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SMARTPHONES, INTERNET OF THINGS AND SERVICE DELIVERY IN POLYTECHNIC LIBRARIES IN SOUTH-EAST, NIGERIA

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Abstract

The study investigated Smartphones, Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria. Two objectives, two research questions and two hypotheses guided the study. The hypotheses were tested at 0.05 level of significance. The study adopted a correlations design. The population of this study was seventy-nine (79) comprising 35 librarians and 44 paraprofessionals in federal polytechnic libraries in South-East Zone, Nigeria. The sample size of the study was 79 which is the entire population. The sampling technique was therefore, total enumeration sampling technique. Questionnaire was used as the instrument for data collection. Face and content validity of the instrument was ascertained through the judgment of the three experts. Pilot study was carried out on 30 respondents from Captain Elechi Amadi Polytechnic, Rumuola Port Harcourt and Federal Polytechnic of Oil and Gas, Bonny which was analysed using Cronbach Alpha to determine the reliability coefficient that yielded a coefficient of 0.87. Out of 79 copies of the questionnaires administered, 75 were used for analysis. The data was analyzed using Pearson Product Moment Correlation (PPMC). The study revealed that smartphones have a strong and significant positive relationship on service delivery in polytechnic libraries in South-East, Nigeria while technologies such as the Internet of Things (IoT) showed weak but significant positive relationships with service delivery in polytechnic libraries in South-East, Nigeria. The study recommended among others that there should be continuous investment in mobile technologies, staff training, digital content development, and user education to fully harness the potential of smartphones in delivering responsive, inclusive, and innovative library services

Keywords: Smartphones, Internet of Things, Service Delivery, Polytechnic libraries, South-East

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Introduction

In the contemporary knowledge economy, the relevance and sustainability of academic libraries are increasingly dependent on their ability to integrate modern technologies into service delivery. Polytechnic libraries, in particular, play a pivotal role in facilitating academic learning, research, and knowledge sharing by providing students, faculty, and researchers with access to timely and reliable information resources. As specialized academic libraries, they serve as the intellectual backbone of polytechnic institutions, supporting teaching, learning, and innovation through a wide range of resources and services. Their primary mandate extends beyond the acquisition and preservation of information resources to include user-centered services that improve accessibility, efficiency, and user satisfaction (Daniels et al., 2023).

Traditionally, polytechnic libraries offered services centered on print resources, physical catalogues, and in-person assistance. However, in the 21st century, advances in digital technology have transformed these libraries into hybrid spaces that combine traditional resources with emerging technologies. Tools such as e-books, digital databases, and online journals have become commonplace, while specialized services like information literacy training, digital scholarship support, and institutional repositories further strengthen their academic relevance (Igwela & Nsirim, 2018; Rafiq et al., 2021). Despite these transformations, the need to continually improve service delivery has led libraries to explore innovative technologies such as Smartphones and the Internet of Things (IoT) both of which have emerged as central drivers of modern library practice.

Smartphones have become indispensable tools in academic environments due to their portability, connectivity, and ability to integrate multiple functions on a single platform. For polytechnic libraries, smartphones facilitate access to digital catalogues, e-books, e-journals, and online databases, enabling students and staff to retrieve information anytime and anywhere (Sharma & Khan, 2024). Mobile library applications now allow users to renew borrowed items, manage accounts, make reservations, and receive automated notifications on due dates and library events. Moreover, smartphones support mobile reference services through instant messaging, email, or social media, bridging the gap between librarians and users. They also serve as tools for information literacy training, offering interactive tutorials and video modules that enhance

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research skills. Consequently, the integration of smartphones into library operations enhances user experience, improves resource utilization, and promotes a culture of independent learning (Ocran, 2020; Odewole & Opele, 2024).

Alongside smartphones, the Internet of Things (IoT) represents another transformative innovation reshaping service delivery in polytechnic libraries. IoT refers to a network of interconnected devices, sensors, and systems that communicate with minimal or no human intervention. Within the library context, IoT applications include smart shelves that track book movements, RFID-enabled circulation systems, environmental monitoring for preservation of fragile resources, occupancy sensors that optimize space utilization, and robotic systems that support automated book delivery (Abdo, 2024; Eiriemiokhale & James, 2023). These technologies allow for real-time data collection, improved resource management, and efficient service delivery, ensuring that library operations are more responsive and user-centered. For instance, RFID and wireless sensor networks simplify book tracking and inventory management, reducing delays and human errors. IoT-powered analytics also generate insights into user behavior, guiding libraries in customizing services to meet the evolving needs of their patrons (Ferguson et al., 2015; Purnik, 2022).

The convergence of smartphones and IoT in library service delivery thus signals a paradigm shift from traditional service models to technology-driven, smart library ecosystems. Polytechnic libraries in South-East Nigeria, like their global counterparts, are under increasing pressure to adopt these innovations in order to remain relevant, competitive, and effective in fulfilling their academic mandates. While smartphones provide a platform for mobile access, IoT ensures automation, real-time monitoring, and intelligent systems that collectively enhance efficiency, accessibility, and user satisfaction. This study therefore focuses on examining the relationship between smartphones and IoT as key technological enablers of service delivery in polytechnic libraries, with a view to understanding how these innovations can be effectively harnessed to improve library services in the region.

Statement of the Problem

Library and information services have undergone significant transformation with the integration of ICT into service delivery. Historically, library services were plagued by delays and backlogs, but the automation of library operations introduced technologies that enhanced cataloging, sustainability, and user service delivery. Despite these advancements, there remains a noticeable

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reluctance among librarians to adopt technologies such as smartphones and Internet of Things in their service delivery. This hesitation poses a challenge to the growth and relevance of the library profession, particularly in the 21st century where smart technologies are pivotal to modern service delivery. Although previous studies have explored the use of these technologies in libraries, none have specifically investigated their application in library service delivery within polytechnic libraries in the South-East geopolitical zone, focusing on the specific technologies highlighted in this study. Therefore, this research aims to address this gap.

Objectives

The main objective is to determine the relationship between smartphones, internet of things and service delivery in polytechnic libraries in south-east, Nigeria. The specific objectives are to investigate:

1. the relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria?
2. the relationship between Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria?

Research Questions

The research will provide answers to the following questions:

1. What is the relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria?
2. What is the relationship between Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria?

Hypotheses

The following null hypotheses was tested at 0.5 level of significance.

Ho_1 There is no significant relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria

Ho_2 There is no significant relationship between Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria

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Literature Review

According to Ocran (2020), smartphones can be employed in polytechnic libraries to improve access to information and enhance user experience. Wells (2020) emphasized that one notable application is mobile access to library catalogs through Online Public Access Catalogs (OPACs), which allow users to search for books, journals, and other resources remotely. Supporting this, Odewole and Opele (2024) observed that library mobile applications provide useful features such as book renewals, account management, reservations, and personalized notifications about due dates and library events. Beyond these, smartphones also facilitate mobile reference services, enabling users to interact with librarians through instant messaging or social media platforms for real-time assistance.

A key contribution of smartphones to library service delivery is access to e-books and e-journals. Aken et al. (2019) noted that academic libraries, including polytechnic libraries, subscribe to a variety of digital resources, while Igwela and Nsirim (2018) added that these resources can be accessed through smartphone-compatible platforms, allowing students to read academic materials on the go. Moreover, the use of QR codes has simplified access to information by linking users directly to library guides, instructional materials, and digital collections. Smartphones also support information literacy training by delivering mobile-based tutorials, videos, and interactive modules that strengthen students' research skills. In line with this, Kolawole et al. (2021) examined the use of mobile library technologies in public and private universities in South-West Nigeria and found that smartphones were actively employed to support service delivery.

The growth of the internet has further enhanced the flow of information globally, transforming the world into what is often described as a "global village." However, this rapid pace of digital transformation also raises concerns, particularly regarding the quality and credibility of information shared online. To address some of these challenges and extend the possibilities of digital service delivery, libraries are increasingly exploring the Internet of Things (IoT).

IoT is a ubiquitous technology that connects physical objects within the library through embedded technologies, enabling them to communicate without direct human intervention. As explained by Abdo (2024), IoT is fundamentally a network of sensors that continually generate data for a wide range of smart applications. This makes it a revolutionary step in technological evolution, as it allows libraries to develop applications that automate processes, streamline workflows, and

improve user satisfaction. Key enablers of IoT in libraries include Wireless Sensor Networks (WSNs) and Radio Frequency Identification (RFID), both of which enhance data acquisition, analysis, and resource management. Unlike static printed materials, digital information accessed through IoT is dynamic and flexible, making it more resilient to technological changes (Ferguson et al., 2015).

The architecture of IoT typically comprises three layers—perception, network, and application. The perception layer involves the use of WSN and RFID sensors to detect events or identify objects such as books. The network layer transmits and analyzes the collected data, either wirelessly or through wired connections, while the application layer ensures that the data is delivered in forms useful to end users (Abdo, 2024). Building on this, Eiriemiokhale and James (2022) described the IoT lifecycle as consisting of five stages: data collection, communication, aggregation, analysis, and action. Chandrashekhar (2016) explained that the first stage involves devices or sensors gathering data from their environment, which is then transmitted, aggregated, analyzed, and ultimately used to generate insights or inform decisions.

By assigning Internet Protocol (IP) addresses to objects, IoT systems enable natural or manmade items to communicate and transfer data autonomously. This supports greater automation, analytics, and integration using advanced sensing, networking, and robotic technologies. For example, Purnik (2022) highlighted the growing use of robotic book delivery systems in polytechnic libraries, which improve efficiency and provide faster access to library materials. Similarly, Albata (2024), in a study of polytechnic libraries in Ghana, found that IoT not only enhances service delivery but also creates an effective learning environment that increases user satisfaction with library services.

Methodology

The study adopted a correlations design. The population of this study was seventy-nine (79) comprising 35 librarians and 44 paraprofessionals in federal polytechnic libraries in South-East Zone, Nigeria. The sample size of the study was 79 which is the entire population. The sampling technique was therefore, total enumeration sampling technique. Questionnaire was used as the instrument for data collection. Face and content validity of the instrument was ascertained through the judgment of the three experts. Pilot study was carried out on 30 respondents from Captain Elechi Amadi Polytechnic, Rumuola Port Harcourt and Federal Polytechnic of Oil and Gas, Bonny

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which was analysed using Cronbach Alpha to determine the reliability coefficient that yielded a coefficient of 0.87. Out of 79 copies of the questionnaires administered, 75 were used for analysis. The data was analyzed using Pearson Product Moment Correlation (PPMC).

Findings and Discussion

Research Question 1: What is the relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria?

Ho_1: There is no significant relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria.

Table 1: Summary of Pearson Product Moment Correlation on the relationship between smartphones and service delivery

Variables		Smartphones	Service Delivery
Smartphones	Pearson Correlation	1	.830**
	Sig. (2-tailed)		.000
	N	75	75
Service Delivery	Pearson Correlation	.830**	1
	Sig. (2-tailed)	.000	
	N	75	75

***Correlation is significant*

Table 1 presents the summary of Pearson Product Moment Correlation on the relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria. The result indicates a positive and strong relationship between the two variables with a correlation coefficient value of (r=.830) and statistically significant at [(p=.000) ($p<0.05$)]. The null hypothesis one which states that there is no significant relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria was rejected and the reverse hypothesis upheld. It can therefore be stated that there is significant relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria.

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Research Question 2: What is the relationship between internet of things and service delivery in polytechnic libraries in South-East, Nigeria?

Ho_2: There is no significant relationship between internet of things and service delivery in polytechnic libraries in South-East, Nigeria.

Table 2 Summary of Pearson Product Moment Correlation on the relationship between internet of things and service delivery

Variables		Internet of Things	Service Delivery
Internet of Things	Pearson Correlation	1	.208**
	Sig. (2-tailed)		.000
	N	75	75
Service Delivery	Pearson Correlation	.208**	1
	Sig. (2-tailed)	.000	
	N	75	75

***Correlation is significant*

The result from Table 2 indicates the summary of Pearson Product Moment Correlation on the relationship between Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria. The result shows a positive and weak relationship between the two variables with a correlation coefficient value of (r=.208) and statistically significant at [(p=.000) ($p<0.05$)]. The null hypothesis three which states that there is no significant relationship between Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria was rejected and the reverse hypothesis upheld. It can therefore be stated that there is a positive, weak, and significant relationship between Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria.

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Discussion of the Findings

Smartphone and Service Delivery in Polytechnic Libraries in South-East, Nigeria

The study revealed a positive, strong, and significant relationship between smartphones and service delivery in polytechnic libraries in South-East, Nigeria. This finding indicates that as the use of smartphones increases, there is a corresponding and notable improvement in library service delivery. This aligns with global trends in the integration of smart technologies into library operations and underscores the growing importance of mobile technology in enhancing access to information and library resources.

Smartphones, as an essential component of smart technologies, provide a versatile platform for library services. Their ubiquitous presence among students and staff has made them critical tools for accessing digital library services such as online catalogues, e-books, databases, academic journals, institutional repositories, and other digital resources. In the context of South-East Nigerian polytechnics, this finding suggests that libraries are increasingly leveraging mobile-friendly platforms and applications to extend their reach beyond physical library walls, thereby promoting user-centered service delivery.

The positive relationship can also be attributed to the ability of smartphones to support real-time communication between library users and librarians through chat services, emails, mobile applications, and social media platforms. These interactions facilitate quick responses to users' queries, enhance reference services, and promote user satisfaction. Additionally, smartphones enable seamless access to library notifications, event updates, overdue book reminders, and other essential services that help maintain effective communication and engagement with users.

Furthermore, the strong relationship reflects the responsiveness of polytechnic libraries to technological innovations and their willingness to adapt service delivery methods to align with the digital preferences and expectations of contemporary library users predominantly tech-savvy students. The integration of smartphones into library services not only supports remote learning and research but also reduces the burden on physical infrastructure, allowing for a more scalable and flexible approach to information dissemination.

This finding corroborates the positions of earlier studies, such as those by Kolawole et al., (2021) and Izuchukwu, et al. (2021) who found that mobile technology significantly enhances library accessibility, resource utilization, and user satisfaction in academic libraries. It also resonates with

the Technology Acceptance Model (TAM), which postulates that perceived usefulness and ease of use are key drivers of technology adoption. Since smartphones are generally perceived as easy to use and highly useful, their integration into library services naturally leads to improved outcomes.

However, while the relationship is strong and significant, it is essential to acknowledge that the full benefits of smartphone integration depend on other supportive factors, such as stable internet connectivity, digital literacy among users and staff, availability of mobile-optimized library resources, and effective ICT policies. Inadequate infrastructure or digital skills gaps may hinder optimal smartphone use, thereby limiting the potential gains in service delivery.

The finding of a strong, positive, and significant relationship between smartphones and service delivery in polytechnic libraries in South-East Nigeria highlights the transformative role of mobile technology in modern library practice.

Internet of Things (IoT) and Service Delivery

The study found a positive, weak, and significant relationship between the Internet of Things (IoT) and service delivery in polytechnic libraries in South-East, Nigeria. This indicates that while IoT technologies have begun to impact service delivery in polytechnic libraries, the current level of adoption and impact remains relatively low. The positive and significant nature of this relationship suggests that while the adoption of IoT is still evolving in these libraries, it is already producing observable improvements in the way services are delivered.

The Internet of Things refers to the interconnection of physical devices such as sensors, computers, RFID-enabled shelves, environmental monitors, and smart systems that collect, share, and respond to data over the internet. Eiriemiokhale and James (2023) noted that in library environments, IoT applications have diverse use cases, including smart shelves that track book movements, automated environmental controls to preserve fragile materials, digital signage for real-time updates, and occupancy sensors to monitor space usage.

The weak relationship may also suggest limitations in the scope or scale of IoT deployment. Factors such as inadequate funding, lack of infrastructure, limited technical know-how, and inconsistent internet connectivity may hinder the full adoption of IoT systems. These constraints are particularly relevant in the polytechnic context, where ICT budgets are often tight and technical support may be limited.

The finding supports earlier research by Albata (2024) who noted that IoT technologies enhance library efficiency, user satisfaction, and access to services, but their adoption in Nigerian academic libraries remains at an early stage. Despite these challenges, the significance of the relationship shows that IoT has the potential to revolutionize service delivery, especially in terms of automation, personalization, and real-time responsiveness.

Conclusion

Technologies have become pivotal tools in transforming traditional library services into more dynamic, efficient, and user-centered systems. Polytechnic libraries, as academic knowledge hubs, must embrace these innovations to remain relevant and responsive to the evolving information needs of students and staff. This study was conducted to explore the relationship between smartphones and Internet of Things and service delivery in polytechnic libraries in South-East, Nigeria. The findings of the study revealed that smartphones have a strong and significant positive relationship on service delivery, making them the most influential technologies currently in use. while Internet of Things (IoT), showed weak but significant positive relationships with service delivery. The study therefore, notes that progressive important role of these technologies in improving service delivery underscores the importance of not just acquiring the technologies, but also ensuring their proper implementation and use.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. There is need for continuous investment in mobile technologies, staff training, digital content development, and user education to fully harness the potential of smartphones in delivering responsive, inclusive, and innovative library services
2. Polytechnic libraries should explore scalable IoT solutions, invest in staff training, and collaborate with technology providers to expand IoT adoption in ways that align with their service delivery goals.

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