INVESTIGATING THE ROLES OF ARTIFICIAL INTELLIGENCE (AI) IN SCHOOL PLANT MANAGEMENT IN GOVERNMENT OWNED UNIVERSITIES IN RIVERS STATE

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ABSTRACT

The study investigated the roles of artificial intelligence (AI) in school plant management in government owned universities in Rivers State. A descriptive survey design was adopted in the study. Three specific objectives and three research questions guided the study. The population of the study consisted of 160 respondents made up of Heads of Departments (HoDs) and Deans of Faculties in the three public universities in Rivers State. All 160 were sampled without the use of any sampling technique as the number is manageable. A structured questionnaire titled Investigating the roles of artificial intelligence in school plant management questionnaire was used as instrument for data collection. 160 copies of the questionnaire were administered to the respondents, and all were retrieved and used for the study. Based on the result of the research questions, the study identified some of the roles of AI in school plant management to include optimizing energy usage by analyzing patterns of energy consumption and identifying areas where energy is being wasted, monitor air quality, temperature, humidity, and other environmental factors in real-time, predicts when maintenance is needed thereby preventing unexpected breakdowns, and prolonging the lifespan of equipment, enhances security by detecting unusual activities and

potential threats in real-time and alerting school authorities immediately, The study also identified some of the AI powered tool utilized in school as; Smart Space, Energy CAP and Maintenance Connection. Amongst the sternest problems confronting the school plant management are high implementations cost, data privacy and security concerns and technical infrastructure limitations. It was concluded that the role of artificial intelligence in school plant management is transformative, offering schools opportunity to enhance efficiency in managing their facilities. Although AI applications like predictive maintenance, energy management, and security monitoring, schools can significantly reduce operational costs, improve resource allocation, and create safer, more conducive learning environments. AI-driven systems allow school administrators to make data-informed decisions, streamline maintenance schedules, and address infrastructure needs in real time, contributing to a well-maintained and optimized learning environment. Based on these findings it was recommended among others that, school administrators should adopt AI-Powered Integrated Management Systems (IFMS) to optimize school plant management, integrating functions such as: facility maintenance scheduling, energy management and efficiency, space utilization and optimization, security and surveillance and data analytics for informed decision-making, school administrators should implement AI-powered facility management software to optimize school plant management, leveraging features such as: predictive maintenance, energy efficiency analytics, automated work order management, space utilization optimization and real-time data analytics and reporting.

Keywords: Investigating, Roles, Artificial Intelligence, School Plant Management

Introduction

The integration of artificial intelligence (AI) in school plant management has emerged as a transformative approach to enhancing the efficiency, sustainability, and safety of educational facilities. As educational institutions face growing challenges related to resource optimization, operational efficiency, and environment impact, AI-based solutions have increasingly provided new ways to manage school infrastructure. School plant management involves the planning, design, maintenance, and utilization of school buildings and facilities, which are essential for creating conducive learning environments. Blaabjerg, Kjaer, and Li (2021) assert that by automating complex tasks, predicting maintenance needs, and optimizing resource usage, AI plays a crucial role in supporting administrators to ensure that school facilities operate smoothly and meet the evolving demands of modern education.

According to Kwon and Kim (2020) the implementation of AI in school plant management encompasses a range of applications, from predictive maintenance and energy management to

safety monitoring and space utilization. In the context of predictive maintenance, AI can utilize data from sensors and monitoring systems installed in school facilities to detect patterns and predict potential failures in equipment such as HVAC systems, lighting, and plumbing (Hou, Xu, and Wang 2018). For example, AI-driven predictive maintenance systems help reduce downtime by forecasting equipment failures before they occur, allowing timely interventions that minimize disruptions to school operations and avoid costly emergency repairs.

Energy management is another area where AI has proven highly beneficial. Schools often have extensive energy requirements, with heating, ventilation, and lighting representing significant operational costs. AI-enabled energy management systems can analyze historical energy usage patterns and external factors such as weather forecasts to optimize energy consumption (Lee, Park, and Choi 2019). These systems can make real-time adjustments to reduce energy usage during off-peak hours or automatically adjust heating and lighting levels based on occupancy, leading to more sustainable and cost-effective energy practices in educational institutions.

Safety and security are paramount in school environments, and AI is instrumental in enhancing these aspects through smart monitoring and surveillance. By integrating AI-powered camaras and sensors, school administrators can monitor school premises more effectively, detect potential security threats, and respond swiftly to incidents. Van de Voort, Jensen, and Olsen (2022) averred that AI-based surveillance systems can recognize unusual behaviours or intrusions and alert security personnel in real-time, which significantly improves response times and reduces risks to student and staff safety. Moreover, AI can support emergency preparedness by using predictive analytics to anticipate natural disasters or other critical incidents, enabling schools to implement timely evacuation or lockdown procedures.

Another significant application of AI in school plant management according to Zhou and Zhang (2021) is in optimizing space utilization. With the fluctuating demands for classrooms, laboratories, and other school facilities, AI tools can analyze occupancy data to ensure that available space is used efficiently. By predicting usage trends and facilitating dynamic scheduling, AI helps prevent overcrowding and ensures that educational resources are available when and where they are needed. This capability has become increasingly important as schools deal with fluctuating enrollment rates and diverse facility needs.

Despite the promising advantages, Blaabjerg, Kjaer, and Li (2021) opined that there are also challenges with AI adoption in school plant management, including concerns over data privacy, initial implementation costs, and the need for technical expertise. Data privacy is particularly important in school settings due to the sensitive information that could be generated through surveillance and monitoring systems. Moreover, implementing AI systems often requires

substantial upfront investment and ongoing technical support, which may pose barriers for schools with limited resources.

Edwards and Baggott (2021) stated that SmartSpace; Siemens' Desigo; EnergyCAP; Planon; Maintenance Connection; Axis Communications; Microsoft Bot Framework; SAP Leonardo; Hippo CMMS and so forth are some of the AI powered tools utilized in school plant management. In summary, the roles of AI in school plant management are vast and continue to expand as technological advancements drive new capabilities. AI contributes to the efficient, sustainable, and safe management of educational facilities, providing school administrators with data-driven insights that help optimize resources, prevent costly disruptions, and create safer environments for students and staff. As AI technology evolves, its integration in school plant management will likely become more widespread, enabling schools to adapt more effectively to the complex challenges of modern educational environments.

Statement of the Problem

The integration of artificial intelligence (AI) in school plant management presents significant potential to enhance the efficiency, safety, and sustainability of school facilities. However, there is limited understanding of how AI can effectively address specific challenges in school plant management, such as maintenance scheduling, resource allocation, energy efficiency, and real-time monitoring of infrastructure conditions. Schools often face budget constraints, a lack of specialized staff, and issues with timely maintenance, leading to inefficient operations and compromised learning environments. This study seeks to explore the role of AI in optimizing school plant management, examining how AI technologies can improve decision-making processes, reduce operational costs, enhance the safety and functionality of school facilities, and ultimately create a more conducive learning environment.

The core problem, therefore, is to determine the practical and effective applications of AI in school plant management and assess the potential benefits and challenges associated with its implementation in educational settings.

Purpose of the Study

This study is aimed at investigating the roles of artificial intelligence (AI) in school plant management in government owned universities in Rivers State. Specifically, the study sought to:

1. identify the roles of artificial intelligence in school plant management in government owned universities in Rivers State.

2. ascertain the artificial intelligence powered tools utilized in school plant management in government owned universities in Rivers State.
3. categorize the challenges of implementing artificial intelligence in school plant management in government owned universities in Rivers State.

Research Questions

The following research questions provided direction for this study:

1. What are the roles of artificial intelligence in school plant management in government owned universities in Rivers State?
2. What is the artificial intelligence powered tools utilized in school plant management in government owned universities in Rivers State?
3. What are the challenges of implementing artificial intelligence in school plant management in government owned universities in Rivers State?

Methodology

The research design that was used for this study is the descriptive survey design. The total population of this study which consisted of the Deans and HoDs (university managers) found in the government owned universities in Rivers State namely; University of Port Harcourt (Uniport), Rivers State University (RSU), and Ignatius Ajuru University of Education (IAUoE), is one hundred and sixty (160) respondents. At the time of this study, this was made up of twenty-four (24) Deans and one hundred and thirty-six (136) HoDs heading 136 departments in the 3 government owned universities in Rivers State (Universities Statistics, 2024). The instrument used for data collection in this study was a fixed response questionnaire, titled “Investigation of the Roles Artificial Intelligence School Plant Management Questionnaire (IRAISPMQ)”.

Research Question 1: What are the roles of artificial intelligence in school plant management in government owned universities in Rivers State?

Table 1: **Mean and Standard Deviation of the roles of artificial intelligence in school plant management in government owned universities in Rivers State**

S/No	Items	Deans		HoDs		Total Mean
		Mean $\ddot{x}_1$	SD_1	Mean $\ddot{x}_2$	SD_2	
1	AI optimizes energy usage by analyzing patterns of energy consumption and identify areas where energy is being wasted	4.03	0.67	3.92	0.89	3.98
2	AI predicts when maintenance is needed thereby preventing unexpected breakdowns, and prolonging the lifespan of equipment	4.10	0.58	4.05	0.80	4.08
3	AI enhances security by detecting unusual activities and potential threats in real-time and alerting school authorities immediately	3.90	0.98	4.12	0.78	4.01
4	AI analyzes usage patterns of classrooms, labs, and other facilities to optimize scheduling and ensure that spaces are used effectively	3.98	0.93	4.08	0.71	4.03
5	AI monitors air quality, temperature, humidity, and other environmental factors in real-time	4.08	0.70	3.67	0.94	3.88
6	AI helps in budgeting and financial planning	3.78	0.88	4.04	0.75	3.91
		4.77	**0.95**	**4.78**	**0.97**	**4.78**

The data on table 1 showed that Deans and HoDs generally agreed on the roles of artificial intelligence in school plant management in government owned universities in Rivers State. Based

on the responses of these respondents to the question posed it is obvious that the respondents agreed on all the items.

Research Question 2: What is the artificial intelligence powered tools utilized in school plant management in government owned universities in Rivers State?

Table 2: **Mean and Standard Deviation of the artificial intelligence powered tools utilized in school plant management in government owned universities in Rivers State**

S/No	Items	Deans		HoDs		Total Mean
		Mean $\ddot{x}_1$	SD_1	Mean $\ddot{x}_2$	SD_2	
7	SmartSpace	3.96	0.90	4.22	0.81	4.09
8	EnergyCAP	4.06	0.66	4.13	0.75	4.10
9	Maintenance Connection	4.16	0.70	4.10	0.69	4.13
10	Axis Communications	3.98	0.92	4.08	0.71	4.03
11	Microsoft Bot Framework	4.00	0.68	3.88	0.99	3.94
12	SAP Leonardo	4.12	0.73	4.01	0.81	4.07
		4.86	**0.92**	**4.88**	**0.95**	**4.82**

The data on table 2 showed that the respondents generally agreed on all the variable items concerning the artificial intelligence powered tools utilized in school plant management in government owned universities in Rivers State. This can be attested to by the total mean which ranged from 3.94 to 4.13 which is higher than the criterion mean of 2.50. Variable item 9 concerning maintenance connection has the highest total mean of 4.13 from all the respondents under consideration for this study.

Research Question 3: What are the challenges of implementing artificial intelligence in school plant management in government owned universities in Rivers State?

Table 3: **Mean and Standard Deviation on the challenges of implementing artificial intelligence in school plant management in government owned universities in Rivers State**

S/No	Items	Deans		HoDs		Total Mean
		Mean $\ddot{x}_1$	SD_1	Mean $\ddot{x}_2$	SD_2	
13	High Implementations Cost	4.00	0.90	4.15	0.82	4.08
14	Data Privacy and Security Concerns	3.22	0.97	4.18	0.77	3.70
15	Technical Infrastructure Limitations	3.00	1.01	3.89	0.93	3.45
16	Lack of Expertise and Skilled Personnel	3.90	0.91	4.21	0.60	4.06
17	Resistance to Change	4.02	0.86	3.65	1.02	3.84
18	Maintenance and Upkeep	3.98	0.93	3.78	1.00	3.88
		4.42	**1.12**	**4.77**	**1.03**	**4.60**

The data on table 3 showed that all the challenge variables considered on research question 3 were all generally agreed upon as problems affecting the implementation of artificial intelligence in school plant management in government owned universities in Rivers State. Based on the responses of Deans and HoDs who constituted the respondents of the study on this research question, it is apparent that item 13 which listed: high implementations cost with a mean 4.08 has the highest total mean. This means that this variable item hinders the effective implementation of artificial intelligence in school plant management. All the other challenge variables also affect the ability of university administrators to effectively manage school plant.

Discussion of Findings

The findings to research question 1 identified the roles of artificial intelligence in school plant management in government owned universities in Rivers State with total mean of 4.78 for Deans and HoDs respectively also revealed that the respondents agreed to the statements that, AI

optimizes energy usage by analyzing patterns of energy consumption and identify areas where energy is being wasted; predict when maintenance is needed thereby preventing unexpected breakdowns, and prolonging the lifespan of equipment; enhance security by detecting unusual activities and potential threats in real-time and alerts school authorities immediately; analyzes usage patterns of classrooms, labs, and other facilities to optimize scheduling and ensure that spaces are used effectively; monitor air quality, temperature, humidity, and other environmental factors in real-time and helps in budgeting and financial planning. The finding agreed with Kwon and Kim (2020) who stated that the implementation of AI in school plant management encompasses a range of applications, from predictive maintenance and energy management to safety monitoring and space utilization.

The findings to research question 2 ascertained the artificial intelligence powered tools utilized in school plant management in government owned universities in Rivers State with total mean of 4.82 for Deans and HoDs respectively; also revealed that the respondents agreed that SmartSpace; EnergyCAP; Maintenance Connection; Axis Communications; Microsoft Bot Framework and SAP Leonardo are artificial intelligence powered tools utilized in school plant management. This corroborates Edwards and Baggott (2021) who stated that SmartSpace; Siemens' Desigo; EnergyCAP; Planon; Maintenance Connection; Axis Communications; Microsoft Bot Framework; SAP Leonardo; Hippo CMMS and so forth are some of the AI powered tools utilized in school plant management.

The findings to research question 3 categorized the challenges of implementing artificial intelligence in school plant management in government owned universities in Rivers State with total mean of 4.60 for Deans and HoDs respectively also revealed that the respondents agreed that high implementations cost; data privacy and security concerns; technical infrastructure limitations; lack of expertise and skilled personnel; resistance to change and maintenance and upkeep are some of the challenges of implementing artificial intelligence in school plant management. The finding aligns with Blaabjerg, Kjaer, and Li (2021) that challenges with AI adoption in school plant management, includes concerns over data privacy, initial implementation costs, and the need for technical expertise.

Conclusion

It was concluded that the role of artificial intelligence in school plant management is transformative, offering schools opportunity to enhance efficiently in managing their facilities. Although AI applications like predictive maintenance, energy management, and security monitoring, schools can significantly reduce operational costs, improve resource allocation, and create safer, more conducive learning environments. AI-driven systems allow school

administrators to make data-informed decisions, streamline maintenance schedules, and address infrastructure needs in real time, contributing to a well-maintained and optimized learning environment. However, the successful integration of AI in school plant management also requires thoughtful planning, adequate training, and investment in necessary infrastructure. While AI brings challenges such budget constraints, privacy concerns, and the need for staff training must be addressed. Moving forward, schools that embrace AI technologies with a clear strategy stand to benefit from a more efficient, resilient, and sustainable approach to managing their facilities. This advancement ultimately supports the primary goal of education institutions: providing students with a safe, supportive, and high-quality learning environment.

Recommendations

1. School administrators should adopt AI-Powered Integrated Management Systems (IFMS) to optimize school plant management, integrating functions such as: facility maintenance scheduling, energy management and efficiency, space utilization and optimization, security and surveillance and data analytics for informed decision-making.
2. School administrators should implement AI-powered facility management software to optimize school plant management, leveraging features such as: predictive maintenance, energy efficiency analytics, automated work order management, space utilization optimization and real-time data analytics and reporting.
3. School administrators should develop and execute a phased plan to integrate artificial intelligence into school plant management, addressing infrastructure, data management, cybersecurity, staff training, and AI solution implementation. The plan should include needs assessment and feasibility study, AI governance framework and ethics guidelines development, infrastructure upgrades and cybersecurity measures, staff training and support, AI solution implementation (facility management, energy management and so on) and monitoring, evaluation, and continuous improvement.

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