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ADOPTION OF PROJECT MANAGEMENT INFORMATION SYSTEM SOFTWARE IN CONSTRUCTION PROJECT DELIVERY IN ABUJA, NIGERIA

[1]Lawal, A., [2*] Waziri, A.Y., [3]Zadawa, N.A.
[1,2.3]Department of Quantity Surveying, Abubakar Tafawa Balewa University, Bauchi, Nigeria

Corresponding Author Email: aywaziri@gmail.com

Abstract
This study investigates the utilization and challenges of Project Management Information Systems (PMIS) software in the construction industry in Abuja, Nigeria. The research aims to identify the barriers faced by professionals in using PMIS, determine the software usage patterns, articulate the factors enabling PMIS adoption, and ascertain the software used by professionals. A quantitative research approach was employed, utilizing a survey questionnaire administered to 120 construction professionals. The findings reveal that while PMIS offers significant benefits, including improved project planning, cost control, and risk management, its adoption faces challenges such as power outages, cybersecurity threats, and resistance to change. The study highlights the need to address these challenges through strategies such as improving infrastructure, enhancing cybersecurity measures, and providing comprehensive training programs. The findings emphasize the importance of PMIS in modern construction and provide valuable insights for stakeholders to optimize its implementation and maximize its benefits. The study recommended that regularly update and improve software features to meet evolving project management needs. Carefully evaluate the specific needs of the organization and select PMIS software that aligns with those requirements. Consider factors such as user needs, project complexity, and budget constraints.

Keywords: Project, Challenges, Adoption, professionals, Cyber security, threats.

Introduction

The construction industry is a complex and dynamic industry with the involvement of owners, contractors, subcontractors, architects, engineers, and suppliers. Every successful construction project depends on effective management of resources such as time, cost, scope, quality, and risks. According to Retnowardhani and Suroso (2019), the effective management of resources is indispensable in bringing about project success, especially given that projects are increasingly complex. The changes in technology have transformed the construction industry, and one of the influencing factors was the adoption of PMIS software. Mahmood, Al Marzooqi, El Khatib, and AlAmeemi (2023) note that such systems have revolutionized project delivery through improved communication, resource allocation, budgeting, and scheduling. Purohit, Chopra, and Dangwal (2022) find that project management information software permits the direction of very complex projects that also deal with many stakeholders where regulatory necessities are severe.

COVID-19 pandemic accelerated the digital transformation in the construction industry. Choi and Ha (2022) indicated that the pandemic compelled many companies to adopt PMIS to maintain operational efficiency amidst challenges like working from home and social distancing. This shift has underlined the strategic benefits of PMIS, including enhanced predictability, accountability, and performance of projects. Micale, La Fata, Lombardo, and La Scalia (2021) observe an increase in interest in digital solutions for construction management to surmount emerging challenges. In the past, the potential of PMIS software to improve the efficiency of projects, reduce costs, and reduce risks has commanded considerable attention. Haloul, Bilema, and Ahmad (2024) indicated that the performance of a project will be enhanced through such facilities as real-time tracking of progress,

early detection of problems, and timely correction. Varajão, Marques, and Trigo (2022) have also highlighted its usefulness in budgeting and cost management, thus enabling a project manager to track expenses, manage budgets, and identify cost variances.

Another valuable contribution of PMIS is resource allocation. It optimizes resource utilization to minimize waste and maximize efficiency. It also facilitates risk management through strong PMIS software, enabling the project team to identify, assess, and mitigate risks while ensuring the implementation of risk management plans. Whereas many benefits exist, the spread of PMIS is varied across the globe. Liu, Wang, and Xiao (2021) expressed that in some regions, few firms heavily apply PMIS software. In Nigeria, there is a growing trend in the adoption of PMIS, but it faces serious challenges, especially in Abuja (Tsurkan, Liubarskaia, Chekalin, Mironova, &Artemiev, 2020; Azhar, Defriani, &Hermanto, 2023). Research has investigated different aspects of PMIS, such as usage, benefits, challenges, the factors affecting its adoption, and its impact on project performance in various construction contexts (Retnowardhani&Suroso, 2019; Haloul*et al.,* 2024).The research will seek to establish the barriers and challenges faced by professionals in using PMIS in construction project delivery, identify the software usage by professionals in construction project delivery, articulate the factors enabling the adoption of PMIS in construction project delivery, and determine the software used by professionals in construction project delivery.

Methodology

This study used an exploratory and descriptive design, as it employed objective approaches to gather information about its origins and challenges. The study also used questionnaires as data collection tools because of the nature of the research issues; hence, a quantitative approach was used in the data collection procedure. Professionals in the construction sector, including Quantity surveyors, Engineers, Architects, and Builders, made up the study's population. Professionals serving the office were said to be 142 comprising the study sample frame. Statistical Package for Social Sciences (SPSS) was used to apply both descriptive and non-parametric inferential statistical techniques to the data gathered for this investigation. Tables, charts, figures, and mean ranking were all included in the descriptive statistics utilized in this study, and regression was employed to analyze the inferential data.

Result

Questionnaire Administration

After restructuring the questions as required by the pilot survey results, the field survey questionnaire was administered. The 120 sets of questionnaires were administered to the professionals in the study area. A total number of 114 questionnaires with a 95% approximate response rate were retrieved from the study area. A total number of 105 (87.5%) were used in the analyses after removing incomplete ones and data screening for outliers.

Table 1: Questionnaire administration

SN	Title	Number and percentage
1	Questionnaire administered	120
2	Questionnaire retrieved	114 (95%)
3	Questionnaire used for analyses	105 (87.5%)

Demographic Attributes

The majority are males, totalling 82%. For age group, the highest number is in the 26-35 age group, composing 33% of the subjects, followed by those aged 36-45 years at 29%. In respect to professional background, the greater percentage of subjects, 43%, are quantity surveyors,

builders compose 32%, and architects account for 29%. A lot of the attention of the respondents has been focused on higher education, where 46% are with a Degree/HND, and another 33% are Master's. For their years of experience in the field of oil and gas, the larger proportion was recorded with 10 to 20 working years' experience with 62%, followed by less than 10 with 24% accordingly. Overall, the demographic profile is a male-dominated, experienced workforce that is well educated, with the majority coming from the field of quantity surveying and building.

Decision Rule

In the entire process, the 5-point Likert scale was used but with an equivalent or different scale explanation for each variable. The concept has a consistent mean rating scale despite the variations in explanation. The rankings were therefore assigned numbers from one (1) to five (5) with one (1) denoting the lowest and five (5) denoting the highest. In this study, the mean score decision interval adapted from which the next interval decisions were inferred in the light of Ramli et al, (2017) study: (1-1.80) = Very low, (1.81-2.60) = Low, (2.61-3.40) = Moderate, (3.41-4.20) = High and (4.21-5.0) Very high. Where applicable, ratings from very good, good, fair, bad, to very bad were used.

The various PMIS software used by project managers in construction project delivery in Abuja, Nigeria

Descriptive statistics based on mean ranking were carried out to explore the various PMIS software used by project managers in construction project delivery in Abuja, Nigeria. The results were presented in Table 2 showing each item's ranking, mean, standard deviation and remark.

Table 2: various PMIS software used

	Mean	Std. Deviation	Rank	Remark
Raken	3.22	1.219	1	Moderate
Buildertrend	3.20	1.198	2	Moderate
Fieldwire	3.18	1.211	3	Moderate
eSub	3.14	1.188	4	Moderate
CoConstruct	3.13	1.181	5	Moderate
Microsoft Project	2.95	1.339	6	Moderate
Smartsheet	2.94	1.288	7	Moderate
PlanGrid	2.93	1.123	8	Moderate
Autodesk BIM 360	2.84	1.134	9	Moderate
Oracle Primavera P6	2.78	1.273	10	Moderate
Procore	2.75	1.164	11	Moderate
Sage 300 Construction and Real Estate	2.73	1.228	12	Moderate
Trimble Connect	2.64	1.198	13	Moderate
ProjectWise	2.58	1.261	14	Low
Jonas Premier	2.55	1.264	15	Low

Table 2 compares available PMIS software ranked by mean user rating. Raked, Builder trend, and Field wire were the top-scoring PMIS solutions with mean scores greater than 3.0 and a "Moderate" remark. These features and usability, respecting overall performance, can be outstanding and serve very well the needs of the project managers. The "Moderate" class includes Microsoft Project, Smart sheet, and Autodesk BIM 360, their mean scores fell around 2.9. As such, these tools could have excellent features but may fall a little short when it comes to user experience within interface design, functionality, or, in general performance. Finally, at the tail end are the

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Project Wise and Jonas Premier that came out with low mean scores and so fell into "Low." Since these tools did not have something in either features or usability or other performance, they get very low ratings to satisfy users. This affects projects in some matters of efficiency or effectiveness.

The level of effectiveness of PMIS software used in construction project delivery in the study area

Descriptive statistics based on mean ranking were carried out to explore the effectiveness of PMIS software used by project managers in construction project delivery in the study area. The results were presented in Table 3 showing each item's ranking, mean, standard deviation and remark.

Table 3: effectiveness of PMIS software

	Mean	Std. Deviation	Rank	Remark
Procore	3.64	1.150	1	High
Trimble Connect	3.59	1.189	2	High
Sage 300 Construction and Real Estate	3.54	1.220	3	High
PlanGrid	3.53	1.216	4	High
CoConstruct	3.52	1.197	5	High
Smartsheet	3.50	1.208	6	High
Oracle Primavera P6	3.49	1.169	7	High
Raken	3.47	1.218	8	High
Jonas Premier	3.37	1.139	9	Moderate
Microsoft Project	3.27	1.155	10	Moderate
Autodesk BIM 360	2.95	1.309	11	Moderate
ProjectWise	2.92	1.322	12	Moderate
Buildertrend	2.86	1.309	13	Moderate
Fieldwire	2.85	1.308	14	Moderate
eSub	2.83	1.316	15	Moderate
Level of effectiveness	**3.28**	**1.228**		**Fair**

Table 3 presents an assessment and comparison of various PMIS software applications. Of those compared, Procure and Trimble Connect ranked first and second, respectively, in the highest ratings for effectiveness. The remaining seven solutions received high ratings for effectiveness: Sage 300 Construction and Real Estate, Plan Grid, Construct, Smart sheet, Oracle Primavera P6, and Raken.Jonas Premier and Microsoft Project received average ratings for effectiveness. The remaining software, in alphabetical order, Autodesk BIM 360, Project Wise, Builder trend, Field wire, sub, Level of Effectiveness, had ratings of being moderately effective. The mean effectiveness rating shows the general measure of performance; a higher mean means a higher perceived effectiveness. The standard deviation indicates the dispersion of ratings, where a lower standard deviation would imply more consistent ratings. The rank gives the relative measure of the effectiveness of the software, and thus, the higher the rank, the higher the effectiveness. Procure and Trimble Connect is recommended for first consideration in the projects that require highly effective PMIS software based on the analysis. On the other hand, Sage 300 Construction and Real Estate, Plan Grid, Construct, Smart sheet, Oracle Primavera P6, Raked stand fit for projects that require high-effectiveness PMIS software. Projects with moderately effective PMIS software may consider Jonas Premier and Microsoft Project. It is necessary to further investigate the suitability of Autodesk BIM 360, Project Wise, Builder trend, Field wire, sub, and Level of effectiveness for particular project needs.

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The challenges faced by project managers in the use of PMIS software in construction project delivery in the study area

Descriptive statistics based on mean ranking were carried out to explore the challenges faced by project managers in the use of PMIS software in construction project delivery in the study area. The results were presented in Table 4 showing each item's ranking, mean, standard deviation and remark.

Table 4: challenges faced in the use of PMIS software

	Mean	Std. Deviation	Rank	Remark
Reliance on generators for power	3.65	1.174	1	High
Lack of robust security measures	2.93	1.363	2	Moderate
Cyber security threats	2.91	1.326	3	Moderate
Outdated hardware	2.89	1.310	4	Moderate
Low computer proficiency	2.88	1.338	5	Moderate
Resistance to change	2.87	1.283	6	Moderate
Licensing fees	2.86	1.322	7	Moderate
Poor internet connectivity	2.85	1.323	8	Moderate
Training and ongoing support costs	2.84	1.352	9	Moderate
Lack of standardized project management practices	2.83	1.333	10	Moderate
Bureaucratic hurdles	2.82	1.338	11	Moderate
Frequent power cuts	2.74	1.300	12	Moderate

Challenges faced in using the PMIS software were based on responses as highlighted in the Table 4 below. The greatest challenges identified in the use of PMIS are from reliance on generators for power, followed by non-robust security and cyber security threats. Other challenges identified include hardware that is considered outdated; general low computer proficiency; resistance to change; licensing fees; poor internet connectivity; costs related to training and ongoing support; lack of standardization in project management practices; bureaucratic red tape; and frequent power cuts. These various issues could be addressed by the organizations on key issues such as providing reliable power solutions, increasing security, upgrading hardware, providing computer proficiency training, managing change, negotiating licensing fees, improving internet connectivity, giving proper training and support, introducing standardized practices, eliminating bureaucratic barriers and reducing power cuts.

The effect of the challenges on the effectiveness of the use of PMIS software by project managers in the delivery of construction projects within the study area.

A multiple regression was carried out to assess the influence of the challenges on the effectiveness of PMIS software used by project managers in construction project delivery in the study area. The R square value in Table 8 shows how much of the variance in the dependent variable-effectiveness of PMIS software used is explained by the independent variable's challenges faced by the use of PMIS software. The $R2=.356$, $f(1,103) = 27.141$, $p<.001$; in this case, therefore, the independent variables of challenges faced by the use of PMIS software explained a 35.6 % large effect size in the effectiveness of PMIS software used with significance at $p<0.001$.

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Table 5: Effect of the challenges on the effectiveness of PMIS software used

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	df	F	Sig.
1	.597[a]	.356	.343	.920	1 103	27.141	.000

a. Predictors: (Constant), challenges faced by the use of PMIS software
b. Dependent Variable: effectiveness of PMIS software used

Discussion

The finding that PMIS user satisfaction is highly stratified with tools like Raked, Builder trend, and Field wire scoring high in a "Moderate" class, while widely used systems like Microsoft Project, Smart sheet, and Autodesk BIM 360 score lower in the same category, and Project Wise/Jonas Premier at the "Low" end generally agrees with the broad consensus in PMIS literature, which emphasizes that usability and fit for purpose are critical to user adoption and project success, often over sheer feature depth (Raymond & Bergeron, 2008; Rebuglio*et al.,* 2021). Previous studies often note that traditional, feature-rich tools like Microsoft Project or Primavera can be complex and costly, making them more suitable for large-scale, formal projects, which aligns with the lower user experience scores (2.9) found here, where interface design is a noted shortcoming. Conversely, the high-scoring tools like Builder trend and Field wire are often specialized for construction/field teams, known for their user-friendly mobile interfaces and targeted functionality, which supports their high mean scores (3.0). Therefore, the ranking validates the view that simplicity, ease of use, and a focus on specific project needs (like field coordination for Field wire) often translate to higher user satisfaction, even if feature parity with more comprehensive, but complex, systems is lacking.

The finding that Procure and Trimble Connect rank highest in effectiveness, followed by a large group including Plan Grid, Oracle Primavera P6, and Raked as highly effective, while widespread tools like Microsoft Project are rated only as moderately effective, agrees with much of the contemporary project management literature that critiques traditional, complex systems in favor of specialized, collaborative, and field-focused PMIS solutions (Sepasgozar*et al.,* 2020; Smirnova *et al*., 2021). The high effectiveness of Procure and Trimble Connect, which are strongly positioned in the construction technology and BIM/collaboration spaces, validates the industry trend where tools that facilitate real-time data flow and interoperability (often with low standard deviation for consistency) are perceived as more effective than standalone scheduling or accounting systems. Conversely, Microsoft Project's moderate rating aligns with findings that, despite its powerful scheduling capabilities, it often lacks the field-level collaboration and modern user experience required for overall project effectiveness in a contemporary context (Raymond & Bergeron, 2008). Therefore, the ranking reflects a shift in what constitutes "effectiveness," prioritizing integration and collaborative function over traditional, back-office feature depth.

The identified challenges in PMIS use ranging from reliance on generators and frequent power cuts to non-robust security, cyber security threats, poor internet connectivity, and low computer proficiencylargely agree with previous studies, particularly those focused on PMIS implementation in developing economies or challenging project environments (Ozorhon*et al.,* 2018; Zolfagharian& Dainty, 2020). While literature often highlights organizational issues like resistance to change, licensing fees, and lack of standardization (Raymond & Bergeron, 2008), the prominence of infrastructure and security challenges (power, internet, and cyber security) here underscores a critical distinction. These external/environmental constraints can be far more debilitating than organizational ones, directly impeding the reliability and accessibility of the software, regardless of its feature set. This finding validates the literature that emphasizes the sociotechnical nature of PMIS adoption, where the success of a technology is fundamentally limited by the technical

infrastructure and the user's capabilities (training/proficiency), confirming that addressing these foundational issues is paramount for effective deployment.

The finding that the challenges faced in using PMIS software explain a 35.6% variance (R2 = .356) in the effectiveness of that software, with a highly significant result ($p < .001$), strongly agrees with the established literature on technology acceptance and PMIS implementation (Davis, 1989; Raymond & Bergeron, 2008). This R2 value signifies a substantial and practical influence of implementation issues such as those related to infrastructure, security, and user proficiency on the perceived effectiveness and successful utilization of the system. Previous studies, particularly those employing models like the Technology Acceptance Model (TAM), consistently highlight that perceived ease of use (which is directly hampered by challenges like power cuts, poor connectivity, and low proficiency) and the quality of the system (affected by security and outdated hardware) are the primary determinants of user attitude, adoption, and ultimately, the software's effectiveness in achieving project goals. The large effect size confirms that overcoming these challenges is not merely a logistical step, but a critical predictor of PMIS success, rather than effectiveness being solely determined by the software's inherent features.

Conclusion

The application of the project management information system has contributed a lot to the successful delivery of construction projects, both in effectiveness and efficiency. Indeed, such strengths of some of the PMIS software were identified within this study, representing two of the most advanced tools for the management of construction projects: Procure and Trimble Connect. Besides, power reliability issues, threats in cyber security, outdated hardware, and poor internet connectivity that project managers face can grossly bring down the performance of these systems. While such challenges are inevitable, the general findings indicate that PMIS software should be leveraged to enhance task coordination, cost control, risk management, scheduling, and document management. Challenges identified-including increasing security measures, updating hardware, providing sufficient training and implementing change management-will reduce barriers to software effectiveness and maximize benefits from using PMIS tools.

Further analysis revealed that effective usage challenges can explain a good deal of PMIS software; thus, such factors have important implications for ensuring successful project delivery. Strategic intervention by organizations must, therefore, aim at mitigating such challenges in order to ensure successful implementation and subsequent adoption of the PMIS software. Full implementation of high-effectiveness PMIS software with comprehensive solutions for how to overcome all the technical and operational challenges will significantly enhance performance in construction projects to meet the threefold objectives of completing projects on time, within budget, and with the desired quality.

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