These activities if well implemented will enhance the performance of the manufacturing firms.

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