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Developing Efficient Lead Time Practice in the Supply Chain Process to Enhance Customers' Satisfaction in FMCGs in Nigeria

Golda Ezeoke[1*] Emmanuel Oyatoye[2] Joseph Mojekwu[3]
1.Department of Business Administration, University of Lagos, Akoka, Lagos, Nigeria
2.Department of Business Administration, University of Lagos, Akoka, Lagos, Nigeria
3.Department of Actuarial Science and Insurance, University of Lagos, Akoka, Lagos, Nigeria

Abstract
The production and delivery of high quality goods and services that satisfy customers' expectations are essential elements in determining the long term achievement of manufacturing companies. This paper aims to develop efficient lead time management in the supply chain processes of Nigerian fast moving consumer goods (FMCGs) manufacturing companies as this would enhance the production of indigenous products of high quality thereby satisfying the consumers' needs, moreover, contributing to economic growth and development of the manufacturing industry in Nigeria. The study uses a quantitative approach consisting of a cross-sectional survey and the administration of structured questionnaires to staff of FMCGs in selected study areas of Lagos and Ogun State, Nigeria. The data available for this study was analyzed using ordered logistic regression model with the aid of different statistical tool; SPSS IBM version 24 and STATA 13.0. The outcome of the study indicated the underlying dimensions of lead times and the service response level of customers, with an overall objective to meet customers' needs. Furthermore, the result showed that adequate stock level and reduction in lead times contributed to the availability of quality products to customers on time.
Keywords: Supply chain, Lead time, Customer satisfaction, FMCGs, Manufacturing industry.
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1. Introduction

The increase in global competition and market uncertainty brings about opportunities along with threats for manufacturing firms, thus, a supply chain that responds proactively to the fluctuating demand patterns for finished goods give room for production managers to take decision in the purchase, production, storage as well as in the distribution of finished goods to consumers. Therefore, the production and delivery of high quality goods and services expected to satisfy customers' needs are vital factors that enables manufacturing companies achieve their long term goals. David, Aquilano and Chase (2003) opine that in order to meet this varying demand, manufacturing companies have taken measures to improve performance, set standards and implement procedures along its supply chain processes to meet customer need and possibly exceed this need.

The manufacturing sector which is one of the key indices of growth and development in Nigeria, have suffered negligence over the years due to the overdependence of the Nigerian economy on the oil sector and the disregard of other sectors (agriculture, mining, energy and infrastructure) that boost manufacturing activities (Mojekwu, 2012). However, it also seems the operators of the sector have not taken into consideration the importance of efficient optimization strategies in the performance of their day to day supply chain activities, so as to improve on the responsiveness in the relationship with its customers. With the challenges it face, the Nigerian manufacturing sector's contribution to real Gross Domestic Product (GDP) dropped from =N=8.97Tn to =N=8.89Tn; and the GDP annual growth rate was estimated at 2.7 percent and -1.5 percent in 2015 and 2016 (Akinmulegun and Oluwole, 2013), hence the need to develop responsiveness in the supply chain processes: operating at lower inventory level while maintaining high service levels; improving forecast accuracy; improving product and order lead times; reducing the scheduling cycle from days to hours; and producing the right mix of products that are of high quality, at the right price and delivered to customers at the right time is of great essence.

Although there has been a continuing interest in the responsiveness issue within the context of the supply chain, further research is required to know the right level of developing efficient order and product lead times in the supply chain, and the strategy that should be adopted to achieve customers' satisfaction. Regardless of its importance, there has been few works that attempted to relate customer satisfaction to responsive supply chain processes, hence, the current study aims to explore quantitatively how developing efficient lead time in the supply chain process would enhance customers' satisfaction and patronage of locally produced fast moving consumer goods (FMCGs) by manufacturing companies in Nigeria.

2. Literature Review

2.1 Order and Processing Lead Time

Marlin (1986) defined lead time as the amount of time it takes to place an order, and the receipt of the ordered product or service by the customer. Extant studies note that lead time serve as a performance measure and a competitive advantage for manufacturing companies as they optimize the time spent along the supply chain in attending to supplier and customer orders, processing these orders, maximizing the time required for production, loading, shipping, distribution and reducing backlogs of inventory as this would assist in cost reduction and capacity utilization (Mourtzis, Doukas, Fragou, Efthymiou, and Matzorou (2014).

Cottleer and Bendoly (2006) investigate the influence of order lead time improvement on operational performance of firms in United States of America. Analysis of covariance (ANCOVA) was applied to the longitudinal data collected. The results suggest variation in lead time performance of firms under different conditions. Koschat (2008) also analyzed the effect of store inventory on demand using a magazine retailing as a case study. Data from segmented stores were subjected to factor analysis followed by regression model with OLS technique. The results showed that when an inventory decrease occur for one brand, it would result in a decrease in demand for that brand, and this would also result in an increase in demand for a competing brand. These observations support the expansion of the traditional Newsvendor model to include inventory effects, as well as the practice to make inventory decisions for retail categories rather than just individual brands.

A review by Mula, Poler, Sabater and Lario (as cited in Sadraoui and Mchirgui, 2014) reveals that the uncertainty in product lead time was less studied in the past. A simulation experiment carried out by Tim and Groenevelt (1984) also indicates the effect of safety stocks and lead times with uncertainty in the demand and supply of a product, however, he confirms that the benefit of safety stock is its responsiveness, whereas safety lead time increases flexibility indicating that safety stock is more effective with uncertainties in demand, and in the case of uncertainty in supply and demand; a safety lead time is more effective than an equivalent level of safety stock. The authors noted that adopting a safety lead time would result to higher inventory levels with a comparable level of safety stock when demand uncertainty is high or the number of stock keeping units is high.

Grubor, Milicevic and Djokic (2016) analyzed the effect of inventory level and lead time on product availability and sale in the FMCG in Serbia. Data were collected from 16 retail stores using ERP information platform connected with store's POS terminals. Data analysis was carried out using structural equation model (SEM) and the results of the research show a much higher level of shelf-life when compared to store stock-out rate and this confirmed the existence of the problem in the realization of internal product flows within retail stores. However, despite the occurrence of this problem, besides direct positive effect of inventory level on sale, its indirect effect was also positive.

Oyatoye and Fabson (2011) investigated the simulation approach in quantifying the bullwhip effect in the supply chain using various forecasting methods and stressed that there was inadequate information in the supply chain and there is a need to improve information management along the supply chain so as to effectively leverage lead times , which also agrees with the study carried out by Sadraoui et al (2014) on the importance of information thereby developing a framework based on the Model Predictive Control (MPC) and a forecasting module that indicated the impact of forecast accuracy on the overall control performance of the supply chain in terms of optimizing lead time in production, and rendering better services, sales growth, lower costs of production and inventory. The study of

Therefore this study views lead time in terms of order lead time and product lead time utilizing the application of the ordered logical regression model to develop an optimum lead time in the supply chain to enhance customer satisfaction in FMCGs in Nigeria.

3. Materials and Methods

3.1 The Study

The purpose of this study was to examine the need for FMCGs especially small and medium FMCGs in Nigeria to develop efficient lead time management in its supply chain processes as a competitive strategy in improving its operational processes in order to enhance product loyalty and patronage among its customers; it therefore uses a quantitative approach for the investigation. The data available for this study was analyzed using ordered logistic regression model with the aid of different statistical tool; SPSS IBM version 24 and STATA 13.0.

This study attempted to investigate best practices from the perspective of service staff and executives of some FMCGs industries. A key objective was to examine the impact of responsive supply chain processes on customer satisfaction.

3.2 Research Questions

i. Will reducing the order processing lead time in the FMCG industry influence meeting the customers' request on time?
ii. Will reducing the product lead time in the FMCG industry affect product availability to customers?

4. Research Design

The current study has adopted a cross-sectional survey design as it can help explore the research problem and provide a profound knowledge of the research problem in a real life situation. This study adopts a quantitative research design which entails testing a hypothesis with quantitative data collections and analysis in order to develop responsive supply chain processes to enhance customer satisfaction.

4.1 Research Setting and Participants

The participants have been randomly selected from 278 fast moving consumer goods (FMCGs) industries located in the south-western states of Lagos and Ogun states.

4.2 Sampling Size and Sampling Techniques

A two stage sampling techniques will be employed. At the first stage, manufacturing firms will be stratified across production sector. The second stage will involve using random sampling technique. Applying the Taro (1967) sampling formula, a total of 278 manufacturing firms will be sampled. The FMCG industry is categorized into 4 sub-sectors: food and beverages; chemical and pharmaceuticals; alcoholic drinks; as well as, home and personal care. For ease of sampling, approximately 70 manufacturing firms will be sampled from each of the FMCG industry sub-sector.

$$n = \frac{N}{1+Ne^2} \qquad (1)$$

Where, n = anticipated total sample size; N = population size; e = acceptable error term (0.05).
Therefore, the total sample size was computed as:

$$n = \frac{916}{1+916(0.05)^2} = 278$$

5. Data Collection

Data will be obtained through the use of a structured questionnaire using five point Likert scale type questions. Relevant data on order processing lead time, product lead time, stock level and customers satisfaction will be sourced from staff of sampled FMCGs manufacturing firms and customers. Operation managers and other employees in the production units will be particularly targeted.

6. Empirical Model (Ordered regression model)

In order to analyze data on the lead times quantitatively, the ordered logit model is applied based on the following specification:

$$y_i^* = b'x_i + \varepsilon_i, \qquad (2)$$

Where $\boldsymbol{x_i}$ is the set of explanatory variables and ε_i, is the error term.
y_i^* is unobserved. What is observed; +

$$Y_i \begin{cases} = 0 & \text{if } y_i^* \leq \mu_0 , \\ = 1 & \text{if } \mu_0 < y_i^* \leq \mu_1, \\ = 2 & \text{if } \mu_1 < yi^* \leq \mu_2, \\ \dots & \\ \dots & \\ = n & \text{if } y_i^* > \mu_{1n}. \end{cases}$$

The explanatory variables in ordered model are nearly all categorical variables. To avoid identification problems for each variable one level has to be omitted from the set of explanatory variables reflecting the various levels of influence an order processing and product lead time would have on the availability of products to customers.

The explicit form of the model is expressed as:

$$y_i^* = b_1'x_1 + \ldots + b_n'x_n + \varepsilon_i \qquad (3)$$

Where y_i represents measure of products' availability;
$x_{1\ldots}x_n$ is the measure of order lead time (product lead time)
The relationship is expressed as:

$$Y = \alpha_i + \beta_1\, ctm_1 + \beta_2\, adtm_2 + \beta_3\, optm_3 + \beta_4\, pktm_4 + \beta_5\, pltm_5 + \beta_6 psvt_6 + \beta_7 vatm_7 + \varepsilon_i \qquad (4)$$

TOP = average time of order placement by customers
ATO= administration time of order
OPS = average time of order processing/production signal
TRP = the time required to produce or process the order
VATM= average 'value added' time on order
PKTM = minimum time required to package a processed good
TPG = average time distance between processed goods and service to customer

7. The Interpretation of the Data and Results

7.1 The Estimated Level of Influence an Order Processing Lead Time Would Have in Meeting Customer's Request on Time in the FMCG Industry

Research Question One: Will reducing the order processing lead time in the FMCG industry influence meeting the customers' request on time?

To determine the level of influence an order processing lead time would have in meeting customer's request on time in the FMCG industry, ordinal logistics regression model was carried out using STATA 13. The results are presented in Table 1.

Table 1. Estimated Level of Influence of an Order Processing Lead Time Would Have in Meeting Customer's Request

Variables	Coeff	Std. Err	Z	p>|z|
TOP	-0.2056239	0.1431549	-1.44	0.151
ATO	0.3372572	0.1481651	2.28	0.023
OPS	0.3232098	0.1590356	2.03	0.042
Log likelihood = -141.56178				
LR $chi^2(3)$ = 13.85				
Prob> chi^2 = 0.0031				
Pseudo R^2 = 0.0466				

The model diagnostics such as Log Likelihood, LR Chi^2 are high and significant (LL = -141.561; LR Chi^2 (3) = 13.85, Prob> Chi^2 = 0.0031). This denotes that the specification is appropriate to achieve the stated objective. The estimated coefficients and the odd ratios of the measures of order processing lead time, which are represented by average time of order placement (TOP), administration time of order (ATO) and average time of order processing/production signal (OPS) are presented. The results show a positive and significant influence both administration time of order (ATO) and average time of order processing/production signal (OPS) would have in meeting customer's request on time in the FMCG industry. The positive and significant coefficient of ATO ($\beta = 0.337$, $p < 0.05$) indicates that a 0.337 unit increase in administration time of order would influence an increase in the log odds of time needed to meet customer request. Also, a 0.323 unit increase in average time of order processing/production signal (OPS) by the FMCG ($\beta = 0.323$, $p < 0.05$) would directly influence the log odds of time needed to meet customer request.

The average time of order placement has no significant influence on the time needed to meeting customer's request on time in the FMCG industry. The result highlights the relevance of adequate supply chain management that seeks to reduce order processing lead time in the FMCG. This is expected to expedite customers' response to efficient service delivery in the system.

Results of the odd ratios of the significant variables or order processing lead time in the FMCG shows that when there is a unit increase in ATO, the odds of meeting customer request on time is 1.40 unit of time more, if all other variables are held constant, Also, for a unit increase in OPS, the odds of meeting customer request on time is 1.38 unit of time more, if all other variables are held constant. This negates the hypothesis that "reduction in the order processing does not influence meeting customers request on time"

7.2 The Level of Influence the Product Lead Time Would have on the Availability of Quality Products to Customers in the FMCG Industry

Research Question Two: Will reducing the product lead time in the FMCG industry affect product availability to customers?

Results in Tables 2 show the estimated influence of the product lead time on the availability of quality products to customers in the FMCG industry using ordered logistic regression. The log likelihood and likelihood ratio are significant which indicates the appropriateness of the specification (LL = -140.891; LR chi^2 (2) = 6.57, Prob> chi^2 = 0.0375). The product lead time, TRP (the time required to produce or process the order) and the average time distance between processed goods and services to customer (TPG) are as denoted. The coefficient of TRP is positive and significant while that of TPG is not significant.

The significance of the parameter of TRP suggests that an increase in the time required to produce or process the order, is expected to result in 0.337 increases in the log odds of availability of quality products, and given that all other variables are constant. This suggests a direct level of influence of TRP on availability of quality product in the FMCG industry. Odd ratio estimates of the level of influence of the product lead time on the availability of quality products indicates that for a unit increase in the time required to produce or process the order, the odds of availability of quality products is 1.4015 greater, given that the remaining variables in the model are held constant. This confirms that reduction in product lead time in the FMCG industry have effect on product availability.

Table 2. Estimated Level of Influence of the product lead time has on the availability of quality products to customers in the FMCG Industry

Variables	**Coefficient**	**Standard Error**	**Z**	**p>|z|**
TRP	0.3376114	0.133699	2.53	0.012
TPG	-0.0181315	0.1398047	-0.13	0.897
Log likelihood = -140.8906				
LR chi2(2) = 6.57				
Prob> chi^2 = 0.0375				
Pseudo R^2 = 0.0228				

8. Discussion

The analysis of the availability of quality products to customers in the FMCG industry in response to lead time produced mixed results which hang on the supply chain activities being considered. The result lend credence to indirect influence of average time of order placement, average value added time on order, and average time distance between processed goods and service to customers. Utilization of minimum time required to package a processed good produce exert direct influence on availability of quality products. Therefore, the null hypothesis of research question three; "reduction in the order processing lead time in the FMCG industry does not influence meeting the customers' request on time" is rejected.

Results in Tables 1 and 2 show the estimated influence of the product lead time on the availability of quality products to customers in the FMCG manufacturing industry. The significance of the parameter of TRP suggests that an increase in the time required to produce or process the order, is expected to result in 0.337 increases in the log odds of availability of quality products, and given that all other variables are constant suggesting a direct level of influence of TRP on availability of quality product in the FMCG industry. Therefore, the null hypothesis of research question four; "reduction in product lead time in the FMCG industry does not significantly affect the availability of products to customers" is rejected.

Furthermore, the result shows the importance of having adequate stock of products in order to optimize lead times in the FMCG industry. While the components of product lead time such as administrative time of order, and average time distance between processed goods and service to customers are at positive level to the availability of quality products to customers, the average value added time on order is indirect to the availability of quality products to customers in the FMCG industry.

9. Conclusion

Developing efficient order and product lead times in the supply chain processes enable operators of the FMCGs to make available quality products on time to their customers by reducing bottlenecks and delay in production, as this would reflect in the repeat purchase and loyalty of consumers over a long period of time. The results from the ordered logistic regression indicates that the administrative time of order and average time distance between processed goods and service to customers are the route to obtaining positive influence on availability of quality products from the product lead time.

Therefore, developing efficient lead times of supply chain processes is a strategy for FMCGs to differentiate themselves, satisfy customers and remain competitive in business. Suggested further work includes extending studies on efficient lead time management to other sectors of the manufacturing sector in Nigeria and other developing nations and not limiting it to FMCGs. It is also important that further research consider other aspects of the supply chain processes with regards to satisfying the needs of customers.

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Golda Ezeoke[1] is a Doctoral Student (Operations and Production Management) in the Department of Business Administration, Faculty of Management Sciences, University of Lagos, Akoka, Lagos State, Nigeria.

Emmanuel Oyatoye[2] is a Professor in Operations Research in the Department of Business Administration, Faculty of Management Sciences, University of Lagos, Akoka, Lagos State, Nigeria.

Joseph Mojekwu[3] is a Professor in Social Statistics (Statistics, Statistics and Production Management, Population Studies and Social Statistics) in the Department of Actuarial Science and Insurance, Faculty of Management Science, University of Lagos, Akoka, Lagos State, Nigeria.

Appendix

Table 3. Demographic Characteristics of Respondents

Variables	**Categories**	**Frequency**	**Percentage**
Sex	Male	93	40.26
	Female	138	59.74
	Total	**231**	**100.0**
Age	18-25	5	2.16
	26-35	132	57.14
	36-45	94	40.70
	Total	**231**	**100.0**
Position	Top Management	2	0.9
	Production Manager	62	26.8
	Service Staff	167	72.3
	Total	**231**	**100.0**
Qualifications	SSCE	7	3.0
	NCE/OND	56	24.2
	HND	108	46.8
	B.Sc.	57	24.7
	Post Graduate	3	1.3
	Total	**231**	**100.0**
Years in FMCG service			
	1-5	198	85.7
	6-10	33	14.3
	Total	**231**	**100.0**

Table 4: Questionnaires Distributed and Returned

	Number distributed	**Number returned**	**Number utilized**	**% response rate**
	278	242	231	83.09