

## **Assessing the Challenges Encountered to the Adoption of Computer-based Project Management Models among the Construction Industry in Enugu State, Nigeria<sup>1, 2</sup>**

**Sunday Aniagolu Ezeh, Francisca Okeke**

Department of Quantity Surveying,  
Enugu State University of Science & Tech, Nigeria

### **Abstract**

The construction industry frequently deals with difficulties like subpar project management, holdups, overspending, and poor quality, all of which can have an impact on how well building projects work. Better planning, execution, and monitoring of construction projects have been made possible in recent years by the development of computer-based project management models. This study assesses the challenges encountered to the adoption of computer-based project management models among the construction industry in Enugu State. The objectives were; to identify economic factors challenging the adoption of computer-based project management models among construction industry; and to recommend possible mitigation measures for the adoption of computer-based project management models in the construction industry. The study adopted a pilot survey approach of research design with a combination of quantitative and qualitative research approaches, and the population of the study is 384. Sample size were determined using Cochran's formula. The result of the study indicate that Lack of awareness of improved productivity due to the technology and lack of demonstration projects and proof of financial were the most widely known cause with mean value of 4.96 and 4.89 respectively, followed by high costs of software and hardware and longer payback periods with mean value of 4.89 and 4.75 respectively. The research also demonstrates high acceptance rates for mitigation measures for the adoption of computer-based project management models in the construction industry, including

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capacity building and training (33%), cost subsidies and incentives (26%), data security and reliability assurance (22%), and policy and regulatory support (19%) of building performance in the construction industry in Enugu state is being explained by the proper application of Computer-Based Project Management, this means a positive relationship between computer-based project management models and building performance. The study recommends the following: capacity building and training, team collaboration, subsidies and incentives for adoption, digital infrastructure development, policy integration, pilot projects and case studies, and custom software solutions.

**Keywords:** *Construction Industry, Computer-Based Project Management Models, Building Performance*

## **1.0 Introduction**

Region's capacity to prosper economically depends heavily on the building sector, in which a wide number of stakeholders, including owners, designers, contractors, suppliers, and regulatory agencies, are frequently involved in complicated construction projects. According to [1], CBPM models provide a collaborative platform that helps in visualizing project timelines, optimizing resource use, and managing risk more effectively. The construction industry in advanced economies like the United States, United Kingdom, Germany, and Japan has experienced increased productivity, fewer disputes, and improved project delivery due to widespread use of these digital solutions [2]. Moreover, because of the various difficulties the industry faces, the performance of construction projects in Nigeria has been a major source of concern. Construction project management is still impacted by some unfavorable factors, despite the field of project management having advanced quickly. The construction industry frequently deals with difficulties like subpar project management, holdups, overspending and poor quality, all of which can have an impact on how well building projects work. Better planning, execution, and monitoring of construction projects have been made possible in recent years by the development of computer-based project management models (CBPMMs), which may improve building performance [3].

Computer-based project management models enable several construction industries in a world where technology is advancing at an accelerating rate. These levels range from routine transactions to strategic initiatives. On the other hand, companies depend on the success of computer-based project management models to building project performance [4]. However, assessing success can be a laborious task because of the intricacy of projects and the numerous technical, behavioral and contextual factors that need to be considered [5]. A fresh phase in the history of design task management has been brought about by the use of computer-based project management models. The computer-based project management model has evolved gradually to serve a variety of users, from those working on simpler product designs to those handling more intricate and sophisticated

design jobs. Technology has improved the ability to support different user needs in designing tasks, such as two- and three-dimensional (3D) drawing tools [6].

A building refers to any structure that is constructed and assembled to provide shelter, support, or serve a specific purpose. Buildings typically consist of foundations, walls, floors, and roofs and may include various components such as doors, windows and mechanical systems (electrical, plumbing and HVAC systems). They are designed to accommodate a range of human activities, including residential, commercial, industrial and institutional use. Building performance refers to the ability of a building project to meet its objectives in terms of time, cost and quality, which ensures that projects are completed on schedule, within budget and to the required quality standards. It also considers the long-term functionality and sustainability of the structure. Using the wrong system and tools for management, coordination and communication is one of these problems. The construction sector in Nigeria is presently facing obstacles related to project performance, which are exacerbating the country's declining gross domestic product (GDP). The current records of project failure in the construction of buildings, roads and other infrastructure projects demonstrate the extent of this performance difficulty. [7] claim that low project performance is retrogressive in the majority of developing economies and can be attributed to inadequate use of critical success factors, project performance measures and best practices for project management, which together make up the multivariate that affects construction projects.

Obviously, building projects in Enugu State, Nigeria, frequently encounter challenges such as cost overruns, project delays, poor quality and ineffective resource management. Traditional project management methods, which rely heavily on manual processes and limited technological tools, often fail to provide the level of precision, coordination, and efficiency required to overcome these challenges [8]. Given the importance of the construction industry to the economic development of Enugu State and Nigeria as a whole, it is crucial to explore how CBPMMs can improve project performance and contribute to more efficient and sustainable construction practices. Addressing this problem will provide valuable insights into the role of digital project management tools in transforming the construction industry in Enugu and beyond.

This study assess the challenges encountered to the adoption of computer-based project management models among construction industry in Enugu State, Nigeria, by examining the economic factors challenging the adoption of computer-based project management models; recommend possible mitigation measures to the adoption of computer-based project management models among construction industry. The study initiate hypotheses to guide the research. However, the result of this study would be of significance for addressing computer-based project management models, team collaboration, policy integration, and encourage the development or

customization of CBPM software tailored to the Nigerian construction context especially those that can operate offline or in low-connectivity environments.

## **2.0 Literature Review**

### **2.1 Concept of Project Management in Construction**

Project management in construction involves planning, coordinating, and controlling activities to achieve specific goals, such as completing the project on time, within budget, and to desired quality standards. It involves managing resources, addressing constraints, and balancing the interests of multiple stakeholders, such as clients, contractors, architects, engineers, and regulatory authorities, to ensure successful project delivery. Building technology, engineering principles of architectural design, environmental consciousness, and economical energy use are the methods used to achieve it [9]. Key components of project management in construction include project planning, scheduling, cost management, quality management, resource allocation, risk management, communication management, procurement management, and safety management. The project life cycle in construction includes initiation, planning, execution, monitoring and controlling, and closure.

Tools and techniques commonly used in construction project management include Critical Path Method (CPM), Gantt charts, Earned Value Management (EVM), Building Information Modeling (BIM), and Microsoft Project [10]. Effective project management is critical to the success of construction projects for several reasons: on-time delivery, cost control, quality assurance, risk mitigation, stakeholder satisfaction, and resource optimization.

However, challenges in construction project management include unexpected delays due to weather, material shortages, or unexpected site conditions, cost overruns when managing a project within budget, stakeholder conflicts due to differing priorities and expectations and regulatory and environmental constraints. To improve efficiency and performance, project managers can use tools such as the Critical Path Method (CPM), Gantt Charts, EVM, Building Information Modeling (BIM), and Microsoft Project [11]. These tools help visualize the project schedule, track progress against deadlines, measure project performance, and integrate all aspects of a construction project from design to completion. Therefore, project management in construction is a complex but essential process that ensures the successful delivery of projects by coordinating various tasks, resources, and stakeholders to achieve project goals related to time, cost, and quality. With the help of modern tools and techniques, effective project management can mitigate risks, optimize resource use, and enhance project outcomes, ensuring that construction projects are completed efficiently and to a high standard.

## **2.2 Computer-Based Project Management Models (CBPMMs)**

CBPMMs are software tools that manage a project's entire lifecycle, automating tasks like scheduling, cost estimation, risk analysis, communication and performance tracking. Popular in the construction industry include Microsoft Project, Civilsoft, Planswift, Revit, ArchiCAD, and Building Information Modeling (BIM), which integrate all aspects of building design, construction, and operation for real-time collaboration among stakeholders. Surprisingly, though, as computer-assisted methods are put into place, the basic principles of project management create a plan, work the plan and regulate changes may become harder to understand and put into practice [12].

CBPMMs can significantly enhance building project performance by improving scheduling, time management, cost control, resource management, risk identification and mitigation, collaboration and communication, and quality assurance and control. They automate scheduling processes, allowing project managers to create detailed schedules, track progress in real-time, and identify delays early. They also provide accurate cost estimates, real-time budget tracking, and forecast future expenditures, enabling more effective resource allocation and preventing overspending. CBPMMs optimize the use of labor, materials, and equipment, reducing waste and ensuring resources are available when needed [13]. They also help identify potential risks early and develop mitigation strategies. They also facilitate real-time collaboration among stakeholders, ensuring everyone has access to the latest information. Lastly, CBPMMs ensure construction tasks are completed according to required quality standards, reducing the risk of substandard construction in Enugu State.

## **2.3 The Impact of Computer-Based Project Management Models on Building Performance**

The construction industry is renowned for its complexity, as projects frequently encounter difficulties with scheduling, budgeting, quality control, and risk management. Computer-Based Project Management Models (CBPMMs) have grown in importance as a means of addressing these issues and enhancing building performance. For instance, [14] pointed out that using CBPMMs could reduce project durations by facilitating improved team coordination, particularly in big projects with several stakeholders. These technologies guarantee that deadlines are met by automating task assignments and tracking, which minimizes time overruns that are common in conventional project management techniques. The performance of building projects has been demonstrated to be significantly impacted by the implementation of CBPMMs in several areas, including time, cost, quality, and overall efficiency.

Construction projects frequently have cost overruns due to financial issues brought on by changes in the project scope, labour expenses, and material prices. Better financial forecasting, real-time cost tracking, and accurate cost prediction are all made possible by the sophisticated budgeting options that CBPMMs offer. Project managers may also simulate different scenarios and modify budgets accordingly with the use of tools like Building Information Modeling (BIM), which helps to avoid expensive adjustments during construction. [15] asserted that by offering precise, current financial data and facilitating proactive management of project budgets, CBPMMs considerably lowered the likelihood of cost overruns. These technologies also make it possible to allocate resources more effectively, which lowers waste and inefficiency.

However, ensuring that construction projects fulfill client demands and regulatory standards requires effective quality control. By offering comprehensive monitoring tools that track the quality of materials, craftsmanship, and overall project execution, CBPMMs contribute to the maintenance of high standards. For instance, BIM makes it possible for contractors, engineers, and architects to collaborate in real-time, which permits the early identification and repair of construction or design oversights. [16], asserted that the application of CBPMMs improved stakeholder communication in Nigerian construction projects, resulting in more efficient project management and fewer conflicts. This was especially true for projects with several contractors or stages when the timely exchange of information was essential to maintaining project progress. Building environmental performance is enhanced by BIM's capacity to incorporate sustainability studies into the design stage, [17]. Throughout the building's lifespan, this integration results in improved energy efficiency, decreased waste, and decreased carbon emissions.

Computer-Based Project Management Models (CBPMMs) like BIM, Civilsoft, Planswift, Revit, ArchiCAD, and Microsoft Project have significantly improved efficiency, cost control, and quality management in construction. However, challenges persist, especially in developing regions like Nigeria, necessitating a comprehensive understanding of these obstacles for industry adoption [18].

The initial high cost of purchasing software, hardware, and infrastructure is a significant barrier to the adoption of Computer-based Project Management Models (CBPMMs). Construction firms, particularly Small and Medium Enterprises (SMEs), may struggle to afford these costs due to limited budgets and the need for expensive software licenses and hardware upgrades [19], These costs are particularly significant in Nigerian construction industry, where capital investment resources are often scarce, making it difficult for SMEs to adopt CBPMMs. Construction-based project management models (CBPMMs) rely on robust technological infrastructure, including high-speed internet, cloud storage, and reliable power supply. However, in many regions, including Nigeria, inadequate infrastructure poses a significant challenge [3]. Inadequate internet

connectivity and frequent power outages in developing countries hinder the use of these systems, especially for real-time collaboration and continuous data access.

The construction industry faces challenges in adopting Construction Business Process Management (CBPMMs) due to a lack of technical expertise, inadequate training programs, and a steep learning curve. Many professionals lack the necessary skills to operate and maintain these systems, and firms often prioritize up skilling due to cost or time constraints. [20] highlight that many project managers and construction workers struggle to adopt CBPMMs due to limited formal training in low- and middle-income countries. Construction professionals often resist change due to their familiarity with traditional methods and fear of job loss or redundancy. They may view CBPMMs as unnecessary or overly complex and fear that automation will reduce manual roles or make certain jobs obsolete. This resistance is a key sociocultural barrier to adopting Information and Communication Technology (ICT) tools, particularly among older professionals who may not be as tech-savvy as younger workers [21]. This resistance to change can disrupt established practices and require a shift in mindset and workflows.

#### **2.4 Significant of Theory of Technology Acceptance Model (TAM)**

The Technology Acceptance Model adds to knowledge on the adoption of technology especially within the construction project management context and its impact on building performance [22]. According to TAM, the perceived value and the ease of use of a CBPMM considerably affects building performance. If a system enhances planning, monitoring, and execution, it will likely be adopted, but complexity or inadequate training can hinder effectiveness. The wider acceptance of computer-based project management models depend on their full integration into everyday project operations and the proactive attitude of project stakeholders toward their use.

Still, TAM attempts to assess the degree of acceptance of tools such as Primavera and MS Project with regard to their use by project managers, architects, and engineers, offers some explanations on the adoption barriers of CBPM tools which may have direct impact on overall project performance in time, cost, quality and gives reasons justifying offering training or policy designed to increase the use of digital project management systems in the local construction industry.

### **3.0 Methodology**

The research design adopted a pilot survey approach which is the combination of quantitative and qualitative research approach. The methods provides a comprehensive understanding of the complex issues regarding the effect of computer-based project management models on building project performance in Enugu State. A questionnaire was used to collect information about the

respondents' profile. Hypothesis testing is done using the Null Hypothesis (H0) and a significance level is used to reject the null hypothesis. The result was further tested using t-test statistical method to determine significant differences in the result.

#### 4.0 Findings and Discussion

Data obtained through the questionnaire were analyzed. The data from the respondents was examined and ranked in accordance with the strength of the effects, on the Tables 1.

Table 1 shows the rank of 16 factors that economic factors challenging the adoption of computer-based project management models among construction industry. Lack of awareness of improved productivity due to the technology ranked 1<sup>st</sup> with mean score of 4.96, lack of demonstration projects and proof of financial constraint, high costs of software and Longer payback periods ranked 2<sup>nd</sup> 3<sup>rd</sup> and 4<sup>th</sup> respectively with RII of 4.89, 4.75, 4.68 respectively.

**Table 1: Economic factors challenging the adoption of computer-based project management models among construction industry.**

S/N	Economic factors challenging the adoption of computer-based project management models among construction industry	W	SA -----					SD	ΣFX	X̄	DECISION
			5	4	3	2	1				
1	Lack of awareness of improved productivity due to the technology	F	370	14	-	-	-	384	4.96	ACCEPT	
		WF	1851	55	0	0	0	1906			
2	Lack of demonstration projects and proof of financial constraint	F	343	41	-	-	-	384	4.89	ACCEPT	
		WF	1714	165	0	0	0	1879			
3	High costs of software and hardware	F	301	69	14	-	-	384	4.75	ACCEPT	
		WF	1509	274	41	0	0	1824			
4	Longer payback periods	F	288	69	27	-	-	384	4.68	ACCEPT	
		WF	1440	274	82	0	0	1796			
5	Social and habitual resistance to change	F	274	68	31	11	-	384	4.53	ACCEPT	
		WF	1371	274	82	14	0	1741			
6	Lack of vision of benefits	F	261	55	41	27	-	384	4.43	ACCEPT	
		WF	1303	219	123	55	0	1700			
7	Lack of digitally skilled professional	F	274	14	55	41	-	384	4.36	ACCEPT	
		WF	1371	55	165	82	0	1673			
8	Lack of technology training	F	257	14	41	58	14	384	ACCEPT		

		WF	1234	55	122	110	14	1535	4.00	
9	Deficit budget	F WF	233 1166	27 110	27 82	56 110	41 41	384 1509	3.93	ACCEPT
10	Limitations of technology infrastructure	F WF	233 1166	14 55	14 41	68 137	55 55	384 1454	3.79	ACCEPT
11	Lack of information acquisition, integration, maintenance, and data management capabilities	F WF	233 1166	14 55	14 41	55 110	68 68	384 1440	3.75	ACCEPT
12	Lack of market data to integrate the selected technology with existing infrastructure	F WF	233 1166	14 55	14 41	41 82	82 82	384 1426	3.71	ACCEPT
13	Lack of understanding of smart/electronic contracts to use selected technology	F WF	164 823	14 55	14 41	82 165	110 110	384 1194	3.11	ACCEPT
14	Lack of management and leaders trust in innovation and new technology adoption	F WF	164 823	14 55	14 41	82 165	110 110	384 1194	3.11	ACCEPT
15	Security issues	F WF	164 823	14 55	14 41	69 137	123 123	384 1179	3.07	ACCEPT
16	Lack of awareness of improved productivity due to the technology	F WF	164 823	14 55	14 41	69 137	123 123	384 1179	3.07	ACCEPT

Source: Researchers field survey 2024

SA = Strongly Agree (5),

N = Neutral (3),

A = Agree (4),

D = Disagree (2),

SD = Strongly Disagree (1)

**Fig 1: Recommended possible mitigation measures for the adoption of computer-based project management models in the construction industry**

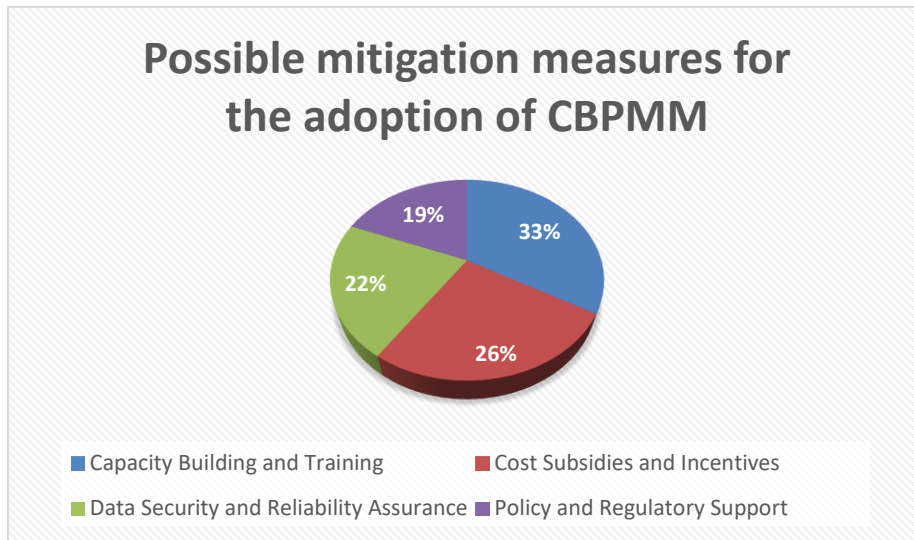


Fig 1 demonstrates high acceptance rates for mitigation measures for the adoption of computer-based project management models in the construction industry, including capacity building and training (33%), cost subsidies and incentives (26%), data security and reliability assurance (22%), and policy and regulatory support (19%).

**Hypothesis**

**Table 5.6: one-sample test of the first hypotheses;**

*H<sub>0</sub>*: There is no significant relationship between computer-based project management models and construction industry

	One-Sample Test					
	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
Lower					Upper	
There is no significant relationship between computer-based project management models and construction industry	0.056	19	.012	15264.0400 0	17107.8056	18338.2402

Using one sample test t-statistics in the test of hypothesis above, based on the decision rule which states, reject null hypothesis if the value of the t-statistics is greater than 0.05 critical value, from the result; the value of the t-statistics as shown from the table is (0.056) which is above 0.05 (critical value) hence we reject the null hypothesis and conclude that there are is significant relationship between computer-based project management models and construction industry.

## **5.0 Conclusion**

Computer-based project management models utilize digital tools and software applications to automate and optimize various aspects of project management in construction industry. These tools help in improving communication among stakeholders, minimizing human error, and providing real-time data for better decision-making.

### **5.1 Recommendation**

The study identifies lack of awareness of improved productivity due to the technology, high costs of software and hardware, longer payback periods, social and habitual resistance to change in Enugu State, Nigeria, challenging the adoption of computer-based project management models among construction industry. Key recommendations include team collaboration, policy integration, and encourage the development or customization of CBPMM software tailored to the Nigerian construction context especially those that can operate offline or in low-connectivity environments.

### **5.2 Contribution to knowledge**

The research has provided an understanding of the challenges of computer-based project management models application, its effects and impact on construction industry in Enugu State.

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Environment, this study highlights the barriers and opportunities for implementing CBPMMs in Nigeria, specifically in the southeastern states like Enugu.

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## About the Authors



**Sunday A Ezeh**

Enugu State, Nigeria



**Surv. Sir Sunday A Ezeh** is a registered Surveyor practicing in Enugu Nigeria and Chief Executive officer of Samphils Global Services limited. He acquired his first degree in surveying and geoinformatics and master's degree in construction project management from quantity surveying department, Enugu state University of science and Technology (ESUT). He is a member of Nigeria Institution of Surveying (NIS) and also member of Association of Private practicing Surveyors of Nigeria (APPSN) with over 15 years' experience.



**Francisca Nkachukwu Okeke**

Enugu State, Nigeria



**Francisca Nkachukwu Okeke** hails from Amoli in Awgu local Government Area of Enugu State. She is a Member of QRSDN and NIQS. She is also an academia with Ph.D degree in Construction Management and a lecturer in the department at Enugu State University of Science and Technology, Agbani. she has taught in different higher institution as lecturer at Gregory University Uburu Abia State from (2018- 2021) and Institute of Management and Technology (2009-2010). As an erudite scholar, an author in various papers, articles and with the professional experiences gotten thus far over the twenty decades, has contributed deeply in applying research in solving real-life challenging while advancing academic excellence.