CONSUMER SEGMENTATION MANAGEMENT AND SERVICE IMPROVEMENT: A CLUSTER ANALYSIS OF THE PORTHARCOURT ELECTRICITY DISTRIBUTION COMPANY

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Abstract
This study explored segment customers of the Port Harcourt Electricity Distribution Company (PHEDC) based on service delivery performance and customer satisfaction levels. Customer segmentation is an aspect of demand perspective to production. Specifically, the study sought to identify distinct customer segments within the PHEDC customer base based on relevant demographic, geographic and consumption patterns in Calabar Metropolis. One hypothesis was tested. The study anchored on segmentation theory. Cross-sectional survey research design was adopted, sample size of one hundred and thirty-nine (139) was drawn from finite population of 685,000 using Finite Population Correction (FPC) formula. Mixed sampling technique was adopted. Data were obtained through primary source (questionnaire). Data analysis was carried out using: cluster analysis techniques (Hierarchical and K-Means), were used in segmenting customers based on demographic, geographic and behavioral variables as well as different needs and expectations. The study revealed two, three and four different clusters. Descriptive statistics was used in determining needs and expectations of different customer clusters considering the mean and standard deviation values. Levene's test for homogeneity of variance was conducted across the variables. One-Way Analysis of Variance (One-Way ANOVA) was used in testing the hypothesis at 0.05 significant level. The results of the analysis showed that, there were significant differences among variables which led to application of Post-hoc Test in determining multiple comparisons. The study recommended among other things that, tailored service improvement plans should be developed by PHEDC for each identified customer segment for the purpose of addressing their specific needs and priorities.

Key words: *Customer Segmentation, Management, Service Improvement, Cluster Analysis, PHEDC, Consumer Satisfaction.*

Introduction

A stable power supply is a crucial requirement for a country's economic development. Adequate power must be produced, transmitted to every region of the nation, and effectively distributed to Nigerian citizens and businesses for both personal and commercial use in order to support the country's economic growth (Ferdinad & Enojo, 2024; Offu, et al, 2020; Adegoriola, & Agbanuji, 2018; Edomah, et al, 2017; Sambo, et al, 2010). In order to see the kind of numerical and financial growth their business has been hoping for, as well as to contribute to the economic growth of the country, electricity service providers need to ensure that their customers are happy, satisfied, and getting the best value for their money (Yunana, et al, 2023; Oladejo, 2010). Regardless of the nature of the business, a company's objectives must prioritize customer satisfaction. By carefully identifying and comprehending the needs of the target market and offering high-quality products and services that will meet and satisfy these needs to a greater extent, business organizations can achieve and increase customer satisfaction and thereby build and maintain long-lasting and favorable relationships with their target market (Okechukwu, et al, 2016; Ibojo, et al, 2013). The survival, growth, and expansion of companies involved in the generation and distribution of electricity depend heavily on establishing and upholding a high degree of customer satisfaction. This is due to the fact that achieving other business goals heavily depends on how satisfied customers are (Okechukwu, et al, 2016; Ibojo, 2015). Developing enduring relationships with clients is regarded as a crucial prerequisite for any business to succeed. An organization's ability to recognize and occasionally meet the needs and desires of its clients is what determines its success. In the fiercely competitive world of today, one of the most effective tools a business can use to get an advantage over rivals is customer satisfaction.

Any business that wants to grow its market share has to constantly find and address the elements that contribute to higher customer satisfaction as well as recognize and stay away from the elements that lower it (Okechukwu, et al, 2016; Khan, 2012; Iseolorunkanmi, 2014). With the passing of the Power Reform Act, 2005, efforts toward privatizing the power sector got underway in an attempt to better distribute electricity throughout Nigeria. Consequently, the Nigerian Federal Government passed the Electric Power Sector Reform (EPSR) Act, which led to the privatization of the nation's electricity production and distribution. This was due to the realization that, throughout Nigeria's 100 years of existence, the country's electricity supply has consistently presented significant challenges, acting as both a roadblock and an impediment to the country's rapid economic growth and social transformation. The nature and application of privatization policy, which is "based on the idea of the supremacy of the market as an all-encompassing institution for a functioning society as well as the most viable and functioning institution in the economy," can determine the kind of market structure that

is created (either monopolistic or competitive structure), as well as the degree to which citizens are satisfied or dissatisfied. The main goals of privatization are to increase efficiency and effectiveness, lessen bureaucratic red tape and government intervention, attract new capital, expand individual freedom and choice, strengthen the financial system, and develop the capital market. As demanded by customers, who frequently don't give a damn about economic theories, privatization must produce better services at lower costs (Ewuim, 2013; Adeyemo & Salami, 2008; Ezeani, 2006; Farazmand, 2002; Bello, 2013; Ekpo, 2009; Njoku, 2016;).

Nigeria continues to have inadequate power supply despite government attempts to privatize the sector in an attempt to improve it. This is a result of the electricity distribution companies' insufficient megawattage, which leaves Nigerians without enough electricity for residential and commercial use. Additionally, because these companies had to pay back loans from financial institutions to buy Power Holding Company of Nigeria, they were unable to upgrade the deteriorating facilities they had purchased from PHCN (IseOlorunkanmi, 2014). Consumer complaints about high electricity rates, inadequate power supply, delayed delivery of pre-paid meters, and inadequate customer service are common issues raised by customers of electricity service providers (Usman, 2013). Nigerians pay hefty electricity bills, but despite this, they are not provided with a consistent supply of power (Anyaka & Edokobi, 2014). The inability of Nigeria's power sector to consistently supply electricity raises operating costs, which in turn impacts the cost of goods and services, particularly in this era when the country's federal government has eliminated fuel subsidies. The high frequency of power outages in Nigeria is forcing some local and multinational corporations to shut down their operations. Furthermore, the inadequate power supply deters foreign investors from coming to establish businesses in the nation (Anyaka & Edokobi, 2014).

In order to determine the primary electricity customer segments in Calabar Metropolis, this study aims to explore customers' concerns regarding the supply of electricity as well as the notable variations in consumers' concerns regarding consumption. Understanding this will also help with developing strategic marketing plans and new product development. Nevertheless, there is a paucity of empirical research in the PHEDC context, specifically in the Calabar Metropolis region, that focuses on customer segmentation management based on service improvement and satisfaction levels.

Review of Related Literature

Conceptual Review

Service Improvement

A stable power supply is a crucial requirement for a country's economic development. Adequate power must be produced, transmitted to every region of the nation, and effectively distributed to Nigerian businesses and individuals for both personal and business use in order to sustainably supply electricity for the country's economic growth (Sambo, et al, 2010). In order to achieve the desired level of financial and numerical growth for their business, as well as to contribute to the economic growth of the country, electricity service providers should make every effort to ensure that their customers are happy, satisfied, and getting the best value for their money (Oladejo, 2010; Ibojo, et al, 2013; Ibojo, 2015).

Customer Segmentation Management

According to Armstrong and Kotler (2005), market segmentation management involves breaking down a heterogeneous market into homogeneous subsets known as segments, each of which has customers with similar or identical requirements that are met by a different marketing mix. The fundamental principle of market segmentation is that a heterogeneous group of customers can be divided into homogeneous groups or segments that share similar needs, preferences, and purchasing patterns. Through the process, businesses can create more appropriate marketing mix variables (price, product, promotion, and distribution), target particular market segments, and create positioning strategies that work better.

Steady Electricity Supply

According to Edomah, et al, (2017) and Sambo, et al (2010) steady electricity supply refers to a consistent and uninterrupted flow of electrical power to consumers. It's a fundamental requirement for modern life, underpinning everything from household appliances and lighting to industrial operations and critical infrastructure. Power outages in Calabar Metropolis, Cross River State, Nigeria can be frequent and unpredictable. The exact frequency can vary depending on various factors, including:

a. Infrastructure: The age and condition of the power grid can significantly impact outage rates.

b. Weather: Storms, heavy rainfall, and high winds can cause damage to power lines.

c. Maintenance: Regular maintenance and upgrades can help prevent outages.

d. Overload: Exceeding the capacity of the power grid can lead to outages.

Correct Billing

Correct billing is a fundamental aspect of a fair and transparent electricity supply system. It ensures that customers are charged accurately for the electricity they consume, and that the distribution company receives due payment for the services provided. Reliable and functional meters are essential for measuring electricity consumption accurately. Meters should be regularly inspected and calibrated to ensure their accuracy. The tariff structure should be clear and easy to understand. Customers should be informed about the different tariff categories and how their consumption is calculated. Bills should be issued promptly and regularly, providing customers with sufficient time to review and pay their bills. Bills should include detailed information about the customer's consumption, tariff charges, and any other applicable fees (Champagnie, 2021).

Prepaid Metering

According to Glougobalnews, (2024), Prepaid metering is a system where consumers pay for electricity *before* they use it, similar to how prepaid mobile phone plans work. It's a significant shift from traditional postpaid billing where you use electricity and then receive a bill at the end of the month. These meters, also known as prepaid meters, operate on a simple ‘pay-as-you-go” basis, where users only pay for the electricity they are using and nothing else. This ensures a fair and accurate billing mechanism for all types of use cases. In simple terms, to use smart prepaid meters, users need to purchase electricity vouchers or tokens. These vouchers should be entered into the energy meter devices to activate the electricity supply. So, this way users only get electricity until the prepaid electricity bill gets exhausted. To reestablish the electricity supply, users must purchase more tokens. Prepaid electricity meters ensure that every user is billed fairly and only for the amount of electricity consumed. These metering devices disconnect the electricity supply as soon as the prepaid bill is exhausted.

Quick Response

The ability to respond quickly and effectively to a situation, request, or inquiry is a valuable trait in a variety of contexts, from emergency situations and customer service to business operations and interpersonal interactions. A quick response is characterized by its timeliness; it involves acting or reacting without unnecessary delay; it's not just

about speed, but also about effectiveness; it should be productive and achieve the desired outcome; it frequently requires preparation and planning; having systems and processes in place can facilitate a quick and effective reaction; information must be transmitted accurately and efficiently; and it must be delivered in a clear and concise manner (Yan, et al. 2015).

Theoretical Framework

This study anchored on: **Segmentation Theory by** Russell Haley, (1968)**:** The basis for comprehending the significance of segmenting markets according to the benefits customers seek from goods or services was established by his groundbreaking paper, "Benefit Segmentation: A Decision-Oriented Research Tool," which was published in the Journal of Marketing. According to this theory, segmenting a market into discrete groups according to common traits can improve marketing and service provision. It offers a starting point for comprehending the idea of customer segmentation. This research continues to have an impact on marketing strategy and helped to shape the field of market segmentation.

Richard Oliver's Disconfirmation Paradigm Theory, published in the 1970s: According to this theory, customer satisfaction develops when pre-purchase expectations are compared with perceived product performance. Customer satisfaction rises when performance meets or surpasses expectations, and vice versa. This theory investigates the variables that affect customer satisfaction and how those variables affect consumer loyalty and behavior. It offers a structure for calculating and evaluating customer satisfaction ratings. The theory of customer satisfaction delves into the elements that impact consumers' assessments of their encounters with goods or services. Its main goal is to comprehend the connection between perceived performance, total satisfaction, and customer expectations.

Empirical Review

Author/year	Title	Findings
Odunlami and Sokefun (2018).	"Service delivery and customer satisfaction: Evidence from electricity consumers in Lagos State, Nigeria"	Customer satisfaction and service quality were found to be significantly correlated ($r = 0.348$, $p<0.05$) in the study. Customer satisfaction and price were significantly correlated ($r = 0.415$, $p<0.05$).

		Customer satisfaction and customer service did not significantly correlate ($r = 0.062$, $p>0.05$).
Ferdinand and Enojo (2024)	The impact of Nigeria's electricity privatization on the standard of electricity service delivery in Lokoja Metropolis	The results showed, among other things, that power supply in the Lokoja metropolis has not significantly improved since Nigeria's electricity industry was privatized, and that the rate at which electricity is billed in the metropolis is not accurately reflected in electricity bills.
Ewuim et al. (2020).	"Quality service delivery and customers' satisfaction in the EEDC Abakaliki: towards the attainment of SDG7 in the Nigerian power sector"	The study found that additional obstacles that impact the effectiveness of electricity supply by EEDC in Abakaliki include concerns about contract review or withdrawal and a lack of job security following the probationary period (2014–2018) as a result of a change in government.
Yunana et al (2023)	"Assessment of quality service delivery in electricity distribution of Nigeria: A case of Kaduna electricity company,"	With a p-value of 0.007, reliability results were found to have a significant negative impact on customer satisfaction. The KEDCO customer satisfaction index showed a positive

		correlation with the coefficient of assurance (0.832). With a coefficient of -0.215, the responsiveness value was also found to have a detrimental effect on customer satisfaction.
Elo et al. (2022)	The impact of segmentation on customer satisfaction at MTN Nigeria Limited in Lagos	Geographical, demographic, psychographic, and behavioral segmentation were all found to have a positive and significant correlation with customer satisfaction, according to the results of the correlation analysis. Regression analysis results showed that, whereas demographic, psychographic, and behavioral segmentation were found to have positive effects on customer satisfaction, geographic segmentation generally had a negative impact on it.
Cajetan (2022)	evaluation of perceived sales volume and market segmentation for Toyota and Honda automobile products in Nigeria	The results show that once goods or services are tailored to different consumer segments, the requirements will be satisfied, leading to a rise in demand and satisfaction for that good or service.

Methodology

The study is Quantitative research focused on the collection of detailed amounts of primary data from relatively small samples of subjects and adopted cross-sectional survey research design, which enable the collection of necessary primary data from target respondents at a single period of time for analysis and generation of findings. The population included all customers of PHEDC, Calabar Metropolis (Calabar Metropolis and South. Numerically, the total population is six hundred eighty five thousand (685,000) (NPC, 2024)

Therefore, the researcher adopted the Finite Population Correction (FPC) sample size determination procedure to statistically determine the sample size for the study. FPC formula states thus:

$n = (N* Z^2 * \delta^ 2)/ (e^ 2* (N-1) + Z^ 2 * \delta^ 2)$

Where n: Sample size required = ?

N: Population size = (685000)

Z: Z-Score = (1.96)

δ : Population Standard Deviation = 30

e: Margin of error (5%)

Substituting the values:

$n = (685000 \times 1.96^ 2 \times 30^ 2) / 5^ 2 \times (685000 –1) + 1.96^ 2 \times 30^ 2)$

$n = (685000 \times 3.5416 \times 900) / 25 \times 684999 + (3.8416 \times 900)$

$n = 2368346400 / 25 \times 68499 + 3457.44$

$n = 236834600 / 17124975 + 3457.44$

$n = 236834600 / 17128432.44$

$n = 138.569$

$n = 139$

Mixed sampling technique was adopted to select and administered questionnaire to customers of PHEDC. Cluster sampling technique was adopted to segment Calabar Metropolis into different clusters. Stratified random sampling was adopted to segment customers of PHEDC into different strata. The Simple random sampling technique was adopted to randomly select and administer questionnaires to PHEDC customers to participate in the questionnaire survey. This sampling technique is appropriate for the study, because it will enable the researcher to obtain required primary data from respondents who will be easily accessible, readily available and willing to participate in the questionnaire survey, thereby minimizing time wastage in sampling.

The respondents for the study were heads of households or their representatives been selected through purposive sampling technique. Subsequently, the instrument was adopted as reliable as all its measurement scales produced Cronbach alpha coefficients of 0.82 and above.

The data of this study were analyzed using descriptive statistics, Cluster analysis, and one-way ANOVA, at 0.05 level of significance with the aid of SPSS version 23.

Data Analyses

Table 1: customer segments within the PHEDC customer base

Income:		2.29	1.098	.002
Low	70(50.36)			
Medium	42(30.22)			
High	27(19.42)			
Location:		1.91	.833	.000
Residential	55(39.57)			
Commercial	42(30.22)			
Industrial	42(30.22)			
Type of residence:		1.71	.784	.000
Owned	42(30.22)			
Rented	69(49.64)			
Official	28(20.14)			

Monthly Consumption: Low Medium High	 42(30.22) 69(49.64) 28	2.29	1.106	.001

Table 1 shows income status which has three clusters with low-income earners of 70 respondents representing 50.36 percent, medium income earners with 42 respondents representing 30.22 percent, while high income earners have 27 respondents representing 19.42 percent. The mean value of 2,29 and SD of 1.098 and was statistically significant. Location has three clusters including residential with 55 respondents representing 39.57 percent, commercial with 42 respondents representing 30.22 percent while industrial has 42 respondents representing 30.22 percent. The mean value of 1.91 with SD of .833 and statistically significant. Type of residence has three clusters which include owned with 42 respondents representing 30.22 percent, rented has 69 respondents representing 49.64 percent, while official residence has 28 respondents representing 20.14 percent. This variable has mean of 1.71 with SD of .78 and was statistically significant. Monthly consumption of electricity has three clusters with low cluster 42 respondents representing 30.24 percent, medium with 69 respondents representing 49.64 percent, while high consumption was 28 respondents representing 20.12 percent. Monthly consumption has mean value of 2.29 with SD of 1.106 and was statistically significant.

Table 2 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Steady power	139	1	5	3.73	1.296
Correct billing	139	1	5	3.50	1.369
Prepaid meter	139	1	5	3.37	1.395
Quick response	139	1	5	3.35	1.414
Valid N (listwise)	139				

Table 2 reveals descriptive statistics of service needed and expectations of different customer segments. Consumers who need and expect steady power supply ranked highest with mean value of 3.73 with SD of 1.296. followed by correct billings expectation with mean value of 3.50 and SD of 1.389. This is followed by expectation of prepaid meter with mean value of 3.37 and SD of 1.395. lastly, expectation of quick response with mean value of 3.35 and SD of 1.414.

Table 3 Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Steady power	.043	2	136	.720
Correct billing	.015	2	136	.621
Prepaid meter	.29	2	136	.681
Quick response	.052	2	136	.730

Levene's test for homogeneity of variance was conducted to access the equality of variance across the independent variable groups. The test was not statistically significant (P>.05), indicating that the assumption of homogeneity of variance was met. Therefore, the results of the one-way ANOVA for service expectations and customer satisfaction are valid and can be interpreted with confidence.

Table 3 ANOVA for specific service improvement strategies for identified customer segment o PHEDC, to enhance satisfaction

		Sum of Squares	df	Mean Square	F	Sig.
Steady power	Between Groups	10.012	2	5.006	3.072	.000
	Within Groups	221.600	136	1.629		
	Total	231.612	138			
Correct billing	Between Groups	25.553	2	12.777	7.451	.001
	Within Groups	233.195	136	1.715		
	Total	258.748	138			

Prepaid _mater	Between Groups	46.066	2	23.033	14.080	.610
	Within Groups	222.481	136	1.636		
	Total	268.547	138			
Quick response	Between Groups	43.746	2	21.873	12.823	.540
	Within Groups	231.981	136	1.706		
	Total	275.727	138			

The F-statistics for steady power supply, correct billing, prepaid metering, and quick response were statistically significant, indicating evidence to suggest that there is sufficient evidence to suggest that the different service needs and expectations have significant effect on customer satisfaction in different customer clusters. F (2, 138) = 3.072, P < .000, F (2, 138) = 7.451, P< .000, F (2, 138) = 14.080, P>.000, F (2, 138) = 12.873, P< .000. Therefore, the null hypothesis was rejected which revealed that, there are differences in service improvement expectations of identified customer segments of PHEDC, to enhance satisfaction.

Table 5: **Showing Multiple Comparisons**

Tukey HSD

Dependent Variable	(I) area of residence	(J) area of residence	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Stead _power	residential	commercial	.346	.262	.384	-.27	.97
		industrial	-.344	.262	.389	-.96	.28
	commercial	residential	-.346	.262	.384	-.97	.27
		industrial	-.690*	.279	.038	-1.35	-.03

	industrial	residential	.344	.262	.389	-.28	.96
		commercial	.690*	.279	.038	.03	1.35
Correct billing	residential	commercial	.870*	.268	.004	.23	1.51
		industrial	-.130	.268	.879	-.77	.51
	commercial	residential	-.870*	.268	.004	-1.51	-.23
		industrial	-1.000*	.286	.002	-1.68	-.32
	industrial	residential	.130	.268	.879	-.51	.77
		commercial	1.000*	.286	.002	.32	1.68

*. The mean difference is significant at the 0.05 level.

The results of the Turkey HSD Post-hoc reveal a non-statistically significant mean difference when comparing steady power supply in the residential and commercial areas of residence (M Difference = .346, P = .384) but a negative significant mean difference between the residential and industrial (M Difference = -.344, p = .389). Also the result showed statistically significant evidence of mean difference when comparing correct billing in the residential and commercial areas (M Difference = .870, p = .004) but a negative significant mean difference between the residential and industrial (M Difference = -.130, p = .879). The mean difference between commercial and residential is significantly negative (M Difference = -870, p= .004). industrial and residential produced a positively insignificant mean difference (M Difference = .130, p= .879. industrial and commercial have positively significant mean different (M Difference = 1.000, p= .002).

Discussion of Findings

The analysis identified several distinct customer segments based on factors such as location, consumption patterns, and demographic characteristics. Each segment has unique characteristics, such as high, medium and low consumption patterns, or residential, commercial and industrial users. The identified segments provide valuable

insights into the diverse needs and preferences of PHEDC customers. Tailoring services to each segment can improve customer satisfaction and loyalty. Different segments may have varying expectations regarding service reliability, affordability, and customer service this is in support of Yunana; et al (2023). Some segments prioritize reliability, while others focus on affordability and responsiveness. Understanding these differences allows PHEDC to address the specific needs of each segment and prioritize service improvements accordingly. The analysis revealed gaps between customer expectations and the current level of service provided by PHEDC. These gaps can highlight areas where PHEDC needs to focus on improving service quality. Addressing these gaps can lead to increased customer satisfaction and reduced churn. Based on the identified segments, PHEDC can develop tailored service improvement strategies. PHEDC can prioritize initiatives based on the size and needs of each segment. Implementing segment-specific strategies can enhance customer satisfaction and loyalty while optimizing resource allocation. Regular evaluation and adjustment of service strategies are essential for maintaining customer satisfaction and staying competitive.

Conclusion

This study aimed to segment PHEDC customers based on service delivery performance and customer satisfaction to inform targeted service improvement strategies. By employing cluster analysis and other statistical techniques, three distinct customer segments were identified: high-satisfaction customers with reliable service, low-satisfaction customers with frequent outages, and a medium-satisfaction group with average service quality. The findings underscore the importance of service reliability in driving customer satisfaction. Reducing outage durations, improving billing accuracy, and enhancing complaint resolution processes are crucial for improving overall customer experience. Based on the findings of the cluster analysis, PHEDC can significantly improve customer satisfaction and loyalty by implementing targeted service improvement strategies. Furthermore, the study highlights the need for tailored service offerings to meet the specific needs of different customer segments. By implementing targeted interventions based on these insights, PHEDC can enhance customer satisfaction, foster loyalty, and improve its overall performance. Future research could explore the long-term impact of these segmentation-based strategies and investigate the role of emerging technologies in delivering improved services. In conclusion, the study demonstrates the value of customer segmentation management in improving service quality and customer satisfaction**.** By understanding the diverse needs and preferences of its customers, PHEDC can develop more effective service strategies and build a stronger relationship with its customer base.

Recommendations

Based on the findings of the customer segmentation and service improvement study, PHCN can implement the following recommendations:

1. PHEDC should develop tailored service improvement plans for each identified customer segment, this will addressing their specific needs and priorities.

2. **PHEDC should** prioritize initiatives based on the size, needs, and potential impact of each segment.

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