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SUPPLY CHAIN MANAGEMENT: ANALYSIS OF END-USERS EXPERIENCE OF PETROLEUM PRODUCTS IN NIGERIA

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Abstract

The chain reactions between the point of production and delivery require effective management. End-users experience of products is influenced by the level of information, product quality, strategic supplier's partnership, lean practices, and customer relationship. Thus, this study evaluates the supply chain management metrics on the end-users experience of petroleum products in Nigeria. A cross-sectional survey was adopted for the study. The population comprises all filling stations retail outlets in Ibadan metropolis, Oyo state, Nigeria. A structured validated questionnaire with a reliability test of Cronbach alpha of 0.79 was used to elicit information from the respondents which comprise of staff and end-users of the selected outlets. Emphasis was on the three popular products at the filling stations which are PMS, AGO, and DPK. Partial least square (projection of latent structures) algorithms and bootstrapping techniques were used to analyze the data with the aid of SmartPLS 3. The findings revealed that product quality, proper dispensing of quantity products, customer relationship management, good payment plans, and constant availability of products contribute significantly to the end-user experience. The study concluded that supply chain management influences the end-user experience in the study area. It is recommended that quality information, service recovery,

accurate quantity product pump dispensing should be enhanced to customer satisfaction and encourages continuous patronage

Keywords: Chain reactions, Effective management, End-users experience, Petroleum products, Supply chain metrics.

JEL Classification: M1 – M11, D2 – D24, L1 - 15

Introduction

The production system is not complete until the finished goods reach the final consumer (Alaba & Agbalajobi, 2014). Business organisations can only succeed in a dynamic business environment where the level of competition focuses on effective relationship building among the chains of distribution. The chain reaction between/among customers, suppliers, and key stakeholders is important for the satisfaction of end-user and lowering costs (Tang, 2006). Supply chain management has yielded better performance in terms of customer focus, organizational performance, customer acquisition, retention, lifetime value, profitability, service quality, and customer satisfaction. End-users experience of petroleum products is a function of effective supply chain management (Lourenço & Ravetti, 2018). Despite the significance of petroleum products as a source of energy and a key factor in the continued development of world economies which plays a critical role in the social, economic, and political development of Nigeria and any inadequacies in its supply will not only restrict social-economic activities but also limit economic growth thereby adversely affecting the quality of life of its citizens (Manuj & Mentzer, 2008; Wildgoose, 2016).

Nigeria has four refineries – Port-Harcourt I & II, Kaduna, and Warri – with a total installed capacity of 445, 000 barrels per day including two offshore jetties and four inland jetties as well as over 90 tank farms with wide-ranging storage capacities being operated by different oil marketing companies to cater for domestic consumption of refined petroleum products (House of Representative (HOR), 2012). Also, there are networks of 5, 120 kilometers of pipelines (consisting of multi-products pipelines and crude oil pipelines), 23 strategic depots, 24 pump stations installed to facilities petroleum products distribution across the country (Alaba & Agbalajobi, 2014). However, the Nigerian petroleum industry is confronted with several challenges. While the upstream sector of the industry faces challenges such as pipeline vandalism and oil exploration disturbances, the downstream sector is equally menaced by lack of maintenances of the refineries resulting in low refining activities for the domestic market,

pipeline vandalism, poor maintenance of pipelines and depots, poor transportation infrastructure for the physical distribution of petroleum products to end-users.

In the view of Okoli and Orinya (2013), Nigeria recorded 16,083 pipeline breaks from 2002 to 2012 with activities of vandals responsible for 15,685 breaks about 97.5% and the remaining 398 breaks of 2.5% were as a result of rupture resulting from poor maintenance of petroleum pipelines. With this, it implies that the majority of the problems encountered in this sector are manmade. Petroleum products supply and distribution in Nigeria have peculiar challenges resulting from the chain reaction from pipeline vandalism and oil exploration disturbances (Ukpere, Stephen, Ikeogu, Ibe, & Akpan, 2012). Pipeline vandalism has resulted in increasing bridging of petroleum products from the south to the north and from the southwest coastal ports and storage terminals to the east and north of the country (Agusto & Co., 2008). The bridging arrangement is inherent with distribution challenges which have serious implications on the petroleum products supply chain, economic development, and growth of the country as well as the welfare of her citizens.

The challenges in the downstream sectors affect the petroleum products supply chain with the resultant effects of perennial shortages and the antecedent long queues at retail stations across the country. The scarcity of petroleum products has a long history of supply disruptions. Onigbinde (2014) maintains that Nigerians have suffered many years of scarcity of petroleum products necessitating an increase in product importation by the government. In an attempt to solve this problem, the government introduced partial deregulation of the downstream sector in 2003. Auwal and Mamman (2012) noted that the deregulation policy was expected to bring competition into the sector as well as increase sources of supply for petroleum products and thereby ameliorate the situation. However, price control and subsidy schemes still in place have negated the benefits of the partial deregulation policy.

End-users at times go through stress to access products of the oil and gas industry due to myriad of challenges facing the supply chain management of the business. Poor governance, mismanagement, frequent petroleum product shortage, fluctuation in pump price, hoarding and exploration by some oil marketers e.t.c. have brought about the major setbacks to effective supply chain management in the industry (Warsing, 2008). Queue that is disheartening is the regular scene at most filling stations on the products that affect households and personal use. The difficulties of supply chain management in the oil and gas industry at times affect the performance of retail outlets which in turn have a serious effect on end-user satisfaction. Thus, this study examines the influence of supply chain management indices on the consumer experience of petroleum products in Nigeria.

Literature Review

Concept of Supply Chain Management Practices

Supply chain management (SCM) is also known as a supply web or supply network. The concept has its origin in different disciplines. Hence, there is no universal basic definition for the SCM concept (Croom & Vidal, 2018). Regardless of the differences in definitions, one will find all these professional associations, interpretations, and areas of emphasis (CSCMP, 2014). SCM

practices have been defined as a set of activities undertaken in an organisation to promote effective management of its supply chain (Somuyiwa, Mcilt & Adebayo, 2012). Carr and Pearson (2000) defined SCM as the streaming of a business' supply-side activities to maximize customer value and to gain a competitive advantage in the marketplace. Therefore, for this study, the SCM definition developed and used by the members of the global supply forum (GSCF) was adopted which states that "*SCM is the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders*" (Lambert & Cooper, 2000). It represents an effort by suppliers to develop and implement a supply chain that is as efficient and economical as possible. The supply chain covers everything from production to product development, to the information systems needed to direct these undertakings (Joel, 2010). It centrally controls or links production, shipment, and distribution of a product through keeping tighter control of internal inventories, internal production, distribution, sales, and the inventories of the company's product purchasers. Supply chain management referred to the web of facilities that involve the raw materials, its processes, to manufacture goods, and effective distribution to customers (Knolmayer et al., 2002). The basic objectives of supply chain management spans procurement, manufacturing, and distribution for optimum performance at least cost i.e. unify all agents of supply chain towards optimum productivity and benefits (Pandey, 2001). In a simple term, Supply Chain Management is the management of material, money, men, and information within and across the supply chain to maximize customer satisfaction and to get an edge over competitors (Sabbaghi & Sabbaghi, 2011).

Dimensions of SCM

Suhong, Bhanu, Ragu-Nathan and Rao, (2006) identify six different dimensions of SCM – Strategic supplier partnership, customer relationship, lean practices, level of information sharing, quality of information sharing, and outsourcing.

Strategic supplier partnership is defined as the long term relationship between the organisation and its suppliers. It is designed to leverage the strategic and operational capabilities of individual participating organisations to help them achieve significant on-going benefit (Finch, 2004)

Customer relationship is the practice of serving the customers to manage customer complaints, building long-term relationships with customers, and improving customer satisfaction (Sukati et al., n.d.).

The lean practice is defined as a multi-dimensional approach that encompasses a wide variety of management practices including just in time, quality systems, work teams, cellular manufacturing, supplier management, and so on in an integrated system (Shah & Ward, 2003).

The level of information sharing is defined as the extent to which critical and proprietary information is communicated to one's supply chain partner (Tang, 2006).

Quality of information sharing includes such aspects as the accuracy, timeliness, adequacy, and credibility of information exchanged to make the entire supply chain more competitive and resourceful (Li & Lin, 2005)

Outsourcing is a process of having suppliers or vendors to provide goods and services which were previously provided internally (Lambert & Cooper, 2000).

Issues and Challenges in SCM

Successful implementation of SCM is seen as closely dependent upon the need for breaking down barriers not only between internal departments and business processes but also across companies within the whole supply chain (Shukla et al., 2011). Its success is also associated with the challenging development of a new culture based on empowerment and on-going and shared learning and continuous improvement. Another challenging and difficult feature of SCM is associated with the development of the network firm, which can lead to a complex web of linkages to be coordinated and managed. The difficulties experienced in the development of a network firm include but not limited to: multiple and hidden goals; lack of common purpose; power imbalances; conflict over autonomy and accountability; culture and procedures; over-dependence and a continuous lack of openness and opportunistic behavior (Lourenço & Ravetti, 2018).

End-Users experience

This is defined as customers' perceptions - both conscious and subconscious of their relationship with the product brand resulting from all their interactions and satisfaction with the product usage and convenience (Wildgoose, 2016). It implies customer involvement at different levels such as rational, emotional, sensorial, and physical. Consumer experience encompasses every aspect of the quality of customer care, packaging, product and service features, ease of use, and reliability (Pandey, 2001). This creates a direct relationship in the place where customers buy, use, and receive services by a business intended for customers such as in-store or face-to-face contact with the customers through the retail staff.

Theoretical review

Strategic choice theory (SCT) can be traced to the study of Child (1970) who evaluated the works of researchers in the United Kingdom. SCT emphasized the link between decision-making to goal achievement and the resultant effects on the end-users (Croom & Vidal, 2018). SCT provides answers to SCM issues such as supply chain decision-making direct and indirect effect on stock prices and profitability; SCM strategies adaptation to business lifecycle; SCM strategies to different end-users attitudes (i.e. reactor, prospectors, analyzers, and defenders); and the conditions for SCM strategies effectiveness (Warsing, 2008). Though SCT is more to the governance structure and political influence in decision-making with less emphasis on functional execution and processes but the decisions affect the end-users. The crux of this theory is the focus on the best value supply chain enacted their environment. SCT is adopted in this study to maximized intra-organizational strategy selection to influence the end-user experience.

Methodology

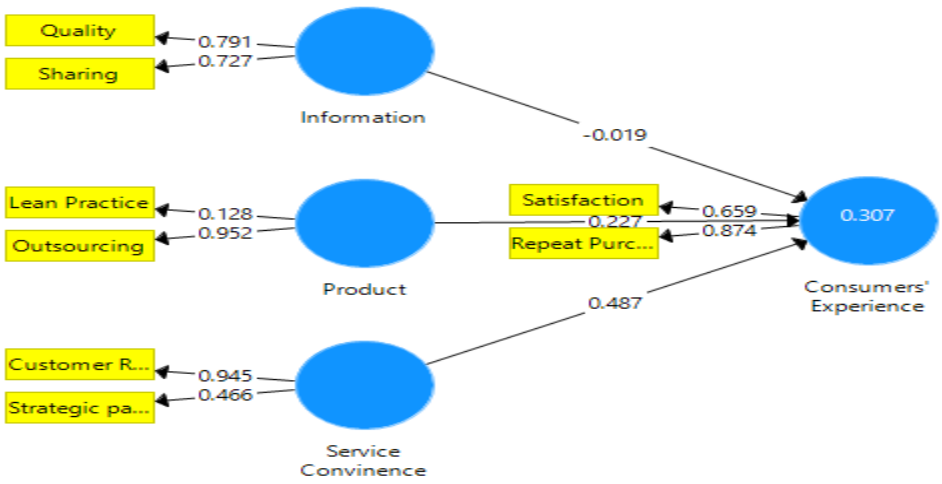
A cross-sectional survey design was adopted for this study. The population involved the filling stations retail outlets staff and the end-users in Ibadan metropolis, Oyo state, Nigeria. Forty major filling stations were randomly selected across the eleven local governments in Ibadan

metropolis with three copies of the questionnaire each (i.e. 120 copies of the questionnaire) and 384 end-users (a sample size generated from proportion) mainly car owners who patronize the filling stations during the survey which sum the total respondents to 504 (i.e. 384+120). A multi-stage sampling technique was used which comprises purposive, quota, availability, convenience, and simple random techniques. The major petroleum products from the refineries include Premium Motor Spirit (PMS i.e. petrol or gasoline), Automotive Gas Oil (AGO i.e. diesel), Dual Purpose Kerosene (DPK), Aviation Turbine Kerosene (ATK or jet-A1), Liquefied Petroleum Gas (LPG), Industry Fuel, Bitumen and Base Oil but for this study, the emphasis was on the three popular products at the filling stations which are PMS, AGO, and DPK. A structured validated questionnaire with a reliability test of Cronbach alpha of 0.79 was used to elicit information from the respondents. The instrument was self-administered with the aid of research assistants. The variables of the study include information, product, service level improvement, and consumer experience. Partial least square (projection of latent structures) algorithms and bootstrapping techniques were used to analyze the data with the aid of SmartPLS 3.

Findings and Discussion

The collated data were scrutinized and the usable instrument was four hundred and twenty-one which 83.5% success rate. The path model of the variables is shown below;

Figure 1: A path model of Supply Chain Management and End-users experience



Source: Researcher's Path Model, 2020

Figure 1 shows the path model of the supply chain management effect on the end-user experience. Supply chain management metrics adopted for the study are Information – proxies by Information sharing and quality of information; Product – proxies by lean practice (i.e. product quality) and product outsourcing; and Service convenience – proxies by customer relationship and strategic partnership. These variables were checked against the end-user experience of petroleum products proxies by consumer satisfaction and repeat purchase. The

figure presents interaction effects where more than single variables contribute to the latent variables.

Table 1: Path Coefficients

	Consumers' Experience	Information	Product	Service Convenience
Consumers' Experience				
Information	-0.019			
Product	0.227			
Service Convenience	0.487			

Source: SMARTPLS Output, 2020

The findings from the path coefficients table show a given standardization of weight ranging from -1 to +1 and the closeness of the weight to absolute 1 shows the strongest paths. On the other way round, weights close to zero reflect the weakest paths (Risher, 2018). Brand extension and product line extension show a positive contribution to the latent variable and multi-brand revealed a negative weight. The absolute magnitude of the brand extension gives a better coefficient approximately twice the product line extension variables. This implies that brand extension path, product line extension, and multi-brand are good models for the prediction of consumer choice of the product brand. The identified variables contribute significantly to the prediction of consumer choice in the study sampled.

Table 2: Outer Loadings

	Consumers' Experience	Information	Product	Service Convenience
Customer Relationship				**0.945**
Lean Practice			**0.128**	
Outsourcing			**0.952**	
Quality of information		**0.791**		
Repeat Purchase	**0.874**			
Satisfaction	**0.659**			
Information Sharing		**0.727**		
Strategic partnership				**0.466**

Source: SMARTPLS Output, 2020

The outer model shows the indicators contribute to the definition of the latent variables. Though, the closer the loading to 1 the better, the convention well-fitting reflective model states that the path loading must be above 70% (criterion for minimum measurement loading) which explained about half of the variance in the indicator and its factor should be greater than error variance. From the result outputs, lean practices, customer satisfaction, and strategic partnership could have been dropped but dropping the indicator did not improve composite reliability. The outer weight model varies from zero to an absolute maximum lower than 1, it has been established that

the more the indicators for a latent variable, the lower the maximum and the lower the average outer model weight. The results of outer model weights justify why the weak loading could not be dropped as all the loading weights were greater than or close to 0.50 except lean practice. Also, these variables were major constituents of the latent variables from the literature.

Table 3: R Square

	R Square	R Square Adjusted
Consumers' Experience	0.307	0.303

Source: SMARTPLS Output, 2020

The common effect size measure in the path shows the R square of 0.307 which implies that 30.7% of the variance in end-user experience can be explained by the joint model of supply chain indices proxies by information, product, and customer convenience. Thus, this is a fair moderate effect (i.e. the variation is greater than 25%) as the identified variables affect end-user experience which implies that the remaining 69.3% is due to other variables not imputed in the model. Though R-square greater than 80% suggests a possible multicollinearity problem (Tolerance = 1- R^2) in this case, there is no multicollinearity problem as tolerance in this data set is greater than 0.25 at the extreme. However, adding predictors to a regression model tends to increase R^2. Adjusted R^2 of 0.303 is close to the unadjusted R square in this model because of the small number of variables involved in the model. This does not have any effect on the findings.

Table 4: Latent Variable Covariances

	Consumers' Experience	Information	Product	Service Convenience
Consumers' Experience	1.000	0.051	0.273	0.506
Information	0.051	1.000	0.048	0.121
Product	0.273	0.048	1.000	0.096
Service Convenience	0.506	0.121	0.096	1.000

Source: SMARTPLS Output, 2020

Supply chain indices contributed to the end-users experience in different ways. Information proxies by the quality of information and information sharing as a component of the supply chain contributed 5.1% to end-user experience in terms of satisfaction and repeat purchase. This implies that the information ready provided and timely disseminated positively affect the customer satisfaction and tendency of repeat purchase. Likewise, product metrics (i.e. lean practices in terms of product quality, product dispensing, and product availability) affect end-user experience by 27.3%. With this, the quality of petroleum products, the right quantity dispensing from the pump in filling stations, and the availability of the products when needed have a positive influence on customer satisfaction and repeat purchase. Service convenience proxies by customer relationship and strategic partnership affect end-user by 50.6%. The implication of this is that sound customer relationship, handling of customer's complaints, service recovery, payment plan options, issuing coupons and other service convenience strategies positively affect customer satisfaction and encourage repeat purchase.

Table 5: f Square

	Consumers' Experience	Information	Product	Service Convenience
Consumers' Experience				
Information	**0.001**			
Product	0.074			
Service Convenience	**0.334**			

Source: SMARTPLS Output, 2020

The weights of these variables are shown in the f square table where the changes in contributions of supply chain indices were revealed according to their importance. The contribution change of information metrics is 0.001, product metrics are 0.074, and Service convenience metrics are 0.334 followed by product metrics and information metrics. The implication of this is that service convenience contributes most significantly to the change effect of end-user experience in terms of customer satisfaction and repeat purchase. Thus, the petroleum products retail outlets need to take cognizance of these variables.

Table 6: Bootstrapping Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Information ->End-User Experience	0.011	-0.010	-0.003	0.560	**0.120**
Product -> End-User Experience	0.218	0.211	0.030	1.986	**0.004**
Service Convenience -> End-User Experience	0.518	0.515	0.078	5.678	**0.000**

Source: SMARTPLS Output, 2020

The PLS bootstrapping output showing the t and p-value revealed that any t value above 1.96 will be significant at a 95% confidence interval and 5% significance level. From the output result, it was observed that product and service convenience metrics were significant in the prediction of end-user experience even significant at .001 probability level while information metrics are not significant while information metrics were not significant. The implication of this is that product and service convenience variables identified in the study were capable of predicting end-user experience which is capable of influencing consumer satisfaction and enhance repeat patronage.

The output of the analysis revealed that for the sampled petroleum products retail outlets to create a favourable end-user experience in terms of satisfaction and continuous patronage, there is a need for the petroleum products outlets to strengthen the quality of the product they offer for sale, ensure good quantity product bump dispensing, maintain good customer relationship, ensure good payment plans, and ensure constant availability of products. All these supply chain metrics are needed to instill a good customer experience. Likewise, the retail outlets need to

work on the quality of information and the mode of their information sharing as supply chain metrics to enhance the end-user experience. It was also revealed that the loading weight of consumer satisfaction was also below the 0.70 cut off suggested for the loading weight. Consumer satisfaction is likely to increase if information sharing, quality of information, and customer relationship metrics of the retail outlets are enhanced. However, supply chain management metrics influence the end-user experience of petroleum products in the sampled area.

Conclusion and Recommendations

Supply chain management metrics were evaluated against the end-user experience of petroleum products in Nigeria with particular reference to the petroleum products retail outlets and their customers within Ibadan metropolis. The findings revealed that product quality, proper dispensing of quantity products, customer relationship management, good payment plans, and constant availability of products contribute significantly to end-user experience in terms of customer satisfaction and repeat patronage with R-square of 30.7%; t-value of product and service convenience variables is greater than 1.96 and p-value of less than 0.05. The study concluded that supply chain management influence end-user experience in the study area. This implies that product and service convenience indices were significant in predicting end-user satisfaction and continuous patronage. The study recommended that;

i. Quality of information and information sharing of the retail outlets needs to be strengthened to enhance consumer satisfaction. Also, constant product availability should be encouraged to promote customer loyalty.
ii. Customer relationship management, service recovery, flexible payment plans, and accurate quantity product pump dispensing should be given priority to improve continuous patronage. A satisfied customer tends to repeat patronage.

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