

Technology Innovation Management and Competitive Advantage of Telecommunication Firms in Enugu State

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Abstract

The study evaluated the Technology Innovation Management and Competitive Advantage of Telecommunication Firms in Enugu State. The specific objectives are to: Examine the relationship between innovation adoption and service differentiation; and evaluate the relationship between technology upgrading and customer retention of Telecommunication Firms in Enugu State. The study used the descriptive survey design approach. The primary source of data was the administration of questionnaire. A total population of 1103 staff was used. The adequate sample size of 285, using Freund and William's statistic formula at 5 percent margin of error was used. 247 respondents returned the questionnaire and accurately filled. Data was presented and analyzed using Likert Scale and the hypotheses using Z - test. Innovation adoption had significant positive relationship with service differentiation of Telecommunication Firms in Enugu State, $Z (9.731, P < .05)$ and Technology upgrading had significant positive relationship with customer retention of Telecommunication Firms in Enugu State $Z (10.069, P < .05)$. The study concluded that Innovation adoption and Technology upgrading had significant positive relationship with service differentiation and customer retention of Telecommunication Firms in Enugu State. The study recommended among others that: Telecommunication firms in Enugu State should continuously adopt innovative technologies to enhance service uniqueness and strengthen competitive differentiation.

Keywords: Technology Innovation Management, Innovation Adoption, Service Differentiation, Technology Upgrading, Customer Retention.

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Introduction

Technology innovation management has become a critical factor in determining the sustainability and competitiveness of modern business organizations, particularly in highly dynamic industries such as telecommunications. In the contemporary global business environment, firms are increasingly relying on technological innovation to improve operational efficiency, enhance service delivery, and maintain a competitive advantage over rivals. Technological innovation management refers to the systematic planning, development, implementation, and control of new technologies and innovative processes that enable organizations to create value and improve their market position. Effective management of technological innovation allows firms to introduce new products and services, adopt advanced communication infrastructures, and respond quickly to changing customer demands and market competition (Tidd & Bessant, 2023).

Globally, the telecommunications industry has witnessed rapid technological advancements driven by innovations such as mobile broadband, cloud computing, artificial intelligence, and fifth-generation (5G) network technologies. These innovations have transformed how telecommunication firms operate and compete in the digital economy. Firms that successfully manage technological innovation are better positioned to enhance service quality, reduce operational costs, and expand their market share. According to Schilling (2023), organizations that integrate innovation management into their strategic objectives often achieve higher productivity and sustained competitive advantage because they can continuously introduce new solutions that differentiate them from competitors.

In developing economies such as Nigeria, technological innovation management is particularly important for telecommunication firms that operate in a highly competitive market. The Nigerian telecommunications sector has experienced significant growth over the past two decades following the liberalization of the industry. Major operators have invested heavily in technological infrastructure to improve network coverage, data services, and digital platforms. Despite these advancements, intense competition among service providers has made it necessary for firms to continually adopt innovative technologies to attract and retain customers while improving service efficiency. Effective innovation management therefore plays a vital role in enabling telecommunication companies to achieve superior performance and maintain a strong market position (Adeleke & Aminu, 2024).

Competitive advantage refers to the ability of a firm to perform in ways that allow it to outperform competitors in terms of profitability, customer satisfaction, service quality, or market share. It is often achieved when an organization possesses unique capabilities or resources that competitors find difficult to imitate. In the telecommunications industry, competitive advantage may be realized through superior network quality, innovative digital services, efficient customer relationship management systems, and rapid adoption of emerging technologies. Firms that successfully manage technological innovation are able to leverage these capabilities to deliver value-added services and maintain customer loyalty (Porter, 2023).

In the Nigerian context, telecommunication firms continue to face challenges such as technological disruptions, high infrastructure costs, regulatory changes, and increasing customer expectations. These challenges require firms to strategically manage innovation processes to remain competitive in the market. Technological innovation management enables telecommunication firms to adapt to these environmental changes by introducing new products, improving operational processes, and enhancing service delivery systems. As noted by Olatunji and Adeyemi (2024), firms that prioritize technological innovation are more capable of sustaining competitive advantage in rapidly evolving industries because innovation enhances their ability to differentiate services and respond to market demands. At the local level, telecommunication firms operating in Enugu State contribute significantly to economic activities by providing communication infrastructure, supporting digital transactions, and facilitating information exchange. However, increasing competition among service providers in the region has intensified the

need for effective technological innovation strategies. Firms that continuously upgrade their technologies, integrate innovative service platforms, and adopt modern communication systems are more likely to maintain customer satisfaction and outperform competitors. Consequently, understanding how technology innovation management influences the competitive advantage of telecommunication firms becomes essential for both practitioners and policymakers.

Statement of the Problem

In an ideal competitive business environment, telecommunication firms are expected to effectively manage technological innovation in order to improve service delivery, enhance operational efficiency, and maintain a sustainable competitive advantage. Technology innovation management enables firms to adopt modern communication technologies, upgrade network infrastructure, introduce innovative digital services, and respond quickly to the changing demands of customers. When innovation is properly managed, telecommunication firms can differentiate their services, improve network reliability, increase customer satisfaction, and strengthen their position in the market.

However, despite the importance of technological innovation in the telecommunications industry, many firms still experience challenges in effectively managing innovation processes. Rapid technological changes, intense competition among service providers, high cost of technological infrastructure, and slow adoption of emerging technologies have made it difficult for some telecommunication firms to fully utilize innovation as a strategic tool for competitiveness. In Enugu State, persistent issues such as network instability, limited technological upgrades, and service quality complaints suggest that some telecommunication firms may not be effectively managing technological innovation to achieve sustained competitive advantage.

If these challenges in technology innovation management are not properly addressed, telecommunication firms may experience declining service quality, reduced customer satisfaction, and loss of market share to competitors who adopt more advanced technologies. This may ultimately weaken their competitive advantage, reduce profitability, and hinder the overall growth and development of the telecommunications sector. It is therefore necessary to examine how technology innovation management influences the competitive advantage of telecommunication firms in Enugu State.

Objectives of the Study

The main objective of the study was to examine Technology Innovation Management and Competitive Advantage of Telecommunication Firms in Enugu State.

The specific objectives are to:

- i. Examine the relationship between innovation adoption and service differentiation of Telecommunication Firms in Enugu State.
- ii. Evaluate the relationship between technology upgrading and customer retention of Telecommunication Firms in Enugu State.

Research Questions

The following research questions guide the study:

- i. What is the relationship between innovation adoption and service differentiation of Telecommunication Firms in Enugu State?

- ii. What is the relationship between technology upgrading and customer retention of Telecommunication Firms in Enugu State?

Statement of Research Hypotheses

The following research hypothesis will guide the study:

- i. Innovation adoption has no relationship with service differentiation of Telecommunication Firms in Enugu State.
- ii. Technology upgrading has no relationship with customer retention of Telecommunication Firms in Enugu State.

Review of Related Literature

Conceptual Review

Technology

Technology in telecommunication firms refers to the application of advanced digital systems, network infrastructures, hardware, and software tools that enable the transmission, reception, and processing of information across distances. It encompasses the deployment of technological innovations such as mobile broadband, fiber-optic networks, cloud computing platforms, and next-generation communication standards like 4G and 5G. According to Akpan and Akpan (2021), technology in the telecommunications sector is not just about physical equipment but also involves digital protocols, smart applications, and integrated systems that improve connectivity, enhance data transfer rates, and support seamless communication services. This broad technological framework allows telecommunication firms to develop efficient service delivery models, support real-time communication, and meet the evolving needs of both individual and corporate customers.

Innovation

Innovation refers to the process of creating, developing, and implementing new ideas, products, services, processes, or business models that generate value for an organization, its customers, or society at large. It is a strategic approach through which firms introduce changes that enhance efficiency, improve service delivery, or provide a competitive edge in the market. Innovation can take various forms, including product innovation, process innovation, technological innovation, and organizational innovation, each contributing to an organization's growth and adaptability in a dynamic business environment (Crossan & Apaydin, 2020). In essence, innovation is not limited to invention alone but includes the practical application and successful commercialization of novel ideas.

Management

Management refers to the process of planning, organizing, directing, and controlling organizational resources in order to achieve specific goals and objectives efficiently and effectively. It involves coordinating human, financial, technological, and material resources to ensure that organizational activities are carried out in a structured and productive manner. Robbins and Coulter (2020), management is the process of working with and through people to accomplish organizational objectives by effectively utilizing available resources. In modern organizations, management also involves strategic decision-making, leadership, and the development of systems that promote innovation, productivity, and sustainable growth.

Technology Innovation Management

Technology innovation management refers to the systematic process through which organizations plan, develop, implement, and control technological innovations in order to improve organizational performance and maintain competitiveness. It involves coordinating technological resources, research and development activities, and strategic decision-making to ensure that new technologies are effectively integrated into organizational operations. According to Melissa A. Schilling (2020), technology innovation management focuses on how organizations identify emerging technologies, develop innovative products or services, and successfully commercialize them to create value and sustain competitive advantage. Through this process, firms are able to transform technological ideas into practical solutions that improve efficiency, productivity, and customer satisfaction.

Component of Technology Innovation Management

The components of Technology Innovation Management represent the key processes and structures through which organizations develop, implement, and manage technological innovations to improve performance and achieve competitive advantage. Major components include the following: Technology Acquisition, Technology Integration, Technology Development, Technology Diffusion and Implementation, Technology Evaluation and Control, Innovation adoption and Technology upgrading, according to the following authors (Melissa A. Schilling, 2020; Joe Tidd and John Bessant, 2021; Henry Chesbrough, 2020; Everett M. Rogers; 2021; Robert G. Cooper , 2021).

Component of Technology Innovation Management that formed part of the objectives

Innovation adoption

Innovation adoption in telecommunication firms refers to the process through which telecommunication companies accept, implement, and utilize new technologies, systems, or innovative practices in their operations to improve service delivery, operational efficiency, and competitiveness. It involves the organizational decision to introduce and integrate new technological solutions such as advanced communication networks, digital platforms, mobile applications, and automated service systems into existing business processes. Innovation adoption enables telecommunication firms to respond to rapid technological changes and evolving customer demands in the digital communication industry. Mugo and Macharia (2020), innovation adoption in telecommunication companies involves the introduction of new equipment, software, and technological systems that enhance network performance and improve the delivery of communication services. These innovations allow firms to remain competitive in an industry characterized by intense competition and continuous technological advancement.

Technology upgrading

Technology upgrading in telecommunication firms refers to the process of improving, modernizing, or replacing existing technological systems, infrastructure, and equipment with more advanced and efficient technologies to enhance operational performance and service quality. It involves continuous improvements in network systems, software platforms, and communication infrastructure to meet evolving industry standards and customer expectations. According to Melissa A. Schilling (2020), technology upgrading enables organizations to strengthen their technological capabilities by adopting improved tools and systems that enhance productivity, efficiency, and innovation performance. In the telecommunications sector, technology upgrading may include the transition from older network systems to more advanced technologies such as high-speed broadband networks, digital switching systems, and improved data transmission infrastructure.

Advantage

Advantage refers to a favorable position, condition, or benefit that enables an individual, organization, or entity to perform better than others within the same environment. In a business context, advantage represents the strengths, capabilities, or resources that allow an organization to operate more efficiently, achieve superior outcomes, or gain better results compared to competitors. According to Jay B. Barney (2021), advantage in organizations arises when a firm possesses valuable resources or capabilities that enhance its performance and enable it to achieve better results than competing firms. These advantages may come from technological capabilities, skilled human resources, effective management practices, or access to superior infrastructure.

Competitive Advantage

Competitive advantage refers to the ability of a firm to perform better than its competitors by creating superior value for customers through unique products, services, or operational strategies. It occurs when an organization develops distinctive capabilities or resources that enable it to achieve higher performance, greater market share, and improved profitability compared to other firms in the same industry. According to Michael E. Porter (2020), competitive advantage arises when a firm successfully implements strategies such as cost leadership, differentiation, or focus that allow it to deliver greater value to customers or operate more efficiently than its competitors. In highly competitive industries such as telecommunications, competitive advantage can be achieved through improved network infrastructure, innovative service offerings, and effective technology management.

Component of Competitive Advantage

The following are components of competitive advantage: Cost Leadership, Product or Service Differentiation, Innovation Capability, Organizational Resources and Capabilities, Customer Relationship and Market Orientation and Operational Efficiency according the following authors (Porter, 2020; Grant, 2021; Barney & Hesterly, 2020; Johnson, Scholes & Whittington, 2021; Teece, 2020; Schilling, 2022; Barney, 2021; Rothaermel, 2021; Kotler & Keller, 2022; Narver & Slater, 2020; Hill, Jones & Schilling, 2021).

Component of Competitive Advantage that formed part of the objectives

Service differentiation

Service differentiation in telecommunication firms refers to the strategic process through which telecom companies distinguish their services from those of competitors by offering unique features, superior service quality, innovative technologies, or customized communication solutions to customers. In a highly competitive telecommunications industry, firms strive to differentiate their services by providing reliable network coverage, faster data speed, innovative digital services, and effective customer support systems. Through such strategies, telecom operators are able to create a unique market position and attract a larger subscriber base. Service differentiation may involve offering specialized data packages, improved connectivity, value-added services such as streaming or cloud integration, and personalized customer experience, all of which enhance customer satisfaction and loyalty (Etuk et al., 2022; Ogunmuyiwa, 2022).

Customer retention

Customer retention in telecommunication firms refers to the strategies and practices implemented to maintain long-term relationships with subscribers and reduce churn, ensuring that existing customers continue using a company's services over time. In the highly competitive telecom sector, retaining customers is often more cost-effective than acquiring new ones, as it builds brand loyalty, strengthens revenue streams, and enhances market stability.

Retention strategies typically involve providing high-quality network services, reliable connectivity, personalized service offerings, loyalty programs, and prompt customer support. Effective customer retention helps telecommunication firms sustain profitability, improve customer lifetime value, and create a stable subscriber base in an industry characterized by intense competition and frequent switching behavior (Akpan & Udo, 2021; Adeoye & Elegunde, 2022).

Conceptual Framework

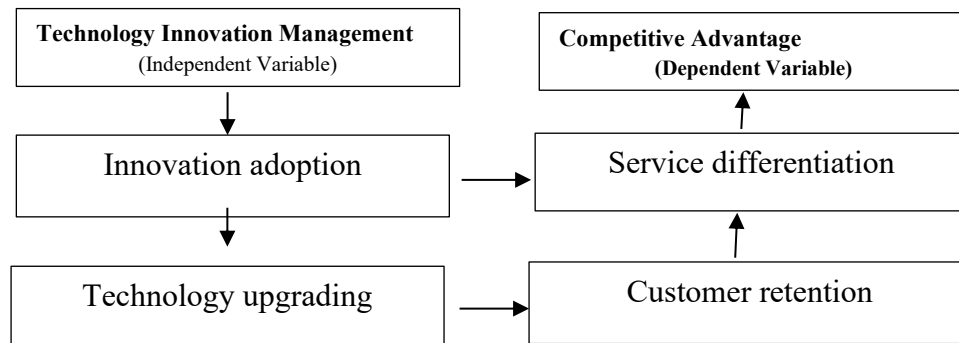


Fig.2 Conceptual diagram

The diagram above illustrates the linkage of the Technology Innovation Management and Competitive Advantage of Telecommunication Firms in Enugu State, Nigeria. The independent Variable of the study Technology Innovation Management includes innovation adoption and technology upgrading while the dependents of the Competitive Advantage are service differentiation and customer retention in Selected Telecommunication Firms in Enugu State, Nigeria.

Theoretical Framework

The following theories guided the study

- i. The Resource-Based View (RBV) theory, proposed by Barney (1991) and
- ii. The Diffusion of Innovations (DOI) theory, developed by Rogers (2003)

Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory, proposed by Barney (1991), posits that firms achieve sustainable competitive advantage by effectively utilizing valuable, rare, inimitable, and non-substitutable resources and capabilities. In the context of telecommunication firms, technological resources such as advanced network infrastructure, innovative digital platforms, skilled human capital, and proprietary software serve as strategic assets that enable firms to differentiate their services and outperform competitors. RBV emphasizes that the unique combination of internal resources and capabilities, when managed effectively through technology innovation, can create long-term competitive advantage and improved organizational performance.

Diffusion of Innovations (DOI) Theory

The Diffusion of Innovations (DOI) theory, developed by Rogers (2003), explains how, why, and at what rate new technologies and innovations spread across organizations and markets. This theory is highly relevant to telecommunication firms because the adoption and management of technological innovations such as 5G networks,

mobile money platforms, and digital value-added services determine their ability to gain competitive advantage. DOI emphasizes factors like relative advantage, compatibility, complexity, trialability, and observability as critical in influencing the successful adoption of innovations. Telecommunication firms that effectively manage the diffusion of technological innovations can improve service quality, meet changing customer needs, and maintain a strong competitive position in Enugu State.

Empirical Review

Innovation adoption and service differentiation

Obabuiké et al (2020) carried out study on Mobile Marketing Strategies and Customer Patronage of Mobile Telecommunication Services. This study empirically examines the relationship between mobile marketing strategies and customer patronage of mobile telecommunication services. The study applied a cross-sectional survey design in a structured questionnaire to collect data from 400 accessible telecom subscribers across the 4 major telecom operators which include; MTN, Glo, Aitel, and 9 Mobile. A total of 4 hypotheses were proposed and Spearman's Rank Correlation Coefficient tool was employed with the help of SPSS version 21.0, in statistically testing them. Findings revealed a positive and significant relationship between the dimensions of mobile marketing strategies and measures of customer patronage.

Awuku et al (2023) conducted study on Service innovation practices and customer loyalty in the telecommunication industry. A quantitative research approach was adopted to study 250 samples from active subscribers of the leading mobile telecommunication companies in Ghana. Descriptive and regression analytical approaches were used to analyze the study's objectives. The result indicates service innovation practices significantly influence loyalty. Innovative service concepts, innovative service processes, and new technologies significantly influence customer loyalty with the latter having the strongest influence.

Rahman et al (2025) investigated Service innovation management practices in the telecommunications industry: what does cross country analysis reveal? The research framework proposes relationships among organisational culture, operating core (innovation process, cross-functional organisation, and implementation of tools/technology), competition-informed pricing, and performance. A total of 176 usable data from both countries are analysed for the purpose of the research. The findings show that organisational culture tends to be more influential on innovation process and cross-functional organisation in Malaysian telecommunication industry.

Dhia et al (2025) conducted study on User-driven innovation in the telecom sector: The power of engaging customers in new service creation. The study employs a quantitative approach, utilizing a structured questionnaire to collect data from 508 employees across major telecom companies in Jordan. The data was analyzed using partial least square structural equation modeling (PLS-SEM). The results reveal that customer engagement through digital channels and feedback frequency significantly influence the speed of innovation, while the direct effect of participation in co-creation activities is not significant.

Omungu & Kavale (2025) conducted a study on Dynamic Capabilities and Performance of Telecommunication Companies in Kenya. The purpose of the study was to assess the effect of dynamic capabilities on organizational performance of telecommunication firms in Mombasa County. The study specific objectives are to determine the effect of sensing capabilities, innovation, reconfiguration capabilities and integration capability on organizational performance. The study is anchored on organizational learning theory, dynamic capabilities theory, performance maximization theory and resource based view. The target population was 37 network facilities providers in Kenya. The study results showed that sensing capability, seizing capability, innovation capability and reconfiguration capability positively and significantly affect the performance of telecommunication companies in Kenya.

Technology upgrading and customer retention

Kyei & Bayoh (2017) conducted study on Innovation and Customer Retention in the Ghanaian telecommunication industry. Data were collected using self-administered questionnaires to 365 customers of 6 telecommunication companies in Accra, Ghana. Descriptive statistics and multiple regression were employed to examine the relationship between the independent and dependent variables. The result shows that there is positive and significant relationship between innovation and customer retention. The study also discloses that service innovation, process innovation, and marketing innovation were the key determinants of customer retention. The study found service innovation to be a significant chief driver of customer retention.

Zhang et al (2022) examined A Data-Driven Approach to Improve Customer Churn Prediction Based on Telecom Customer Segmentation. Numerous valuable clients can be lost to competitors in the telecommunication industry, leading to profit loss. Thus, understanding the reasons for client churn is vital for telecommunication companies. This study aimed to develop a churn prediction model to predict telecom client churn through customer segmentation. Data were collected from three major Chinese telecom companies, and Fisher discriminant equations and logistic regression analysis were used to build a telecom customer churn prediction model. According to the results, it can be concluded that the telecom customer churn model constructed by regression analysis had higher prediction accuracy (93.94%) and better results.

Saleh & Saha (2023) examined Customer retention and churn prediction in the telecommunication industry: a case study on a Danish university. We employ five machine learning algorithms: random forest, AdaBoost, logistic regression, extreme gradient boosting classifier, and decision tree classifier on four datasets from two geographical regions, Denmark and the USA. The first three datasets are from online repositories, and the last one contains responses from 311 students from Aalborg University collected through a survey. We identify key features extracted by the best-performing algorithms based on five performance measures. Based on that, we aggregate all the features that appear important for each dataset. The results demonstrate that customers' preferences are not aligned. Among the prominent drivers, we find that service quality, customer satisfaction, offering subscription plan upgrades, and network coverage are unique to the Danish student population.

Sikri et al (2024) conducted study on Enhancing customer retention in telecom industry with machine learning driven churn prediction. This work evaluates several machine learning algorithms Perceptron, Multi-Layer Perceptron, Naive Bayes, Logistic Regression, K-Nearest Neighbour, Decision Tree, alongside Ensemble techniques such as Gradient Boosting and Extreme Gradient Boosting (XGBoost) on balanced datasets achieved through our proposed Ratio-based data balancing technique and the commonly used Data Resampling. Results reveal that our proposed Ratio-based data balancing technique notably outperforms traditional Over-Sampling and Under-Sampling methods in churn prediction accuracy.

Abdulwahab & Iyer (2025) investigated the Future of 5G and Digital Experience: Enhancing Customer Engagement and Retention in UAE Telecom. This study explores the impact of 5G-driven digital transformation on customer retention in the UAE telecom sector by examining how advanced technologies such as AI-powered chatbots, real-time analytics, immersive AR/VR experiences, and IoT integration enhance user engagement and satisfaction. Employing a qualitative research approach, this study conducts in-depth interviews with 15 industry experts, including telecom executives, digital transformation specialists, and customer experience strategists. Thematic analysis is applied to extract key insights on the benefits, challenges, and future potential of 5G in fostering customer loyalty. Findings reveal that while 5G enables hyper-personalization, seamless omnichannel experiences, and improved customer support mechanisms, telecom providers face significant challenges, including high infrastructure costs, data privacy concerns, and regulatory compliance.

Kishore et al (2026) carried out a study on Behavioural Study on the Impact of Artificial Intelligence on Customer Services Retention in Telecom Industry. The data was collected from 400 mobile phone users to assess the impact of AI on their commitment (retention) with the telecom company. PLS-SEM, through SMART PLS software, has been done to assess the theoretical model of the study and the results were analyzed in this chapter. The results of the structural model have shown that both experiences of hedonic and recognition has a significant impact on customer commitment. Thus, we can say that AI-enable services of telecom brands should increase the customer experience in terms of hedonic and recognition to retain their customers.

Gaps in Literature Review

Despite the growing body of literature on technology innovation and competitive advantage, several gaps still exist that justify further investigation, particularly in the context of telecommunication firms in Enugu State. Most existing studies have examined technology innovation from a broad organizational perspective without focusing specifically on how technology innovation management contributes to competitive advantage in the telecommunications sector. While previous research has highlighted the importance of technological advancement in improving firm performance, many of these studies emphasize general innovation strategies rather than the specific management of technological innovations that sustain competitive advantage.

Methodological gaps also exist in the literature. Many studies have relied on secondary data or conceptual analyses, with limited empirical evidence drawn directly from employees or managers within telecommunication firms. There is therefore a need for more empirical studies using primary data to examine the relationship between technology innovation management and competitive advantage in the telecom industry. Finally, the rapid evolution of digital technologies in the telecommunications industry such as 4G, 5G networks, mobile applications, and artificial intelligence-driven services has created new dynamics that earlier studies did not adequately address. Consequently, there is a need for updated research that reflects the current technological landscape and how firms strategically manage these innovations to gain competitive advantage.

Methodology

The study was carried out in Enugu State. The area of the study was four (4) firms out of nine (9) listed telecommunication firms in Enugu state Nigeria. The study adopted a survey research design. The primary source of data was the administration of questionnaire. The population was one thousand, one hundred and three (1,103) employees. The study was drawn from the three levels of employees in these organizations under study using a stratified sampling method. To determine the adequate sample size of 285, the study used Freund and William's statistical formula. Two hundred and fourteen (247) staff returned the questionnaire and accurately filled. The validity of the instrument was tested using content analysis and the result was good. The reliability was tested using the Pearson correlation coefficient (r). It gave a reliability co-efficient of 0.880 which was also good. Data was presented and analyzed by mean score and standard deviation. The hypotheses were analyzed using Z - test statistic tool.

Data Presentation

The relationship between innovation adoption and service differentiation of Telecommunication Firms in Enugu State

Table 4.2.1.1: Responses on the relationship between innovation adoption and service differentiation of Telecommunication Firms in Enugu State

		5	4	3	2	1	ΣFX	-	SD	Decision
		SA	A	N	DA	SD		X		
1	Innovation adoption enables telecommunication firms to introduce unique and advanced services, thereby enhancing service differentiation in Enugu State.	640	336	21	22	17	1036			Agree
		128	84	7	11	17	247			
		51.8	34.0	2.8	4.5	6.9	100%	4.19	1.145	
2	Through innovation adoption, telecommunication firms can develop improved communication solutions that distinguish their services from competitors.	625	336	21	38	12	1032			Agree
		125	84	7	19	12	247			
		50.6	34.0	2.8	7.7	4.9	100%	4.18	1.119	
3	Innovation adoption supports the creation of value-added services, which strengthens service differentiation among telecommunication firms.	655	336	21	24	13	1049			Agree
		131	84	7	12	13	247			
		53.0	34.0	2.8	4.9	5.3	100%	4.25	1.082	
4	When telecommunication firms adopt innovative technologies, they improve service quality and offer customized solutions that enhance service differentiation.	655	336	21	24	13	1049			Agree
		131	84	7	12	13	247			
		53.0	34.0	2.8	4.9	5.3	100%	4.25	1.082	
5	Continuous innovation adoption allows telecommunication firms to remain competitive by providing distinctive and superior services to customers in Enugu State.	650	336	21	22	15	1044			Agree
		130	84	7	11	15	247			
		52.6	34.0	2.8	4.5	6.1	100%	4.23	1.110	
Total Grand mean and standard deviation								4.22	1.1076	

Source: Field Survey, 2026

Table 4.2.2.1, 212 respondents out of 247 representing 85.8 percent agreed that Innovation adoption enables telecommunication firms to introduce unique and advanced services, thereby enhancing service differentiation in Enugu State with mean score of 4.19 and standard deviation of 1.145. Through innovation adoption, telecommunication firms can develop improved communication solutions that distinguish their services from competitors 209 respondents representing 84.6 percent agreed with mean score of 4.18 and standard deviation of 1.119. Innovation adoption supports the creation of value-added services, which strengthens service differentiation among telecommunication firms 215 respondents representing 87.0 percent agreed with mean score of 4.25 and standard deviation of 1.082. When telecommunication firms adopt innovative technologies, they improve service quality and offer customized solutions that enhance service differentiation 215 respondents representing 87.0 percent agreed with mean score of 4.25 and 1.082. Continuous innovation adoption allows telecommunication firms to remain competitive by providing distinctive and superior services to customers in Enugu State 215 respondents representing 86.6 percent agreed with a mean score of 4.23 and standard deviation 1.110.

The relationship between technology upgrading and customer retention of Telecommunication Firms in Enugu State.

Table 4.2.2.1: Responses on the relationship between technology upgrading and customer retention of Telecommunication Firms in Enugu State.

		5	4	3	2	1	ΣFX	-	SD	Decision
		SA	A	N	DA	SD		X		
1	Technology upgrading helps telecommunication firms improve network quality, which encourages greater customer retention in Enugu State.	680	336	21	30	5	1072			Agree
		136	84	7	15	5	247	4.34	.944	
		55.1	34.0	2.8	6.1	2.0	100%			
2	When telecommunication firms upgrade their technology, they provide faster and more reliable services that strengthen customer loyalty.	640	312	21	42	12	1027			Agree
		128	78	7	22	12	247	4.17	1.148	
		51.8	31.6	2.8	8.9	4.9	100%			
3	Technology upgrading enables telecom firms to introduce better service features, which positively influences customer retention.	660	312	21	34	13	1040			Agree
		132	78	7	17	13	247	4.21	1.128	
		53.4	31.6	2.8	6.9	5.3	100%			
4	Improved technological infrastructure allows telecommunication firms to respond more efficiently to customer needs, enhancing customer satisfaction and retention	615	312	21	50	14	1012			Agree
		123	78	7	25	14	247			
		49.8	31.6	2.8	10.1	5.7	100%	4.10	1.199	

5	Continuous technology upgrading helps telecommunication firms maintain high service standards, thereby promoting long-term customer retention.	635	312	21	52	9	1029			Agree
		127	78	7	26	9	247	4.17	1.127	
		51.4	31.6	2.8	10.5	3.6	100%			
Total Grand mean and standard deviation								4.198	1.1092	

Source: Field Survey, 2026

Table 4.2.2.1, 220 respondents out of 247 representing 89.1 percent agreed that Technology upgrading helps telecommunication firms improve network quality, which encourages greater customer retention in Enugu State with mean score of 4.34 and standard deviation of .944. When telecommunication firms upgrade their technology, they provide faster and more reliable services that strengthen customer loyalty 206 respondents representing 83.6 percent agreed with mean score of 4.17 and standard deviation of 1.148. Technology upgrading enables telecom firms to introduce better service features, which positively influences customer retention 210 respondents representing 85.0 percent agreed with mean score of 4.21 and standard deviation of 1.128. Improved technological infrastructure allows telecommunication firms to respond more efficiently to customer needs, enhancing customer satisfaction and retention 201 respondents representing 81.4 percent agreed with mean score of 4.10 and 1.199. Continuous technology upgrading helps telecommunication firms maintain high service standards, thereby promoting long-term customer retention 205 respondents representing 83.0 percent agreed with a mean score of 4.17 and standard deviation 1.127.

Test of Hypotheses

Test of Hypotheses One: Innovation adoption has relationship with service differentiation of Telecommunication Firms in Enugu State

	Innovation adoption enables telecommunication firms to introduce unique and advanced services, thereby enhancing service differentiation in Enugu State.	Through innovation adoption, telecommunication firms can develop improved communication solutions that distinguish their services from competitors.	Innovation adoption supports the creation of value-added services, which strengthens service differentiation among telecommunication firms.	When telecommunication firms adopt innovative technologies, they improve service quality and offer customized solutions that enhance service differentiation.	. Continuous innovation adoption allows telecommunication firms to remain competitive by providing distinctive and superior services to customers in Enugu State.
N	247	247	247	247	247

Uniform Parameters ^{a,b}	Minimum	1	1	1	1	1
	Maximum	5	5	5	5	5
Most Extreme Differences	Absolute	.608	.596	.620	.620	.616
	Positive	.069	.049	.053	.053	.061
	Negative	-.608	-.596	-.620	-.620	-.616
Kolmogorov-Smirnov Z		9.560	9.369	9.751	9.751	9.687
Asymp. Sig. (2-tailed)		.000	.000	.000	.000	.000

a. Test distribution is Uniform.

b. Calculated from data.

Decision Rule:

Since the calculated z-value (9.731) > critical z-value (.000) at the 5% significance level, we reject the null hypothesis (H_{01}).

Decision:

Furthermore, comparing the calculated Z- value ranges from $9.369 < 9.731$ against the critical Z- value of .000 (2-tailed test at 95percent level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that **Innovation adoption had significant positive relationship with service differentiation of Telecommunication Firms in Enugu State**

Test of Hypotheses Two: Technology upgrading has relationship with customer retention of Telecommunication Firms in Enugu State

One-Sample Kolmogorov-Smirnov Test

	Technology upgrading helps telecommunication firms improve network quality, which encourages greater customer retention in Enugu State.	When telecommunication firms upgrade their technology, they provide faster and more reliable services that strengthen customer loyalty.	Technology upgrading enables telecommunication firms to introduce better service features, which positively influences customer retention.	Improved technological infrastructure allows telecommunication firms to respond more efficiently to customer needs, enhancing customer satisfaction and retention	Continuous technology upgrading helps telecommunication firms maintain high service standards, thereby promoting long-term customer retention.
N	247	247	247	247	247
Uniform Parameters ^{a,b}					
Minimum	1	1	1	1	1
Maximum	5	5	5	5	5
Absolute	.641	.584	.600	.564	.580
Most Extreme Differences					
Positive	.020	.049	.053	.057	.036
Negative	-.641	-.584	-.600	-.564	-.580
Kolmogorov-Smirnov Z	10.069	9.178	9.433	8.860	9.115
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

a. Test distribution is Uniform.

b. Calculated from data.

Decision Rule:

Since the calculated z-value (10.069) > critical z-value (.000) at the 5% significance level, we reject the null hypothesis (H_{01}).

Decision:

Furthermore, comparing the calculated Z- value ranges from $8.860 < 10.069$ against the critical Z- value of .000 (2-tailed test at 95percent level of confidence) the null hypothesis were rejected. Thus the alternative hypothesis was accepted which states that Technology upgrading had significant positive relationship with customer retention of Telecommunication Firms in Enugu State

Discussion of Findings

Innovation adoption and service differentiation of Telecommunication Firms in Enugu State.

From the result of hypotheses one, the calculated Z- value ranges from $9.369 < 9.731$ against the critical Z- value of .000 which implies that Innovation adoption had significant positive relationship with service differentiation of Telecommunication Firms in Enugu State. In support of the result in the literature review, Obabuikie et al (2020) carried out study on Mobile Marketing Strategies and Customer Patronage of Mobile Telecommunication Services. Findings revealed a positive and significant relationship between the dimensions of mobile marketing strategies and measures of customer patronage. Awuku et al (2023) conducted study on Service innovation practices and customer loyalty in the telecommunication industry. The result indicates service innovation practices significantly influence loyalty. Innovative service concepts, innovative service processes, and new technologies significantly influence customer loyalty with the latter having the strongest influence.

Technology upgrading and customer retention of Telecommunication Firms in Enugu State.

From the result of hypotheses two, the calculated Z- value ranges from $8.860 < 10.069$ against the critical Z- value of .000, which implies that Technology upgrading had significant positive relationship with customer retention of Telecommunication Firms in Enugu State. In support of the result in the literature review, Kyei & Bayoh (2017) conducted study on Innovation and Customer Retention in the Ghanaian telecommunication industry. The result shows that there is positive and significant relationship between innovation and customer retention. Kishore et al (2026) carried out a study on Behavioural Study on the Impact of Artificial Intelligence on Customer Services Retention in Telecom Industry. The results of the structural model have shown that both experiences of hedonic and recognition has a significant impact on customer commitment.

Summary of Findings, Conclusion, Recommendations and Contribution to knowledge

Summary of Findings

- i. Innovation adoption had significant positive relationship with service differentiation of Telecommunication Firms in Enugu State, $Z (9.731, P < .05)$. This indicates that adopting new technologies enable firms to offer unique services, improve customer experience, and stand out competitively in the market.
- ii. Technology upgrading had significant positive relationship with customer retention of Telecommunication Firms in Enugu State $Z (10.069, P < .05)$. This implies that continuous improvement of technological infrastructure enhances service reliability and satisfaction, thereby encouraging customers to remain loyal to the firms.

Conclusion

The study concluded that Innovation adoption and Technology upgrading had significant positive relationship with service differentiation and customer retention of Telecommunication Firms in Enugu State, Technology Innovation Management significantly enhances the competitive advantage of telecommunication firms in Enugu State by

improving service quality, operational efficiency, and customer satisfaction, enabling firms to adapt quickly to market changes and sustain superior performance.

Recommendations

Based on the findings, the following recommendations were proffered:

- i. Telecommunication firms in Enugu State should continuously adopt innovative technologies to enhance service uniqueness and strengthen competitive differentiation.
- ii. There is need for Telecommunication firms to implement continuous and customer-centric technology upgrades such as improving network quality, expanding data services, and adopting modern digital customer service platforms to enhance user experience, reduce service disruptions, and build stronger customer loyalty.

References

- Abdulwahab, R., & Iyer, S. S. (2025). The Future of 5G and Digital Experience: Enhancing Customer Engagement and Retention in UAE Telecom. *Journal of Management World*, 2025(2), 451-460. <https://doi.org/10.53935/jomw.v2024i4.972>
- Adeleke, O., & Aminu, A. (2024). Technological innovation and competitive performance of telecommunications firms in emerging economies. *Journal of Technology and Innovation Management*, 12(1), 45–60.
- Adeoye, A., & Elegunde, A. (2022). Customer retention strategies and performance of telecommunication firms in Nigeria. *International Journal of Marketing Studies*, 14(3), 45–58.
- Akpan, E., & Udo, J. (2021). Service quality and customer retention in the Nigerian telecommunications industry. *Journal of Business and Management Research*, 12(2), 102–118.
- Akpan, J. E., & Akpan, R. U. (2021). The role of advanced communication technologies in service delivery: Evidence from Nigerian telecommunications industry. *International Journal of Telecommunications Systems and Management*, 10(3), 145–159.
- Awuku, E., Agyei, P. M., & Gonu, E. (2023). Service innovation practices and customer loyalty in the telecommunication industry. *PloS one*, 18(3), e0282588. <https://doi.org/10.1371/journal.pone.0282588>
- Ayankola, A. A., & Adeleke, B. S. (2020). Strategic advantage of service differentiation on the competitive sustainability of telecom firms in Nigeria. *European Journal of Management and Marketing Studies*.
- Barney, J. B. (2021). *Gaining and sustaining competitive advantage* (5th ed.). Pearson Education.
- Barney, J., & Hesterly, W. (2020). *Strategic Management and Competitive Advantage*. Pearson.
- Chesbrough, H. (2020). *Open innovation results: Going beyond the hype and getting down to business*. Oxford University Press.
- Cooper, R. G. (2021). *Winning at new products: Creating value through innovation* (5th ed.). Basic Books.
- Crossan, M. M., & Apaydin, M. (2020). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 57(4), 674–714.
- Dhia, Q., Abdallah Q., Bataineh, M.A. (2025) User-driven innovation in the telecom sector: The power of engaging customers in new service creation, *International Journal of Innovation Studies*, Volume 9, Issue 2, Pages 165-179, ISSN 2096-2487, <https://doi.org/10.1016/j.ijis.2025.05.001>.
- Etuk, E., Udo, J., & Okon, A. (2022). Market penetration strategies and competitive performance in the telecommunications market. *GAS Journal of Economics and Business Management*.
- Griffin, R. W. (2021). *Management* (13th ed.). Cengage Learning.
- Hill, C., Jones, G., & Schilling, M. (2021). *Strategic Management: Theory and Cases*. Cengage Learning.
- Kishore, K., Ramprakash, K.R., Arun, C.J. & Xavier, M.J. (2026) A Behavioural Study on the Impact of Artificial Intelligence on Customer Services Retention in Telecom Industry. DOI: <https://doi.org/10.52783/rlj.v11i5s.960>

- Kotler, P., & Keller, K. (2022). *Marketing Management*. Pearson.
- Kyei, D.A. & Bayoh, A.T.M. (2017) Innovation and Customer Retention in the Ghanaian telecommunication industry. *International Journal of Innovaion*. Vol. 5(2)
- Mairesse, J., Parisi, M. L., & others. (2006). Innovation activity and productivity growth: Evidence from firm-level studies. *Journal of the Knowledge Economy*.
- Mugo, P., & Macharia, J. (2020). Technological innovation and competitive advantage in telecommunication companies in Kenya. *International Journal of Research in Business and Social Science*, 9(5), 38–47.
- Musyoka, M. N., Arasa, R., & Ombuki, C. (2022). Porter’s generic competitive strategies and firm performance of mobile telephone network service providers in Kenya. *Strategic Journal of Business & Change Management*, 9(4), 596–608.
- Narver, J., & Slater, S. (2020). Market orientation and business performance revisited. *Journal of Marketing*.
- Obabuike, I.N., Amangala, E.A. & Wali, A.F. (2020) Mobile Marketing Strategies and Customer Patronage of Mobile Telecommunication Services. *International Journal of Marketing Research Innovation; Vol. 4(2);*
- Ogunmuyiwa, M. (2022). Promotional intensification and customer engagement in telecommunications markets. *Journal of Marketing Development*.
- Ogunyemi, A., & Adeyemi, K. (2021). Innovation strategies and competitive performance in the Nigerian telecommunications sector. *African Journal of Technology and Innovation Management*, 8(1), 55–70.
- Okon, A., Etuk, E., & Udo, J. (2021). Customer relationship management and retention in Nigerian telecom operators. *International Journal of Business and Social Research*, 11(4), 55–70.
- Okoro, O. G., & Eze, C. N. (2022). Digital transformation and competitive performance of telecommunication firms: The influence of emerging technologies. *Journal of Technology Management and Innovation*, 17(2), 78–92.
- Olatunji, R., & Adeyemi, K. (2024). Innovation strategy and firm competitiveness in Nigeria’s telecommunications sector. *African Journal of Business and Economic Research*, 19(2), 88–102.
- Oluwaseun, T. (2022). Digital engagement and subscriber loyalty in mobile telecommunications. *African Journal of Management Studies*, 8(1), 77–92.
- Omungu, F. & Kavale, S. (2025) Dynamic Capabilities and Performance of Telecommunication Companies in Kenya. DOI: <https://dx.doi.org/10.47772/IJRISS.2025.9020012>
- Porter, M. (2020). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free Press.
- Porter, M. E. (2023). *Competitive strategy: Techniques for analyzing industries and competitors* (Updated ed.). Free Press.
- Rahman, S.A., Taghizadeh, S.K., Ramayah, T. (2025) Service innovation management practices in the telecommunications industry: what does cross country analysis reveal? *SpringerPlus* 4, 810. <https://doi.org/10.1186/s40064-015-1580-8>
- Robbins, S. P., & Coulter, M. (2020). *Management* (14th ed.). Pearson Education.

- Saleh, S. & Saha, S. (2023) Customer retention and churn prediction in the telecommunication industry: a case study on a Danish university. *SN Appl. Sci.* 5, 173. <https://doi.org/10.1007/s42452-023-05389-6>
- Schilling, M. A. (2020). *Strategic management of technological innovation* (6th ed.). McGraw-Hill Education.
- Sikri, A., Jameel, R., Idrees, S.M. (2024) Enhancing customer retention in telecom industry with machine learning driven churn prediction. *Sci Rep* 14, 13097 (2024). <https://doi.org/10.1038/s41598-024-63750-0>
- Teece, D. (2020). Dynamic capabilities and strategic management. *Strategic Management Journal*.
- Tidd, J., & Bessant, J. (2021). *Managing innovation: Integrating technological, market and organizational change* (7th ed.). Wiley.
- Zhang, T., Moro, S., & Ramos, R. F. (2022). A Data-Driven Approach to Improve Customer Churn Prediction Based on Telecom Customer Segmentation. *Future Internet*, 14(3), 94. <https://doi.org/10.3390/fi14030094>