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Impact of Lean Manufacturing Practices on Customers Satisfaction in Kogi State, Nigeria

Audu Samson, PhD
Department of Business Administration and Management, The Federal Polytechnic Idah
Kogi State, Nigeria
(Orcid ID: https://orcid.org/0000-0003-2671-9868)
Email Address: asamson@fepoda.edu.ng,
Tel: (+234) 8054836107

Abstract

Manufacturing sub-sector play a significant role to the Nigerian economy but its performance largely depends on customers' satisfaction. This research on Impact of Lean manufacturing Practices on Customers' Satisfaction with a focus on Obajana Cement PLC Kogi State is carried out to examine the extent to which lean manufacturing practices influences customers' satisfaction in Kogi state. The study adopts a research survey design with a total population of 1054 who are employees of the company and sample of 246 was used using the Godden sample size formular. However, out of the total sample size of 246 reached only 216 completed and returned the questionnaire giving a retrieval rate of 88%. The study elicited data from primary source. The hypotheses were tested using multiple regressions. The research showed that there is significant positive relationship between lean manufacturing practices and customers' satisfaction. The study revealed that there is significant positive relationship between lean manufacturing practices and customers satisfaction in Kogi state. The research also submitted that lean manufacturing practice such as elimination of idle time, reduction of idle time, reduction in unnecessary movement and reduction in over storage significantly contribute to customers satisfaction. Based on the findings, this research therefore recommends that lean manufacturing practices should not only be sustained but be periodically reviewed to ensure it is in line with contemporary trends to enable it meets customers' perceived expectations and needs. The study also recommends that stakeholders' interest should be considered and also be reviewed from time to time to enable the firm meet it mandate of improved performance.

Keywords: *Lean, Manufacturing, Practices, Customers, Satisfaction.*

Introduction

Customers are increasingly becoming more sophisticated, protected and dynamics owing to the reality of stiff competitiveness in this era of globalization where business can only strive competitively through putting up innovative strategies to satisfy their customers efficiently. Therefore, for firms to meet their stakeholders' expectations especially customers there is need to ensure that customers are well served at the most cost-effective manner. To this end, delivering product or services to them requires ensuring that unnecessary costs, procedures and logistics are avoided as much as possible especially considering the fact that all these translate into cost minimization and improved performance. Manufacturing activities in this era of stiff competitiveness requires monitoring, strengthening and application of lean manufacturing activities targeted at ensuring that products are satisfactorily delivered to customers cheaply and conveniently lean manufacturing originated from automobile industry but has gained prominence across various sectors owing to its relevance and capability in improving performance. The main idea of lean manufacturing practices according to (Charanjit et al 2020, Ping-kvn et al 2020 & Wagner et al, 2017) is to focus on core areas that have direct link to manufacturing while

unnecessary activities creation of standardized routines and strengthening production process are pursed. It is worthy to note that lean manufacturing is seen as the manufacturing technique of eliminating all non-value added tasks thereby avoiding wastages in production process with the understanding of meeting specific customers' needs and providing same in the most efficient manner (Mrugalska, Wyrwicka, 2017 & Dossou, et al, 2020). No wonder, Netland (2016), Cestaidi et al, (2016) and Sven-vegard (2018) argued that lean manufacturing practices has become the most prominent and efficient paradigm in recent time owing to its capability of supporting manufacturing firms in the area of improved responsiveness to customers, reduced cost of production, product improvement and reliability as well as lead time implying that there is a link between application of lean manufacturing techniques and improved performance Kogi State is located in North-central Nigeria and housed the gigantic Obajana cement Plc where cement are produced. The cement product which is largely used for building and construction though produced in Obajana, Kogi state but its customers cut across several parts of the country. Therefore, satisfying these customers in the most cost-effective manner requires application of lean manufacturing practice targeted at minimizing wastages, errors, defects and so on. This is because, for business to attain continuous competitive edge as well as gain customers loyalty which translates into improved patronage requires adoption of methodologies that will satisfy customers perpetually.

Statement of Objectives

This research evaluates the impact of lean manufacturing practices on customers satisfaction in Kogi State, Nigeria. The paper however is set to accomplish the following specific objectives:

i. To evaluate the relationship between elimination of idle time and customers satisfaction.
ii. To ascertain the relationship between error reduction and customers satisfaction.
iii. To examine the relationship between reduction of unnecessary movement and customers satisfaction.
iv. To examine the relationship between over-storage and customers satisfaction.

Hypotheses of the Study

Premised on the research objectives the study postulated the following null hypotheses:

H_1: There is no significant relationship between elimination of idle time and customers' satisfaction.

H_2: There is no significant relationship between error reduction and customers' satisfaction

H_3: There is no significant relationship between reduction of unnecessary movement and customers' satisfaction.

H_4: There is no significant relationship between over-storage and customers satisfaction.

Literature Review

Lean manufacturing is seen as a manufacturing technique anchored on the elimination of non-value added in the production process or supply chain. This technique according to (Krisztina & David, 2012) was initiated by Taii Chi Ohno, the executive director of Toyota in the 1950s after the Second World War. Lean manufacturing therefore means application of manufacturing methods which is based on elimination of unnecessary or non-value added methods with the aim of meeting

customers' needs efficiently (Buer et al, 2018 & Jayaram, 2016). Lean manufacturing is therefore capable of eliminating wastages, idle time, errors, and unnecessary movements as well as over storage in the entire production process (Koiberg et al, 2017). Based on this, Bortolotti et al (2015), Chen and Lin (2017) and Dossou et al (2020) further suggested that lean manufacturing practices requires value stream mapping which is a manufacturing technique that integrate all value-added and pursuing production efficiency as well as customers satisfaction.

Furthermore, (Bevilacqua et al, 2017) noted that these practices are fundamentally capable of pursuing a more prosperous manufacturing system and production efficiency through shorter lead time, improved quality, improved returns on investment and customers' satisfaction. Based on this, it can be affirmed that there is a link between production efficiency, customers' satisfaction and customers' satisfaction. Therefore (Bevilacqua et al 2017, Barney 1991, Antikainen, Valkokari, 2019 & Uchenna, Audu 2021 & Uchenna, Audu 2022) revealed that for manufacturing firms to be able to implement lean manufacturing practices effectively there are seven fundamental wastages capable of affecting production efficiency that should be avoided. These wastages include the following:

a. Errors: Error in production occurs when products are produced outside the required stipulated standard. This could happen by mistake but be it by mistake or willful destruction by staff or machine it is a waste of financial resources as well as loss of significant number of customers.
b. Waiting times: waiting time is the time spent in between two or more stages of production. Excessive waiting time amounts to loss of man-hour especially when employees or machines are kept in queue at the work station.
c. Over production: over production occurs when more product is produced more than expected, demand or required. This could lead to loss of profit, capability of rendering firm funds idle or in necessary expenses for storage spaces as well as product obsolescence or expiration.
d. Unnecessary displacement: production logistics play cardinal role in the pursuance of manufacturing efficiency and improved performance. This is required to ensure that products are move to the desired location within the work station at any point in time.
e. Unnecessary treatments: there is need to understand the production procedure as well as being able to identify the critical activities as well as functions that do not in any way add input to the entire process. The moment this does not take place, it leads to unnecessary treatments in production thereby adversely affects the manufacturing process (Avishkar et al, 2021).
f. Unnecessary movements: unnecessary movements do occur in production when production logistics is either not properly scheduled or prioritized. Therefore, it is important to ensure that movements of people and goods are strategically planned in the most efficient manner.
g. Over storage: this occurs when either raw material, semi-finished or finished goods are held more than required. This leads to over stocking and incurring of unnecessary costs (Hadipuro, 2022).
h. A customer is the client or those who benefit from firm's products or services. Customers are therefore expected to be the immediate focus of every firm because the level of satisfaction greatly affects patronage of the firms' products or services that is why firms must strive to ensure that their customers are satisfied.

Theoretical framework

This research explores the resource-based view (RBV) which portrays that Organizations' competitive advantage can be vigorously pursued and attain when resources are rare, scare and heterogeneous. Thus, for manufacturers to have competitive advantage above other firms they should be in charge of resources that are not commonly moved or requiring an extensive learning curve by similar firms to adopt and apply such resources. This research on lean manufacturing

practices and customers' satisfaction is being anchored on the Resources Based View (RBV) considering its relevance to this research and its practical application.

Research Methodology

The research adopted a descriptive research design. This research method is a research survey design involving surveying the respondents with the view to collecting responses with the aim of making statistical analysis. Thus, this study which examines lean manufacturing practices and customers satisfaction involved collecting data through primary sources. The primary data obtained were through a structured questionnaire while the data were subjected to descriptive and inferential analysis. The population of this study comprised the entire employees in Nigeria Obajana Cement PLC Kogi state numbering about 1054. However, considering the fact that the population for this study may not be manageable effectively, it becomes impossible to study the entire population. Thus, the research adopted Godden' statistical formula.

The Godden (2004) sample size determination statistical technique is appropriate for determination of sample size with a finite population less than 50,000

The Godden (2004) formular denoted as.:

$$SS = \frac{Z^2 (P)(1-P)}{C^2} \quad \text{-- equ (1)}$$

$$\text{New SS} = \frac{SS}{1 + \frac{(SS-1)}{\text{Population}}} \quad \text{equ (2)}$$

Where SS = Sample size
Z = Confidence level 95 %
P = Percentage of population (70%)
C= Confidence interval = 5 % (0.05)

$$SS = \frac{1.96^2 (0.7)(1-0.7)}{0.05^2} \quad \text{equ (1)}$$

$$SS = \frac{3.8416 (0.7)(1-0.7)}{0.0025}$$

$$SS = \frac{0.806736}{0.0025}$$

$$SS = 322$$

Population = 1054

$$\text{New SS} = \frac{322}{1 + \frac{(322 - 1)}{1054}}$$

$$\frac{322}{\frac{322}{1 + 0.32}}$$

$$SS = \frac{322}{1.31}$$

New SS = 246

Therefore, the sample size = 246

However, out of the total 246 questionnaire distributed only 216 were duly completed and returned giving a retrieval rate of 88%.

The questionnaire was the only source of primary data therefore in doing this the study designed a structured questionnaire which was close ended while a five- point Likert-scale responses of strongly agree, Agree, Undecided, Disagree and strongly disagree was used. The decision criterion is to accept any item with a mean of 3.00 and above otherwise such a mean will be rejected.

Data Analysis and Results

Table 1. Descriptive Statistics

	Mean	Std. Deviation	N
EIT	3.25	1.24	216
RE	3.73	134	216
RUM	3.70	1.59	216
ROS	4.18	0.91	216
CS	3.40	1.02	216

The table shows the selected scale mean lies within the accepted range, therefore they are of high extent and the research can conclude that data obtained and analyzed is significant and reliable. More so, in order to ascertain the variability of the data the standard deviations of both variables were examined. The mean of elimination of idle time (EIT) is 3.25 and the standard deviation is 1.24, the mean of reduction in error (RE) is 3.73 and the standard deviation is 1.34, the mean of reduction in unnecessary movement (RUM) is 3.70 and the standard deviation is 1.59, the mean of reduction in over-storage (ROS) is 4.19 and the standard deviation is 0.91 while that of customers satisfaction (CS) has the mean value of 3.40 and standard deviation of 1.08. hence all variables lies within the value of high extent as indicated by their corresponding means and standard deviations which are closely related

Test of Hypotheses

The statistical decision rule of p- value states that the Null hypothesis should be accepted if P-value is greater than alpha value (i.e. level of significant which is 0.05) otherwise it should be rejected while the Alternative hypothesis is adopted.

Table 2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.467[a]	.218	.200	.96883

a. Predictors: (Constant), EIT, RE, RUM, ROS.
Source: Field survey, 2023

Table 3 reported that the change in customers satisfaction which is brought about by the changes in lean manufacturing practices variables by 22% (.218) as indicated by the adjusted R^2 value. The independent variables explain 21% of the variability of the dependent variable

Table 3. Fitness of the Model

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	55.037	5	11.007	11.727	.000[b]
	Residual	197.112	210	.939		
	Total	252.148	215			

a. Dependent Variable: CS
b. Predictors: (Constant), EIT, RE, RUM, ROS.

Source: Field survey, 2023

The *F*-ratio in table 4 shows that the variables of lean manufacturing practices statistically significantly predict customers satisfaction, $F(5, 210) = 11.727$, $p < .0005$ (this means that the regression model is a good fit of the data).

Table 4. Coefficient

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.475	.390		1.220	.224
	EIT	.274	.062	.315	4.410	.000
	RE	.135	.054	.167	2.488	.014
	RUM	-.023	.045	-.033	-.502	.616
	ROS	.059	.059	.078	1.002	.318

a. Dependent Variable: CS

Table 5 shows that elimination in idle time (B= 0.274, S.E= 0.62, t. cal = 4.410, p= 0.000, P < 0.05), reduction in error (B= 0.135, S.E= 0.54, t. cal = 2.488, p= 0.014, P < 0.05), reduction in unnecessary movement (B = -0.23, S.E= 0.45, t. cal = -.502, p= 0.616, P > 0.05), reduction in over-storage (B = 0.59, S.E= 0.59, t. cal = 1.002, p= 0.318, P < 0.05). This implies that elimination of idle time has a more strongly relation to customer satisfaction followed by reduction in error with p value of p= 0.000 and p= 0.014 P < 0.05 respectively. Again, reduction in unnecessary movement and over- storage do not adversely affects customers satisfaction instead it would lead to increase cost. Finally, elimination of idle time was found to have the most significant influence on customers' satisfaction with a beta coefficient of B = .274.

Conclusions and Recommendations

The research showed that there is significant positive relationship between lean manufacturing practices and customers' satisfaction in Kogi state. The research also submitted that lean manufacturing practice such as elimination of idle time, reduction of idle time; reduction in unnecessary movement and reduction in over storage significantly contribute to customers' satisfaction. Premised on the findings, this study therefore recommends that lean manufacturing practices should not only be sustained but be periodically reviewed to ensure it is in line with contemporary trends to enable it meets customers' perceived expectations and needs. The study also recommends that stakeholders' interest should be considered and also be reviewed from time to time to enable the firm meets its mandate of improved performance.

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