



# Implementing Project Management Information System and Project Risk Management in Developing Economies: A Case Study of Nigeria

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Date of Submission: 24-02-2024

Date of Acceptance: 05-03-2024

## Abstract

Developing nations have in recent times witnessed a rise in developmental projects, continue to experience low technology adoption. Several projects in this region fail or are abandoned due to numerous challenges largely caused by ineffective management of projects. Project execution faces the challenges of improper use of project resources and low penetration of information technologies and systems in the project development lifecycle. The key factors studied were the impact of frequency of PMIS adoption and use of PMIS application tools on project outcomes. The adoption of PMIS systems involving utility tools timely and accurate planning, controlling, and monitoring of projects across various project teams was considered. The research approach utilized an online questionnaire for the field survey. A total of 130 responses were recorded for the data collection. The respondents were key players and relevant stakeholders in project management organizations' in Nigeria including business owners and project managers. The questionnaire that measured the level of adoption and application of PMIS in the development stages of various projects in developing nations was designed using the Likert Scale. Statistical techniques of mean, correlation and regression were used for the data analysis. There was occasional adoption of PMIS applications for managing various stages of projects in Nigeria from planning to evaluation. PMIS was observed to have a significant positive influence on expected project outcomes with the continuous use of PMIS tools. This positive influence on project outcomes included improvement in productivity of work, quality of decision, control of project activities and schedule, efficient allocation of resources and time management. A strong positive relationship ( $r = 0.827$ ) exists between the use of

PMIS application tools and project outcomes, while there is a mild positive relationship ( $r = 0.435$ ) between the frequency of PMIS usage and the project outcome. However, a negative contribution of the frequency of usage of PMIS tools on the project outcome was observed from the regression model which suggests that developing nations tend to face operational difficulties in the use of PMIS in project management.

**Keywords:** Project Management, Information System, Risk management

## I. Introduction

The advent of information systems and technology has altered the procedures humans adopt to perform their activities. Information systems and technology have brought about business globalization, creating avenues for organizations to plan, control and evaluate project operations across several locations, boundaries, and stakeholders. The traditional process involving linear and hierarchical project development and execution across several skilled practitioners has now been replaced with robust applications. The typical transfer of information involving the use of paperwork and file keeping has now been replaced using electronic means resulting in faster and more precise decision-making. In the last decade, the architecture of Project management Information Systems (PMIS) has experienced considerable changes while being constantly developed into more complex, multifunctional, and distributed, management systems to encompass the entire operations of the project cycle (van Besouw & Bond-Barnard, 2021). Technology has infiltrated the core operations of projects with increasing capacity to incorporate all



the activities and stakeholders involved in a project across continental boundaries (Varajo & Amaral, 2021). There are specialized technologies for different fields of application such as the PMIS for project managers.

PMIS is a computer-based information technology and software system structured to organise and manage project data. These systems have the capability to create, analyse, store, and retrieve project information for efficient and effective performance. PMIS technologies are developed comprising several different software applications to perform dedicated function such as project information management, resource management and allocation, stakeholders and team collaborations, data repositories and cost management systems. Over the last years, PMIS technologies have been developed to a great extent in project management, designed with the capabilities to support the entire life cycle of complex projects across various organizations (Braglia & Frosolini, 2014). The purpose of a PMIS system is to improve the efficiency of project development cycles through proper and transparent flow of information across all users such that the project managers are empowered to track the progression of projects and specific tasks (Amami *et al.*, 1993).

Developing nations like most African and some Asian countries continue to trail developed nations like American and European countries due to their low adoption of technology and automated systems. Despite the increasing number of projects being executed in these regions, there seems to be a disproportionate increase in supporting technologies. Most of these developing nations depend on foreign technologies developed by other countries. These countries are generally poor lacking human and financial capacity to drive the development of the technologies that best fit their system. Incessant failure and project abandonment are characteristics of projects in this region. This situation further deepens the development gaps. Prevailing management challenges such as inadequately skilled project managers and lack of standard practices are responsible for numerous project failures or abandonment leading to loss of valuable resources. In addition, weak coordination of project activities, improper communication and collaboration between project managers and other team members, and the problems of proper resource management (money, facilities, time, and people) shrink the chances of the success of a project. These challenges can easily be addressed through

the adoption of information systems, such that projects are wholistically managed within the project cost and time based on accurate information. Therefore, this study investigated the potential influence of PMIS adoption on project outcomes in developing nations with a focus on Nigeria.

### **Project Information Management Systems (PIMS)**

Ilyas *et al.* (2013) described Project Information Management System as a systematic process that involves locating, collecting, organizing, modifying, sharing, and using information systems and technology. These Information Systems are suitable tools and techniques for gathering relevant information about a project, and then utilising these tools for managing the project processes and complexities. They have become indispensable for developing proper support structures necessary for the integration and distribution of information that aids project managers in planning, organising, and controlling the activities and resources of any project (Micale *et al.*, 2021). The dimensions of a PMIS are solely structured around communication and documentation for project-related information purposes. These systems are designed to handle basic information about the project such as the project goals, location, stakeholders' information, teams involved, current calendar, project status *e.t.c* (Berisha-Shaqiri, 2014). This implies that technology is both a product and a procedure for achieving identified activities and supporting the capabilities of humans.

Zambare and Dhawale (2017) described Project management information systems (PMIS) as important building blocks for modern project management. Over the last decade, the architecture of PMIS systems has experienced considerable changes and is constantly being developed into more complex, multifunctional, and distributed, management systems to encompass the entire operations of the project cycle (van Besouw & Bond-Barnard, 2021). These systems are designed with the capability of automating project management processes by connecting various project teams across several locations around the world. As many organizations are gradually expanding transforming from focusing on individual projects to multiple complex and global projects across international boundaries, they tend to handle various projects that are vastly multifaceted. The complexity of these projects is



compelling management to harmonise their administration of these projects concurrently with the desired level of detail-specific accuracy and unparalleled precision competitively to ensure that they remain relevant in business as well as dominate in their respective fields. This empowers project managers to effortlessly aggregate all planning, stakeholders' collaboration, activity scheduling, organization, control and monitoring of the project tasks. Consequently, these systems are designed to adapt to the project management needs of present-day managers under specific project initiation, implementation, and administration (Berisha-Shaqiri, 2014). Even though the complexities of global corporations are increasing, PMIS is being designed to be a more reliable support tool that can assist in managing the difficulties of these complex projects increasing the confidence of managers. For instance, advancement in the information technology and software development industries has provided some of the most dependable application solutions suitable for handling the complexities of projects (Obeidat & Aldulaimi, 2016).

The use of information systems in project management is gradually replacing the exclusive reliance on human potential for storing and retrieving large information, project planning and execution. The globalised integration of sophisticated systems and software solutions with remote location capability in modern business overcomes the barriers to the execution of projects in various locations at a time. Project Information Management Systems has the capability for project risk management. Due to their nature, organizations continue to encounter increasing project complexity imposed by the uncertainty, volatility, and ambiguity of the business environment (Varajão & Amaral, 2021). Information system has become the core assets of businesses and has become critical in every aspect of the organisation and the handling of projects. They are essential for achieving competitive advantages, operational cost reduction and productivity improvement (Varajão *et al.*, 2021). There are various project management software developers competing to dominate the market by offering sophisticated software to their various clients. The fierce competition among the largest manufacturers: Oracle, Microsoft, Autodesk, Meridian, and Huddle among others will continue to drive innovations in the continuous development of PMIS (MacAs *et al.*, 2021; Micale *et al.*,

2021). Presently, the Information System for project management is of various sizes and structures most of which are either of standard operation or customised to suit the business operations of the clients (Braglia and Frosolini, 2014). For instance, there is the implementation of modules for Customer Relationship Management systems (CRM), Enterprise Resource Planning (ERP), Business Intelligence (BI) and supply chain. Management (SCM) systems (van Biene-Hershey & Strous, 2017). These IS modules are usually customised for businesses (large or small) with the capability for business and process improvement through information technology (Brodin, 2018).

## II. Research Methodology

The research procedure and rationale for accomplishing the objectives of this work are subdivided into the research design, sampling and data collection techniques, procedures for data analyses and ethical considerations. The data collection procedures involve quantifying the perceptions of the respondents based on the attributes of using the Project management information systems in the management of their various projects. This is achieved through the development of a questionnaire that measures the level of adoption and application of PMIS in the development stages of various projects in developing nations. The most appropriate respondents are the key players and stakeholders in project management organizations including business owners and project managers. A suitable sampling technique is applied to ensure that only these relevant stakeholders are involved in the research process. Features of a PMIS such as project planning, control, utility, risk analysis, communication management and their Influences on project outcome are considered. Collected data are analysed quantitatively using statistics. The underlying research technique for this study includes the choice of research philosophy, the approach of the study, and the research strategy. These form the basis and framework for this research.

### Sampling And Sample Size Estimation

The nature and requirement of this research restrict the target population exclusively to project managers and business owners of organizations that are project oriented. Hence, a nonprobability sampling design approach of purposive sampling is adopted for designing the sample frame of the respondents for data collection



(Teddlie & Tashakkori, 2009). This sampling technique is most appropriate to select suitable respondents with appropriate knowledge and vastness on the subject matter. This therefore confines participants to a limited number of respondents with a small sample of project managers, business owners, executive managers, and other administrators from large corporations including public and private firms. These categories of people in every firm are principally responsible for making decisions in the project's life cycle such as project initiation, funding, and monitoring. They are saddled with the formulation of the project strategy making decisions on the direction of the project, scheduling of activities, and resource allocation. However, this sampling strategy is highly subjective and allows for bias. The sample size is limited and does not statistically represent the entire target population. A sample of 150 – 200 respondents was adopted.

#### Data collection

The questionnaire for the survey is administered electronically through the designed form on Qualtrics. To distribute the questionnaires effectively to the target population, the link to the form is sent through various channels primarily e-mails and social media handles of the respondents. Likewise, some respondents who are members of various project management platforms are encouraged to share the link on their platforms for other respondents to have access to it. In addition, interactions are made with some project management organizations like the Project Management Institute (PMI) in Nigeria through emails requesting their members to partake in the survey. These participants easily access and respond to the questionnaire online at any time of the day. This procedure of data collection is suitable due to the physical barrier and distant location of the respondents which tends to be

better and faster compared to physical administration. Likewise, it is more cost-effective to reach the vast population of respondents located in various regions of the country within a short period. However, this method is subjected to low responses due to technological requirements and the need for internet connectivity.

#### Data analysis

The quantitative technique is employed to analyse the data collected. This includes the use of descriptive statistics (frequency, mean score, and standard deviation) and inferential statistics (correlation analysis). The descriptive statistics show a summary of the demographics of the population and characteristics of the study environment (Mohr *et al.*, 2021). Inferential statistics is employed to describe the nature of the relationship between the variables under study. Specifically, the statistics utilized in the data analysis are presented.

### III. Results and Discussion

The data were collected online through a questionnaire designed on Qualtrics. The respondents filled out and submitted their responses to the questionnaire through the link sent to them via email and social media channels. No printed copy of the questionnaire was distributed or received from the respondents. A total of 205 contacts of potential respondents were identified through links to various project management organizations and institutes in Nigeria such as the Project Management Institute (PMI), and Chartered Institute of Project Managers (CIPM). Out of the potential respondents, a total of 130 responses were recorded. Therefore, the response rate is:

$$\text{Response rate} = \frac{\text{Total number of response received}}{\text{Total number of potential respondents}} \times 100$$

$$\text{Response rate} = \frac{130}{205} \times 100 = 63.41 \%$$

The statistical analysis of the questionnaire is presented using frequency, percentages, mean and standard deviation. The data on the Likert scale is interpreted as shown in Table 1 as suggested by Terano (2015).



**Table 1: Interpretation of the Likert scale**

Scale	Interval	Interpretation
1	1.00 - 1.49	Strongly disagree /Never
2	1.50 - 2.49	Disagree/Rarely
3	2.50 - 3.49	Neutral/Occasional
4	3.50 - 4.49	Agree/ Often
5	4.50 - 5.00	Strongly agree/Very often

### Application of Project Management Information System

PMIS is adopted in various degrees in these organisations. The result measured the degree to which the project managers adopted various tools and functions of PMIS at the different stages of the project lifecycle. These PMIS tools were categorised into 4 groups: project activity planning, controlling function, monitoring function, and evaluating function tools.

**Table 2: Adoption of PMIS Tools in Activity Planning**

Tool	Min	Max	Mean	Standard Deviation
Work Breakdown Structure (WBS)	1.00	5.00	2.59	1.02
Critical Path Method	1.00	5.00	2.71	1.06
Gantt chart	1.00	5.00	2.53	0.96
Spreadsheets	1.00	5.00	3.14	1.16
Milestones	1.00	5.00	2.69	1.04

The result from Table 2 shows that there is occasional adoption of the Critical Path Method, Work Breakdown Structure, Gantt chart, Milestones and Spreadsheet applications in planning activities of project management. Most PMIS applications are built with the above-named tools which may be responsible for the similar results obtained. The application of these tools in resource allocation and planning is shown in Table 3.

**Table 3: Use Of PMIS in Resource Planning**

Field	Min	Max	Mean	Standard Deviation
Allocation of resources	1.00	4.00	2.00	0.82
Balancing of resources	1.00	4.00	2.14	0.71
Managing cost	1.00	4.00	2.38	0.97

The result shows that with means less than 2.49, PMIS applications are rarely used in the allocation of resources, balancing of resources, or managing project costs. However, these tools were adopted in the control of project activities as shown in Table 4.



**Table 4: Use of PMIS in Project Control**

Field	Min	Max	Mean	Standard Deviation
Performance Tracking	1.00	5.00	3.39	1.06
Budget Control	1.00	5.00	3.46	1.07
Time Control	1.00	5.00	3.59	1.05
Travel Costing	1.00	5.00	3.32	1.06
Quality Management and Validation	1.00	5.00	3.51	1.07

The result obtained in Table 4 shows that PMIS application tools were often used in time control, and quality management with means of 3.59 and 3.51 respectively. While with means of 3.46, 3.39, and 3.32, these tools were occasionally used in project performance tracking, budget controlling and travel costing respectively. PMIS applications are composed of several

utility tools. The respondents were asked to specify their level of adopting these utility tools. The summary of their responses is shown in Table 5. With means ranging from 3.20 to 3.43, there is occasional use of the to-do list, customised fields, contact list and procurement management utility tools in PMIS.

**Table 5: PMIS Utility Tools**

Field	Min	Max	Mean	Standard Deviation
Customized fields	1.00	5.00	3.02	1.24
To-do list	1.00	5.00	3.40	0.93
Procurement management	1.00	5.00	3.43	1.07
Contacts list	1.00	5.00	3.40	1.04

In comparison to communication management tools, Table 6, shows that with means ranging from 3.59 to 3.92, the respondents signified they often utilized E-mail, Chat, Communication Group, Forum, Video & Audio, and Activity Comments and media for communication. While with means of 3.32 and 3.13, there is occasional use of other media for messaging outside the system and RSS Feed respectively.

**Table 6: Use of PMIS Communication Tools**

Field	Min	Max	Mean	Standard Deviation
Chat	1.00	5.00	3.78	1.06
Communication Group	1.00	5.00	3.77	1.07
Video & Audio	1.00	5.00	3.59	1.10
E-mail	1.00	5.00	3.92	1.05
Forum	1.00	5.00	3.64	1.08
Activity comments	1.00	5.00	3.61	1.07
Messages Outside the System	1.00	5.00	3.32	1.01
RSS feed	1.00	5.00	3.13	1.19

Similarly, in terms of the reporting capabilities of PMIS, Table 7 shows that with means between 3.59 and 3.70, PMIS tools are often used in document management, reporting and archiving project information while with a mean of 3.31, there is the occasional use of PMIS in version tracking.



**Table 7: Use of Reporting Tools**

Field	Min	Max	Mean	Standard Deviation
Managing document	1.00	5.00	3.70	0.99
Project reporting	1.00	5.00	3.82	0.93
Tracking project version	1.00	5.00	3.31	1.17
Archiving project information	1.00	5.00	3.59	1.08

PMIS is adopted in the management of project risks. Table 8 shows the results of the responses of the respondents to their adoption of PMIS in the management of risks in their projects. Similar to the utility tools, with mean responses between 3.11 and 3.31, there is the occasional use of PMIS in the management of risk.

**Table 8: Use of PMIS In Risk Analysis**

Field	Min	Max	Mean	Standard Deviation
PERT	1.00	5.00	3.14	1.11
Simulation	1.00	5.00	3.22	1.14
Risk Management	1.00	5.00	3.29	1.13
Issue Management	1.00	5.00	3.31	1.10
Claim Management	1.00	5.00	3.11	1.02

**Relationship between PMIS and Project Outcome**

The regression and correlation analyses were carried out to quantify the nature of the relationship between the degree of implementation of PMIS and the project outcome. Table 9 shows the correlation output between the independent variables (Frequency of Use and PMIS Application Tools) and the dependent variable (Project Outcome).

**Table 9: Correlation Result of PMIS Implementation and Project Outcome**

		Frequency_Us e	PMIS Tools	Project_Outco me
Frequency_Use	Pearson Correlation	1	.657(**)	.435(**)
	Sig. (2-tailed)		.000	.000
	N	129	129	129
PMIS_Tools	Pearson Correlation	.657(**)	1	.827(**)
	Sig. (2-tailed)	.000		.000
	N	129	129	129
Project_Outcome	Pearson Correlation	.435(**)	.827(**)	1
	Sig. (2-tailed)	.000	.000	
	N	129	129	129

**\*\* Correlation is significant at the 0.01 level (2-tailed).**

The result shows there is a very strong positive relationship ( $r = 0.827$ ) between the use of PMIS application tools and project outcomes, while there is a mild positive relationship ( $r = 0.435$ ) between the frequency of PMIS usage and the project outcome. Table 10 shows the regression output of these variables. This is significant in determining the effects of a unit change of the independent variables on project outcomes.



**Table 10: The Regression Output of PMIS Implementation and Project Outcome**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	.277	.185		1.502	.136
	PMIS_Tools	1.119	.067	.827	16.588	.000
2	(Constant)	.648	.219		2.965	.004
	PMIS_Tools	1.288	.087	.952	14.829	.000
	Frequency_Use	-.281	.095	-.190	-2.965	.004

a Dependent Variable: Project\_Outcome

Based on the values of Table 4.19, the regression model is developed thus:  
 $Project\ Outcome = 0.678 + (1.288 \times PMIS\ Tools) - (0.281 \times Frequency_i)$

There is an average expected positive value of 0.678 for the response variable when all the independent variables are zero. This implies that there is an expected positive project output without the adoption of PMIS tools. The use of PMIS tools has a positive coefficient (1.288) which signifies the expected improvement in project outcome for a unit use of PMIS tools. In the case of the frequency of use, the negative coefficient (-0.281) indicates a decrease in project outcome for a unit increase in the frequency of PMIS usage.

#### IV. Conclusion

The use of PMIS application tools and the frequency of PMIS usage were the key components of PMIS implementation that were observed to have significant influences on project outcomes. The use of PMIS tools is positively related to the project outcomes. This suggests an expected improvement in project outcome with the continuous use of PMIS tools. This positive influence on project outcomes arises from improvement in productivity of work, quality of decision, control of project activities and schedule, efficient allocation of resources and time management. These quality issues are primarily responsible for increased costs and time overflows in the project execution. Therefore, the adoption of IS for quality management and performance monitoring of organisations is critical to accurately determine the quality costs of projects, especially before execution. Organisations are thus able to predict quality failure patterns and costs, and thereby adequately strategize prevention plans. Even though project execution in developing nations continues to face diverse challenges and incompetency, the adoption of PMIS in

the management of projects in developing nations tends to face operational difficulties, high expectations and overreliance. These systems must be designed to be robust to avoid unwarranted emphasis on monitoring and reporting activities of the project with the tendency to over-rely on the technology for these activities rather than on the quality of information.

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