ADOPTION OF COST-EFFECTIVE MANAGEMENT SYSTEM OF POWER SUPPLY FOR EFFICIENT LIBRARY SERVICES IN SELECTED NIGERIAN UNIVERSITIES

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Abstract

The imperativeness of adopting cost-effective system of power supply for effective library services in Nigerian Universities is unequivocal, especially in this digital age. The purpose of this study is to explore the benefits of adoption, the challenges to the adoption and the practical steps for implementation in selected Universities in Nigeria. The population of the study is 165 respondents. This number consisted of the total population of the librarians in the selected Universities in Nigeria. Descriptive survey design is adopted for this study which is more convenient to evaluate the benefits of adoption and challenges to adoption. The finding revealed that the challenges are surmountable but the benefits which include cost savings, services reliability, user health and comfort cannot be overemphasized.
Keywords: Adoption, cost-effective, library services, management system, power supply.

Introduction

Libraries as a central facility providing a range of related services for information dissemination and knowledge development consume high level of energy or electrical power to sustain operational library efficiency, particularly through lighting, heating, air conditioning (HVAC), and digital infrastructure. Remarkably, the cost of energy consumption is on the increase in all developing countries which poses barrier to efficient and effective library services in some of the universities in Nigeria (Alabi, 2022). Cost effective power supply management emerges as a critical strategy to ensure uninterrupted and sustainable library services. This study explores the challenges of energy demand and consumption in libraries. The adoption of energy efficient practices, integration of renewable energy sources, energy-efficient technologies and retrofitting etc. emphasize the economic and operational benefits of such approaches (Zhang & Chem, 2025).

University libraries are known in high level of energy consumption due to extended operating hours. For instance, in university libraries in Nigeria, energy consumption situations reveal that HVAC systems, mechanical circuits, electrical appliances dominate usage. A comprehensive review of electricity consumption in university libraries reveals that libraries contributes to rising cost of library maintenance due to digitization and library service expansion (Wang and Li, 2021). This finding corroborates global trends, where library's energy intensity (EUI) benchmarks indicate variability across facilities, with larger institutions like the Universities of Ibadan and Lagos that consume up to 25% of library yearly budgetary allocation underscoring the need for scalable, cost-effective interventions (Okeke & Okwu, 2022).

Empirical studies highlight that low or non-supply of the power to the university libraries stems from poor infrastructure and suboptimal operational practices, leading to high cost of library services sustenance and inadequate resource acquisition and user programs. Energy-solving design strategies including solar power integration and advanced insulation, have alleviated the problem of high cost of power supply to university libraries with not less than 10-15%, which has also paved way for a more reliable power supply that supports 24/7 digital access and more friendly environment for studies and research according to Adebayo (2021).

The adoption of cost-effective power supply management system in university libraries is inevitably important to ascertain operational efficiency and enhanced at this time of high inflation rate with rising cost of energy demand and consumption which is unavoidable in universities because of their roles for knowledge growth and promotion of research activities (Alabi, 2022). Consistent power for lighting, air conditioning (HVAC) and digital infrastructure to support user services such as digital access to a vast range of resources like eBooks, audiobooks, academic journals and other materials often available 24/7 from anywhere with internet access (Nwanza et al., 2023).

Conceptual Framework

This study is premised on the concept of Garcia's renewable energy in public libraries, benefits and challenges Garcia (2023). This concept was used as a guide for this study. According to Garcia (2023) "constant supply and utilization of power enhances effective library services and use of library collections both print materials and electronic information resources. The conceptual model guides librarians in achieving the organization's goals. The framework is based on the assumption that adoption of cost effective management system of power supply will promote efficient library services and the image of the library.

Literature Review

In this information age, efficient power supply management is inevitably needed to promote effective library services and use to satisfy the client without incessant power failure, where power is constantly supply, the library operational system admired by the host community because the atmospheric conditional is favorable and digital information is easily accessed and retrieved (Gorchels, 2005).

The adoption of renewable power sources, smart grid technology, and energy – efficient practices are emphasized in this study. Library service demand is very high in this era of information explosion. And to meet this demand, power supply in the library becomes very essential indispensable (Garcia, 2023). Without power, there digital information resources remain dormant and unuseful. The use of computer and communication technologies in information handling and processing is necessitated by the information explosion. In order to keep pace with the processing of influx of information, information technology application becomes unavoidably important with steady supply of power (William & Tabor, 2020).

In this information technology (IT) driven age every library especially academic library requires constant supply of power to survive. (Fulan, 2009) observed that with the advent of information and computer technology, there training of library staff for effective library services becomes easier with the steady and power supply. By reducing operational costs associated with efficient power supply, service delivery is perfected and this helps every digital library to effectively meet the growing demands of their patrons.

In this information age, every library that is poised to meet the demands of the library users must adopt cost effective management systems to enhance efficiency reduce waste and improve profitability (Alibi, 2022). In Nigeria, a diverse economy with varying degrees of financial constraints has made it a necessity for the library managers to adopt cost-efficient management systems of power supply. Digital transformation of the libraries is not optional but a necessity in order to satisfy the users or else the library will become a good for nothing entity and no more a living organism. And to make this dream a reality, information Computer Technologies (ICTs) and incessant power supply are indispensable in information age (Adebayo, 2021).

There is a growing emphasis on sustainability of library services and uses of library collection to promote teaching, learning and research activities. This is where adoption of cost-effective management systems of power supply is inevitably needed to ensure that internet connectivity and access of data base is not frustrated because of power failure or irregular supply of power to the library.

Murray et al., (2020) declared that cost effect power management system must be adopted to enhance financial savings especially with the missing cost of power supply all over the world library is the live – wire of every institution of learning, providing access to information and promoting learning and research activities for human capacity development. Remote use of libraries has increased the need of power supply to enhance the access of tens of thousands of electronic journals and electronic books. The importance of power supply management in libraries cannot be over emphasized. Constant supply of power for library services promotes operation continuity. Uninterrupted power is very essential for the sustenance of effective library services. With the constant supply of power for library services, electronic information resource is accessed with ease (Smith & Johnson, 2021).

The imperativeness of power supply in library services is also viewed from “Cost efficiency” perspective. Adoption of cost – effectiveness management system of power supply. For effective library services in Nigerian Universities can lead to significant savings of energy cost. Adopting renewable energy, especially solar photovoltaic systems is remarkably cost – effective. The advent of solar installation has enhanced a reliable supply of power for effective library services. Another importance of integration of cost – effective management system of power supply for library services is sustainability. The need for sustainable energy for library services has motivated the library users including students, academic staff, host community members and researchers to confidently rely on library services and time (Perterson, 2023).

Nigeria economic depression, high level inflation and exorbitant exchange rate has made the acquisition of solar power and diesel engine unaffordable to many library managers. Consequent upon this some of the libraries in Nigeria are now serving as relaxation and discussion center to while away time (Murrary et al., 2020). Cost – effective power supply management system has severally been adopted by many libraries and much success has also been recorded. Not with standing some challenges are noticeable in the course of integration of cost – effective management system of power supply for efficient library services. Many libraries are faced with challenges of high initial costs, lack of expertise, policy and leadership gap, worst of all is the problem of information communication infrastructure and solar energy infrastructure.

Strategies for Adoption

1. Energy audits and smart mastering: These are concepts that relate to increasing energy efficiency and optimizing energy usage in buildings such as University Libraries and Systems. According to Zhang and Chen (2025), this can involve a range of techniques from smart building technologies to advanced energy management systems.
2. Integration of Renewable Energy Sources: Adopting renewable energy, particularly solar photovoltaic systems, which is very is very cost effective. The introduction of solar installation can achieve paybacks periods of 5-7years goals (Nwanza et al., 2023). Hybrid systems combining solar with grid power for effective library sources and enabled consistent digital access and user comfort (Okeke & Okwu, 2022).
3. Blockchain-Enabled Microgrids: Recent discoveries such as blockchain-based microgrids systems increase energy distribution, help to lower the demand on fossil fuel which invariably help to promote cost savings through localized power generation according to (Khalid et al., 2021).

The study investigated the adoption of cost-effective management systems of power supply for efficient library services, the benefits of adoption, the challenges to adoption and the practical steps for implementation in the selected Universities in Nigeria. The population of the study is 165 respondents. This number consisted of the total populations of the librarians selected from Universities in Federal Republic of Nigeria.

Statement of the Problem

In this technology driven age, library and information professionals can no longer be effective and efficient in the discharge of their duties for teaching, learning and research if they continue to rely on the use of the manual systems of service delivery. However, preliminary investigations by the researcher show that many users seem not to use the electronic information resources in various university libraries where they are available. Could this be because of lack of cost-effective management system of power supply for effective library services? What are the benefits of integration cost-effective management system of power supply for effective library services? What are the constraints in adopting cost-effective management system of power supply for efficient library services? What are the perceived steps for the implementation of cost-effective management systems of power supply for effective library services? All these observations and questions require an empirical study to understand the actual situation of the integration of cost-effective management system of power supply for efficient library services consequently, this study has set out to investigate the adoption of cost – effective management system of power supply for effective library services.

Research Questions

This study sought answers to the following research questions

1. What are the benefits of adoption of cost-effective management system of power supply for efficient library services?
2. What are the challenges to adoption of cost effective management system of power supply for efficient library services?
3. What are the perceived steps for implementation of cost-effective management system of power supply for efficient library services?

Materials and Method

This study investigated the adoption of cost-effective management system of power supply for effective library services in Nigerian Universities, especially in this digital age. The purpose of this study is to explore the benefits of adoption, the challenges to the adoption and the practical steps for implementation in selected Universities in Nigeria. The population of the study is 165 respondents. This number consisted of the total population of the librarians in the selected Universities in Nigeria. The questionnaire was distributed during the 62nd Nigeria Library Association conference held from July 7th to 11th 2025. Most of the librarians from the selected universities served as my liaison officers in distributing the questionnaire in their various universities and later way billed them back to me. Descriptive survey design is adopted for this study which is more convenient to evaluate the benefits of adoption and challenges to adoption. The finding revealed that the challenges are surmountable but the benefits which include cost savings, services reliability, user health and comfort cannot be overemphasized.

Table1: Population for the Study

S/N	University Libraries	Frequency	Percentage(%)
1	Federal University of Technology, Owerri	11	6.7
2	Abia State University, Uturu	8	4.8
3	University of Calabar, Calabar	14	8.5
4	Federal University of Technology, Akure	12	7.3
5	University of Port-Harcout, Port-Harcout	10	6.1
6	Cross Rivers University of Technology, Calabar	9	5.5
7	Ambroes Ali University, Ekpoma	13	7.9
8	Delta State University, Abraka	11	6.7
9	Ondo State University of Science and Technology, Okitipupa	9	5.5
10	University of Benin, Benin City	14	8.5
11	Federal University of Petroleum, Effurun	10	6.1
12	University of Nigeria, Nnsuka	15	9.1
13	Nnamdi Azikiwe University, Akwa	7	4.3
14	Obafemi Awolowo University, Ife	14	8.5
15	University of Maduguri, Yola	8	4.8
	Total	165	100.0

Source: University Librarians Offices

Table 2: Benefits of adoption of cost-effective management systems of power supply for efficient library services

Benefits	Frequency	Percentage (%)
Cost savings	62	37.6
Service rehabilitee	58	35.2
Environmental sustainability	25	15.2
User health and comfort	20	12.0
Total	165	100.0

Table 2 shows that cost savings is the highest benefits 62(37.6%) of the respondents are of the view that energy efficient systems are renewables significantly reduce electricity bills. This declaration corroborates with the finding of Peterson (2023) when he declared that the sustainability of power supply for library services has motivated library users to confidently rely on library services. 58(35.2%) of the respondents declared that service reliability is one

of the benefits because stable power supply ensures uninterrupted access to digital services, automated systems, user satisfaction and operational efficiency.

Table 3: Challenges to adoption of cost-effective management systems of power supply for efficient library services.

S/N	Challenges	Frequency	Percentage(%)
1	High initial costs	67	40.6
2	Lack of expertise	42	25.5
3	Policy and leadership gaps	26	15.8
4	Infrastructure limitation	30	18.1
	Total	165	100.0

Table 3 shows that 67(40.6%) of the respondents revealed that the major challenge to adoption of cost-effective management system of power supply for efficient library services is high initial costs. Library budgetary allocation can be affected adversely particularly in institutions that are not large in terms of student population and school fees for internally generated revenue.

The results also show that the second major challenge is lack of expertise 42(25.5%) and infrastructure limitation 30(18.1%). This finding is in alignment with the view Smith and Johnson who postulated that a good number of library staff have limited technical knowledge which hinders effective implementation of advanced system of power supply for efficient library services. Modern library needs a well-structured building to accommodate modern energy-efficient technologies, which increases higher costs for successful implementation (Soliman and Mehanna, 2023).

Table 4: Perceived steps for implementation.

S/N	Perceived steps for implementation	Frequency	Percentage(%)
1	Conduct baseline assessments	20	12.1
2	Develop a phased plan	27	16.4
3	Secure funding	72	43.6
4	Engage stakeholders	46	27.9
	Total	165	100.0

The result presented in table 4 revealed that the best practical step for implantation is secure funding 72(43.6%), engage stakeholders 46(27.9%), develop a phased plan 27(16.4%) and conduct baseline assessments 20(12.1%).

Conclusion and Recommendations

Cost-effective management system of power supply for efficient library services are critical for the sustainability and growth of libraries in Nigeria. As demonstrated by Success stories of University of Ibadan, University of Benin and Covenant University. Effective cost management not only improves profitability, but also enhances usability. Based on the findings of the study, it was established that adoption of cost-effective power supply management system Nigerian University in libraries is absolutely a requisite or indispensable to promote efficiency in library costs, and enhance digital library services without interruption by incessant power failure. The integration of perceived steps for implementation and efficient technologies and innovative solutions such as microgrids, libraries will certainly

achieve high level of digital library services and create a conducive friendly environment for learning and research activities.

Recommendations

1. The University librarians and their staff should endeavor to attract government incentives, grants or seek partnership with energy providers to grant payment on instalment basis.
2. The university librarians can also explore the involvement of library staff, users and stakeholders in the host communities, perhaps some of them are close associates to those in business circle and political office holders to assist in procuring meaningful financial assistance.

Contribution to knowledge

1. The study established that stable power supply ensures uninterrupted access to digital services, friendly library environment and library operational efficiency.
2. The study revealed that energy-efficient system reduces to a large extent, electricity bills and resource acquisition because of access to data bases.
3. The study also established that library user's health and comfort is maximized because of the efficient HVAC and improved lighting system.

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