



# The Role of Project Management Information Systems towards the Project Performance: The Case of Construction Projects in United Arab Emirates

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## ABSTRACT

Project management information systems (PMIS) has become an essential tool in contemporary organizations. 21<sup>st</sup> century project managers cannot afford the losses, delays, and disappointments often triggered by redundant projects. PMIS is even more critical for business organizations, where profitability and long-term sustainability is pegged on competitively performing projects. PMIS has thus become a strategic resource for project managers when seeking optimal level of project performance. United Arabs Emirates (UAE) has gradually transformed to an epicentre of economic development in the Middle East. In pursuit of economic development and globalization, UAE has made unprecedented investments in the construction of infrastructural and networking systems. The present study established that construction represents perhaps the most advanced and progressive market-based industries in UAE. Construction projects are now defined by a complex matrix of profitability, performance, and cost-time balance. After collecting questionnaire data from a purposive sample of 20 project managers in UAE, the survey established a positive correlation ( $r = +0.72$ ) between the use of PMIS and project performance. The findings validated the hypothesis of the study, and affirmed that, there is a significant positive relationship between the quality, information output and user influence of PMIS and project performance when implementing construction projects in UAE. Future research should cover a more reliable sample size and triangulate the data collection instruments to generate more reliable findings. Further, future research should focus on establishing how PMIS improve project management while in actual practice, rather than exclusively relying on the admissions of relatively biased project managers whose core interest is display their companies as market leaders in practice.

**Keywords:** Project Management Information Systems, Project Management, Construction Projects, United Arabs Emirates, Project Outcomes, Project Objectives

**JEL Classification:** O22

## 1. INTRODUCTION

Modern organizations have gradually transformed from single-project ventures to the management symmetry of numerous global projects. Managers are now mandated to integrate many and highly complex projects managed simultaneously and with unprecedented level of accuracy and detail-specific precision. Not only are projects requisite, but also an assortment of such projects at any one time, given that modern “organizations are continually been involved in many projects as a competitive tactic to ensure that they remain relevant in their respective fields” (Kahura, 2013. p. 104). In contemporary organizations, projects management has now emerged as a multifaceted process of

implementing assorted initiatives, all whose planning and control need a simultaneous nerve center (Meredith and Mantel, 2012). Globalized management of projects in an extremely competitive world market and the fact that such projects now encompass real-time information technology (IT), biological innovation, engineering, complex construction requirements, assembly of policy requirements, and pioneer context-specific adaptation, has redefined the art of contemporary project management (Liberatore and Pollack-Johnson, 2003).

According to Liberatore and Pollack-Johnson (2003), projects now compel managers to seamlessly interlink and aggregate planning, organization, scheduling, inter-party collaboration, monitoring,

accountability, and control to a level that was impossible to imagine a few years ago. Consequently, project management has had to adapt to the needs of modern managers in terms of how projects are initiated, implemented, and administered. From relying on exclusive human potential, project management now requires advanced software solutions whose reliability and potential in the management of projects is as infinite and globalized, as modern business. As Karim (2011) asserts, “complexity of worldwide organizations have giving confidence to management scientists to search for extremely reliable and more dependable support tools that can assist project managers in managing challenges of high complex projects” (p. 22).

Advances on the IT industry have offered perhaps the most reliable solution for modern project managers. This explains why, according to White and Fortune (2002, p. 1), software development and IT has been adopted in “current project management,” at a time when reorganizing business processes, advancing research and innovation, as well as implementing unprecedented levels of development is the very lifeline of business. This reality is the very background upon which the project management information systems (PMIS) has become a popular project management tool, and an essential instrument of ensuring the efficiency, effectiveness, and performance of contemporary projects. PMIS is one available option of IT-based software solutions “widely regarded as an important building block in project management” (Kahura, 2013, p. 106). According to Ali et al. (2008), Ahleman (2009), White and Fortune (2002), and Raymond and Bergeron (2008), PMIS represents comprehensive IT-based systems integrating a user interface in the management of the entire life cycle of simultaneous projects, project portfolios and project programs in the planning, implementation and control stages.

PMIS has been defined in different words, though with consensus of thought, by numerous schools in the literature. Project Management Knowledge (2010) defined PMIS as “system tools and techniques used in project management to deliver information.” According to Project Management Knowledge (2010), PMIS ensures that project are implemented, controlled, and sustained to completion in a manner that achieves “all of the project goals and objectives while honouring the preconceived project constraints of time, budget, quality, and scope as well as optimizing the allocation and integration of inputs needed to meet pre-defined objectives while mitigating any risks.” Nearly four decades ago, Cleland and King (1982, p. 16) define PMIS from a user perspective as software solutions that provide “essential information on the cost-time performance parameters of a project and on the interrelationship of these parameters.” For the present article, PMIS denotes:

- A user-based interface of electronic information systems employed by managers in contemporary organizations as custom-made software solutions to plan, schedule, implement, control, report, communicate, forecast, review, and handle the cost of all aspects of a project, in pursuit of optimal project performance.

When employed by project managers, PMIS has been linked by empirical research findings to “better project planning, scheduling, monitoring, and controlling, which consequently led

to highly effective and efficient project management decision making in each phase of project lifecycle” (Karim, 2011, p. 22). The pressured of modern business necessitate organizations to “acquire a PMIS as a mean to provide top managers with the essential tools that aid the decision making process with regards to selecting, planning, organizing, and controlling projects and portfolios” (Karim, 2011, p. 22). PMIS has been linked to several benefits as a tool for project management, which include success rate, relevance, cost-benefit analysis, timeliness.

For instance, following an empirical study Kahura (2013, p. 104) found that “PMIS helped in the achievement of the project success while respecting the projects constraints and meeting the project objectives.” Raymond and Bergeron (2008) observed that modern project management without such tools as PMIS, remain problematic since most are completed on time and most instances, having exceeded their initial budgets. What is absent from the literature however, is the relationship, significant or otherwise, of PMIS and overall project performance, where performance integrates all these outcomes of project management from cost to timeliness. Derivatively, from the foregoing review, project performance for the present article represents a comprehensive assembly of:

- a. Attainment of pre-defined project objectives
- b. Fluid management of projects in terms of planning, scheduling, controlling, communication, and foresight
- c. Timeliness based on reliable schedule maintenance
- d. Alignment of cost to the original budget
- e. Simultaneous implementation of all activities and rhythmic integration of all stakeholders in the project team
- f. Optimal yields of projected/anticipated benefits (project success).

## 2. LITERATURE-BASED GAP IN KNOWLEDGE

The present study was inspired by two gaps in contemporary knowledge, namely the concept of overall project performance, and the jurisdiction relevance of empirical findings. To begin with, contemporary literature on PMIS is in most cases a partial reflection of how PMIS affects project management. As noted in the foregoing section, scholars and researchers have previously focused their attention between PMIS and such variables as success rate of projects, timeliness, costing outcomes etc. (Raymond and Bergeron, 2008; Karim, 2011; White and Fortune, 2002; Ahleman, 2009), with little if any evaluation of how PMIS impacts on the overall performance of projects. A project can be accomplished within pre-set time and budget constraints, and still be a failed investment based on eventual outcomes.

As such, based on previous research findings, IMPS has become a vital tool due to “the importance of keeping the balance of the creative processes that are unstructured, rule free and even chaotic, with structured processes monitor and control” (Borstnar and Pucihar, 2014, p. 14). Howler, merely stating that the attainment of objectives makes a project successful (Raymond and Bergeron, 2008), fails to integrate considerations of how much time, cost, manpower, and management demands it required before it became

successful. As such, besides characterizing a project as successful, it is important to consider all the other factors involved in project management, and then integrate all these considerations into one attribute for every project. This comprehensive attribute is herein represented as the performance of a project, from the perspective of the planner, implementer, controller, and manager of the said project (project manager).

Secondly, many of the previous studies accessible in the literature have been conducted in more advanced economies, either from a generalist perspective or in assorted industrials. Only recently have researchers started investigating the impact of PMIS in such countries as Pakistan (Arshad et al., 2011), China (Li et al., 2015; Lu and Wang, 2004) Japan (Siang and Yih, 2012), India (Choudhury, 2014), Australia (Ramdani, 2012), Kenya (Kahura, 2013), Singapore (Kamardeen, 2009) and similar states, as globalization becomes a universal business requirement. The absence of Saudi Arabia in this entry of nation-specific research on PMIS not only needs redress, but also a context-specific focus of a key industry in the country. This jurisdictional mandate mandates an empirical investigation as is reported by the present study.

It is certain that United Arab Emirates (UAE) has gradually transformed to an epicentre of economic development in the Middle East. In pursuit of economic development and globalization, UAE has made unprecedented investments in the construction of infrastructural and networking systems. The present study established that construction represents perhaps the most advanced and progressive market-based industries in UAE. In China, “the unprecedented Chinese urbanization leads to massive government-funded construction projects” (Li et al., 2015), which emerges as a similar reality in UAE today. In most developing countries where construction projects define the rate of growth and progress, constructions are now defined by a complex matrix of profitability, performance, and cost-time balance (Choudhury, 2014). In India for instance, the country’s sole electric power producer is the National Thermal Power Corporation, where to face an upsurge in the demand of power, PMIS has become a critical tool to help manage the timeline and success rate of projects (Choudhury, 2014).

Constructions need what Remington and Pollack (2007, p. 131) regard as one of the “tools for complex project.” PMIS has become an essential tool in contemporary organizations. 21<sup>st</sup> century project managers cannot afford the losses, delays, and disappointments often triggered by redundant projects. PMIS is even more critical for business organizations, where profitability and long-term sustainability is pegged on competitively performing projects. Today, project management faces numerous “difficulties associated with decision-making and goal attainment which appear to stem from complexity” (Remington and Zolin, 2009), and PMIS is an essential tool for such high-cost projects as constructions in the UAE. PMIS has thus become a strategic resource available for project managers when seeking optimal level of performance in complex construction projects, but the accuracy and reliability of such a deductive reasoning has not been established, validated, supported, or questioned by empirical research. This bi-focal research problem inspired the present study.

### 3. PURPOSE, AIM AND OBJECTIVES OF THE STUDY

#### 3.1. Purpose of the Study

Accruing from the foregoing bi-focal research problem (investigating overall project performance and the use of PMIS within a subjective case study of UAE’s construction industry), and the independent and dependent variables in focus, it was the primary purpose of the present research undertaking, to:

- Investigate the role of PMIS in a case study of construction projects in United Arab Emirates, in terms of pursuing and attaining project performance as indicated by (a) quality of the customized software, (b) quality of the overall information output, and (c) and its influence on the project manager, in contemporary project management.

#### 3.2. Broad Aim of the Study

The broad aim of the research undertaking captivated the purpose of the study comprehensively, when investigating the role of PMIS on the performance of construction projects in UAE. As such, the broad aim of the study was to:

- Investigate the role of PMIS in the performance of construction projects in United Arab Emirates, based on usability, user influence and the quality of information output.

#### 3.3. Narrow Objectives of the Study

The foregoing broad aim of the study incorporates within it, several critical variables each of which will be important to the purpose of the study. Pursuing the broad aim wholesomely could jeopardize some of these critical variables when collecting and analysing data or presenting the findings. Consequently, the broad aim was broken into narrow, specific, and achievable objectives, each of which is a component variable of the study’s purpose. The three, narrow research objectives thus formulated were:

- a. Determine how project managers felt was the reliability and effectiveness of PMIS when managing construction projects in UAE
- b. Establish the quality of information output generated by project managers who use PMIS for construction projects in UAE
- c. Establish how PMIS influenced project managers when planning and implementing construction projects in UAE.

### 4. RESEARCH QUESTION AND HYPOTHESIS

#### 4.1. Research Question

Having defined the gap in knowledge, variables, purpose, broad aim, and narrow objectives of the study, research questions helped facilitate the research process. The research questions were particularly useful when choosing the most appropriate research methods for the anticipated findings, such that the study was conducted to generate accurate, relevant, and reliable findings. Consequently, to facilitate the attainment of the purpose of the study, the main research was:

- Does the quality, information output and user influence of PMIS significantly influence the role of PMIS among construction project managers in UAE?

## 4.2. Hypothesis

Derived from the research question, and based on initial secondary research, the study had one hypothesis for eventual validation or invalidation. The hypothesis was:

- There is a significant positive relationship between the quality, information output and user influence of PMIS and project performance when implementing construction projects in UAE.

## 4.3. Relevance and Significance of Research Findings

The findings generated by the study were both relevant and significant when informing project managers currently involved in construction projects within and without UAE, on the efficiency, reliability, and effectiveness of PMIS. Attaining optimal performance in construction projects saves costs, improves safety standards, enhances the quality of projects, reduces time expenditure, and galvanizes the profitability of companies. PMIS helps make the management process fluid, systematic and multifaceted for several simultaneous projects. The study provides empirical evidence on how PMIS as a software tool, positively influences project managers, offers reliable information output, and improves current practices in the construction industry. The findings are critical for the developing nation, in terms of displaying a profitable opportunity for private businesses, and informing an active phase of UAE's infrastructural development.

# 5. RESEARCH METHODOLOGY AND DESIGN

## 5.1. Research Methodology

The study needed statistical measures to relate the independent and dependent variables, within the scope of UAE's construction projects as the case study. As such, the study employed a research methodology that employed the instruments of quantitative research methodology. Analyzed using statistical measures of central tendency, the quantitative research helps to determine the numerical significance of research variables among a sample, and the findings generated from an approximate are generalizable for the larger population (Dowdy and Wearden, 1983; Cohen et al., 2002).

## 5.2. Research Design, Variables and Research Model

### 5.2.1. Research design

In its implementation, the study employed a correlational research design. The correlational design helps determine if two variables are correlated or otherwise, where a decrease or increase in one of the variable (independent variable), corresponds to an equal rate or degree of decrease or increase in the other dependent variable (Mukaka, 2012; Cooper and Schindler, 2002). A correlational research design attempts to relate two or more quantitative variables that similar in context and scope to establish if any relationship (derivatively correlational) exists between the

variables by virtue of their means (Jones, 2000; Cohen et al., 2002; Cooper and Schindler, 2002).

### 5.2.2. Research variables

Captivating the research problem above, are several variables that define the current gap in knowledge. Of essence is to determine how PMIS affects or influences the management of construction projects in UAE, based on the perspective of the users who employ PMIS. Noting that PMIS is often customized by an organization to best serve its needs with context-specific effectiveness and efficiency, then any evaluation of PMIS influence on project performance needs to be user based. Consequently, the study embraces several independent variables when investigating a singular dependent as the resultant project performance. These variables are as listed below, for the present study.

Independent variables: The three independent variables for the present study were:

- a. Quality of the customized PMIS software when employment in terms of delivery, and reliability of project outcomes (i.e. timeliness, costing, objectives etc.).
- b. Quality of the overall information output PMIS generates during project management, as an information system.
- c. Influence/impact PMIS has on the project manager (user) throughout the project management cycle.

Dependent variable: The singular and comprehensive dependent variable (that significantly influences the dependent variables) was:

- Project performance.

### 5.2.3. Research model: General linear model (GLM)

The study employed the GLM, which is the very background of nearly all statistical analyses models in modern statistical analysis, particularly in the social and applied research (Christensen, 2002; Friston et al., 1995). GLM was chosen as the most appropriate model in the study, given that there was only one dependent variable under analysis and thus requiring a linear regression analysis (Christensen, 2002). GLM represents a generalization of the linear model of regression analysis, where the study has one or several dependent variables. GLM is calculated with the equation stated below:

$$y=b_0+bx+e$$

In the equation, y represents the set of outcome variables, which in the study was the one dependent variable (project performance). x represents the set of pre-program variables or covariates (such as as the three independent variables of quality of the customized PMIS software, quality of the PMIS information output, PMIS user influence). The  $b_0$  represents the set of intercepts where the value of each y when x is at 0, and  $b_x$  represents a set of coefficients for each x (Wichura, 2006). The study had three independent variables and one outcome variable (dependent), and the y-value was calculated as an outcome of several x-values, separately, to determine the x/y relationship (Christensen, 2002).

## 6. POPULATION AND SAMPLE

### 6.1. Target Population

The target population for the case study included all project managers previously and currently using PMIS when managing construction projects in UAE. The population incorporates project managers in UAE's construction industry, and who use PMIS.

### 6.2. Sampling Procedure and Final Sample

#### 6.2.1. Sampling procedure

The study employed a purposive sampling procedure, to recruit project managers within the target population of project managers in UAE's construction industry, and who are using or have used PMIS. The sample included managers either in the same organization but with different projects, or in separate organizations. Using an alphabetically arranged list of over 41 registered and operating construction companies in UAE today, as recorded in the national database, the researcher purposively selected the first 20 names, and then made a call to the selected companies. Subsequent follow-up helped recruit a final sample, defined by the following inclusion criteria.

- a. In a private company primarily involved with construction projects in UAE
- b. Had to be a senior manager in charge of a previous or current construction project, and thus acting as the overall project manager
- c. The construction project for which they are in charge, either as expatriates or nationals, as well as the operational base of the company is in UAE
- d. Had to be using or have used PMIS for the construction project under review
- e. Was a fluent speaker of the English language
- f. Was available to voluntarily participate in the study.

#### 6.2.2. Final sample size and characteristics

The final sample for the study were 20 purposively selected project managers, in charge of previous or current construction projects in UAE, and who are be using or have used PMIS for the construction project under review.

## 7. DATA COLLECTION PROCESS, INSTRUMENTS, AND PROCEDURE

### 7.1. Nature of Collected Data

The study collected primary data using three phases. First, the study needed to investigate how the project managers felt and thought about the reliability and effectiveness of PMIS when managing construction projects in UAE, based on quality of the software, reliability of project outcomes and enable then to maintain timeliness, observe the costs involved, and attain the project objectives. Secondly, the study needed to establish the quality of information output generated by project managers who use PMIS for construction projects in UAE, where PMIS is a software-based toll for information processing. Finally, the study needed to how PMIS influenced the sampled project

managers when planning and implementing construction projects in UAE. The quality of PMIS, quality of information output, and user influence were thus construed quantifiably in statistical terms of central tendency (mean), among the sampled respondents.

### 7.2. Data Collection Instrument

The study employed a survey questionnaire as the sole data collection instrument, to collect data from the sampled project managers, incorporating both close-ended and open-ended questions. The sample questionnaire has been attached as an appendix to the article. Among the key questions in the questionnaire included:

1. Have you managed any construction project in the country (UAE) in the last 2 years?
2. If yes, did you act as the overall manager of the project?
3. Based on your experience as a construction project manager in UAE, would you say that using PMIS improves, enhances or consolidates the performance of a project?
4. Based on your experience and practice as a construction project manager, what do you feel is the overall quality of the PMIS as a software solution for project management in the construction industry?
5. When using PMIS to manage a construction project, what do you think is the quality of the information output you receive?
6. Would you say that PMIS significantly influences you, either negatively or positively, during the project management process? (YES/NO)
7. If you answered YES in the foregoing question, how does PMIS influence you in the six ways listed below.

### 7.3. Data Collection Procedure

The researcher implemented the research process by first initiating contact with the senior managers at the selected companies. Given the distance between the researcher and the recruited companies, nature of the study, and available resources to conduct the study, much of the communication was conducted via Email messages. In most of the companies, the researcher was introduced to the senior project managers by the public relations manager of selected companies, with who contact was relatively easy. Once in introduced to the project managers, the researcher sent a brief introduction of the study as an email attachment, focusing on its purpose, research question, and the role of their participation. At this point of the interaction, the researcher made the first phone call to each of the potential participants.

Thereafter, once all potential respondents had received the introductory information, the researcher proposed to recruit them for participation. The recruitment process was based on precise ethical guidelines, and a consent form, and only those participants who signed the consent form, were recruited for participation. Based on the availability and convenience of each recruited manager, the researcher sent the survey questionnaire, also as an Email attachment. The researcher followed up the questionnaire with a second phone call to each respondent. The filled questionnaires were ultimately sent to the researcher, again as Email attachments, at the convenience of the relatively

busy respondents. All the questionnaires sent out to the sample were received, although three of the respondents requested for additional time. The researcher finally called each respondent for the last time, thanking them for their voluntary participation, and reaffirming that their responses would be treated as confidential, and published with anonymity.

## 8. DATA ANALYSIS

After collecting primary data from the sampled project managers, the next stage of the research process was to implement the correlational design, and analyse the findings. As such, the study focused on testing whether the (a) quality, (b) information output, and (c) user influence of PMIS is correlated to the project performance. First, the study collected primary data from the sampled project managers on the (a) quality, (b) information output, and (c) user influence of PMIS using measures of central tendency. Thereafter, the mean attained for the three variables was related to findings on the reported performance of PMIS in construction projects. This helped generate a correlation coefficient using Pearson Product Moment Correlation, to depict the statistical/numerical representation of the direction and or strength of the relationship between the variables (Jones, 2000; Cohen et al., 2002).

## 9. OVERVIEW OF ETHICAL CONSIDERATIONS

The primary research required the participation of human subjects (project managers) from UAE. The respondents have very important and sensitive jobs and social positions, and it was therefore important to consider their image and reputation in the manner they were depicted as participants in the study. The researcher thus ensured that all participants were treated with respect and dignity, after being informed that the study was voluntary and no discrimination was triggered by failure to participate. Further, the participants were accorded complete anonymity. All business names, participants' names, job titles, and positions were omitted in all the study's documentation. The filled questionnaires and consent forms were assigned identification codes, rather than participant names, to ensure that the participants received absolute confidentiality.

During the data collection processes, the researcher provided adequate time for respondents to fill and return the survey questionnaires due to their busy schedules. All participants were consulted and requested to participate voluntarily prior to the study. The research purpose, objectives, and research questions were provided to all respondents in preparation for the data collection process, so that they were adequately aware of what was required of their participation. Further, each participant was only involved after signing a consent form, and reading an ethical statement of the study. It was hoped that these measures would help protect their reputation, since none of their contributions is traceable to any participant. The data generated from respondents was used exclusively for the purposes of the study and will not be availed to third parties for any other purpose whatsoever.

## 10. PRESENTATION OF FINDINGS

### 10.1. Overview of Research Purpose and Objectives

#### 10.1.1. Research purpose

The primary purpose of the present research undertaking, to investigate the role of PMIS in a case study of construction projects in United Arab Emirates, in terms of pursuing and attaining project performance as indicated by, (a) quality of the customized software, (b) quality of the overall information output, and (c) and its influence on the project manager, in contemporary project management.

#### 10.1.2. Research objectives

The study had three, narrow research objectives that included to, (a) determine how project managers felt was the reliability and effectiveness of PMIS, to (b) establish the quality of information output generated by project managers who use PMIS, and to (c) establish how PMIS influenced project managers when planning and implementing construction projects in UAE.

### 10.2. Variable-specific Findings

#### 10.2.1. Quality and reliability of PMIS

The quality of PMIS received overwhelming support from the respondents, with 17 of them (85% of the sample), affirming that PMIS was the best available IT-based tool for project management. According to the respondents, PMIS was a quality software solution, which when customized, provided modern project managers with an accurate, reliable, and objective system of real-time information encourage a construction project. Only two respondents (10% of the sample), testified that though good, PMIS was not the best available among alternative project management software, for high quality delivery of project needs. To one respondent, PMIS is a good and competitive solution among available alternatives. Findings on the quality of PMIS are illustrated in the Figures 1 and 2.

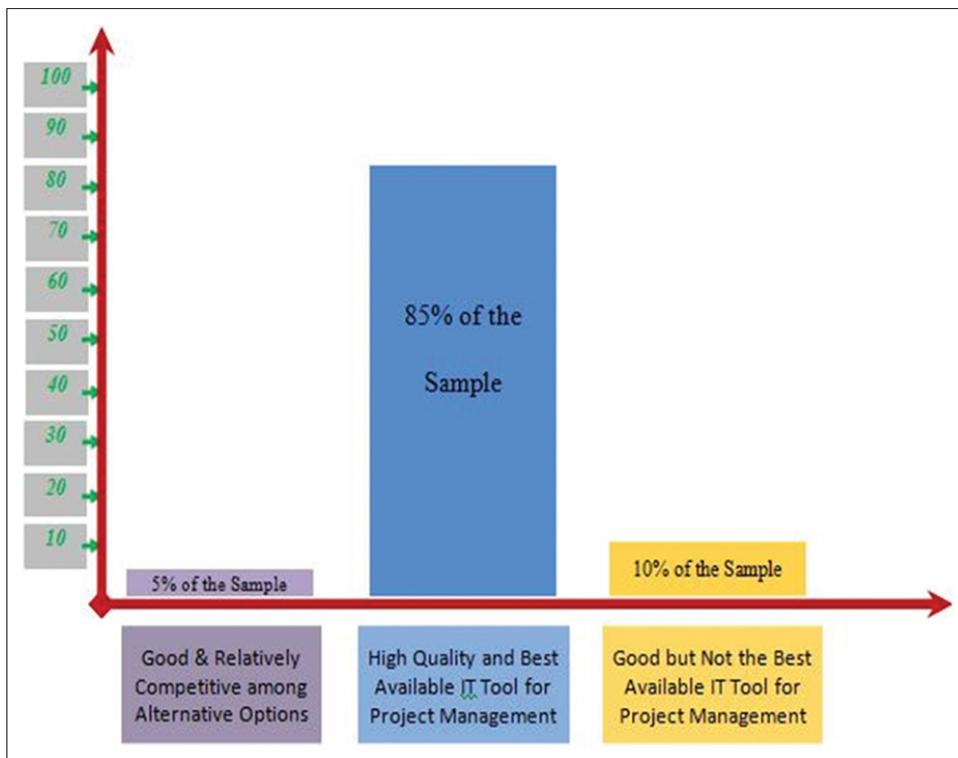
##### 10.2.1.1. Efficiency of information output

All but two of the sampled respondents qualified the information output of PMIS as reliably accurate, comprehensive and real-time relevant in project management. As such, 90% of the sample qualified PMIS information output as high quality, while one respondent (5% of the sample) felt it was reliable though not the best possible, and one respondent (5% of the sample), felt that the information was not always reliably accurate unless the project manager ensures that the information is accurately updated into PMIS. The responses were as illustrated in the pie chart hereunder.

##### 10.2.1.2. User influence, convenience and rate of project success

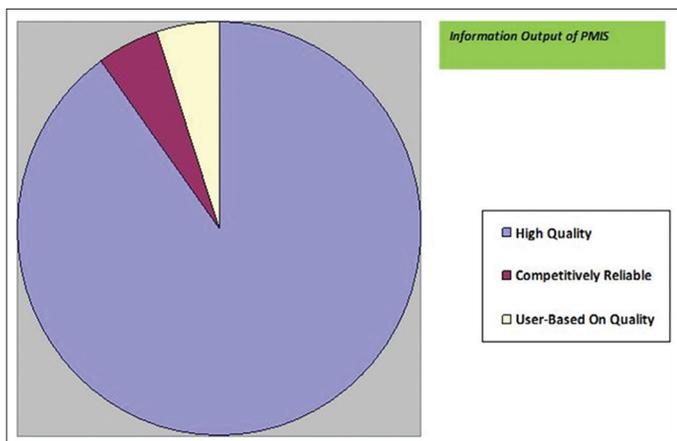
Among all the projects under review, and which had employed PMIS in the project management process, 14 of the projects had terminated successfully, and 6 of those currently underway had attained a profile the respondents characterized as successful. Not only did the 19 respondents accredit PMIS with convenient usability, but according to the project managers, PMIS had helped them plan, schedule, account for, and control the projects. In specifics, PMIS had helped the managers in the ways tabulated Table 1.

**Figure 1:** Chart on the quality of project management information systems among construction project managers in United Arab Emirates



Source: According to construction project managers in United Arab Emirates, the overall quality of the project management information systems software solution was not only high quality, but the best available IT tool (among 85% of the sample), good but not the best available IT tool for project management (among 10% of the sample), as well as good relatively competitive among alternatives (among 5% of the sample)

**Figure 2:** Pie chart of respondent’s valuation of the information output of project management information systems



Source: The information output of project management information systems was qualified as high quality by 90% of the sampled respondents, as reliable though not the best possible by 5% of sampled respondents, and not always accurate or reliable by 5% of the sampled respondents

### 10.3. Overall Findings in Response to Research Question

The last stage of data analysis involved generating the overall research findings for the broad research question the study was designed and implemented to respond to. The study generated findings regarding PMIS and project performance, based on the main research question, by deriving the correlational coefficient of PMIS and project performance of construction projects in

UAE. The research question focused on the overall quality of PMIS both as customized software and in information output, and in influencing managers when planning and implementing construction projects in UAE.

To do this, the study employed the Pearson correlation coefficient, which is popular in social sciences as a measurement tool for the strength of any linear association accruing between two variables (linear model of regression as proposed by GLM). In the Pearson correlation coefficient, the value  $r$  of 1 represents a perfect positive correlation between the variables, and the value  $r$  of  $-1$  represents a perfect negative correlation of the variables. Each of the three independent variables had three categories as noted in the Table 2, and for which each respondent was ranked in one of the three categories of 1, 2 and 3.

After respondents were summed up in the appropriate category for each independent variable, the overall ranking was then related to their response to the 11<sup>th</sup> survey question. The question required that, “with regards to project performance, do you think, on the overall, that using PMIS when managing construction projects improves the resultant performance of that project?” A [YES] response was awarded a ranking of 2, and a [NO] response was awarded a ranking of 1. The resultant Table 3 was as illustrated.

$$r = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{[N \sum x^2 - (\sum x)^2][N \sum y^2 - (\sum y)^2]}} \quad (1)$$

Correlation ( $r$ )

**Table 1: Tabulated survey of how using PMIS influences construction project managers in UAE**

User influence of PMIS in UAE's construction projects		
User influence	Number of respondents	Percentage of the sample
Attaining pre-defined project objectives	20	100
Planning, timeliness and scheduling, and schedule maintenance	19	95
Alignment and control of cost in the budget	14	90

Source: Among the samples participants, PMIS was deemed as significantly influential in three distinct ways, including attaining project objectives (100% of the sample), project planning, timeliness, and scheduling (95% of the sample), as well as cost budgeting (90% of the sample). PMIS: Project management information systems, UAE: United Arabs Emirates

**Table 2: Overall findings categorization of independent variables of PMIS as rated by construction project managers in UAE**

Respondent	Project performance (y)	Independent variable category (x)	x*y	x*x	y*y
1	2	15	30	225	4
2	2	15	30	225	4
3	1	11	11	121	1
4	2	15	30	225	4
5	2	15	30	225	4
6	2	15	30	225	4
7	2	15	30	225	4
8	2	14	28	196	4
9	2	15	30	225	4
10	2	15	30	225	4
11	2	15	30	225	4
12	2	10	20	100	4
13	2	15	30	225	4
14	2	15	30	225	4
15	2	15	30	225	4
16	2	13	26	169	4
17	1	10	10	100	1
18	2	15	30	225	4
19	2	15	30	225	4
20	2	15	30	225	4
Sum=20	38	283	545	4061	74

PMIS: Project management information systems, UAE: United Arabs Emirates

Where:

N = Number of pairs of scores

$\Sigma xy$  = Sum of the products of paired scores

$\Sigma x$  = Sum of x scores

$\Sigma y$  = Sum of y scores

$\Sigma x^2$  = Sum of squared x scores

$\Sigma y^2$  = sum of squared y scoers

$r = 0.724$

$$r = \frac{20(545) - (283 * 38)}{\sqrt{[20(4061) - (283 * 283)][20(74) - (38 * 38)]}}$$

$$r = \frac{146}{\sqrt{40716}}$$

$$r = \frac{146}{201.782}$$

The study thus established a positive correlation of 0.72 ( $r = +0.72$ ), as analyzed above, where the relationship between project performance and such indicators as quality of the software, quality of information output, and depth of user influence among construction project managers who used PMIS in UAE, was nearly perfect. The findings thus validated the hypothesis of the study, and affirmed that, indeed, there is a significant positive relationship between the quality, information output and user influence of PMIS and project performance when implementing construction projects in UAE.

## 11. CONCLUSION AND RECOMMENDATIONS

### 11.1. Conclusions

Though not as reliably generalizable as should be because of the relatively small sample, and the reliance of a single data collection instrument not triangulated for reliability and validity of the data generated, the study offers an informative picture of how PMIS has been adopted in UAE's construction industry. Based on the research process, it is evident that the PMIS offers a reliable, efficient, and high-end support for project management among project managers in the construction industry. Project managers in charge of construction in UAE are employing PMIS to embrace the challenges other come with complex projects in a highly active industry. Based on their admissions, PMIS is a quality software solution, which when customized for individual companies, provides project managers with an accurate, reliable, and objective system of real-time information encourage a construction project. Only one respondent 5% of the sample testified that PMIS was not the best available among alternative software, for high quality delivery of project management needs.

The study concludes based on the empirical findings, that not only is the information output of PMIS reliably accurate, comprehensive and real-time relevant in project management, but it also ensures the successful completion of simultaneous projects regardless of their complexity. Conclusively therefore, the adoption of PMIS positively correlates with project performance of construction projects in UAE at  $r = 0.72$ , such that based on the overall quality of PMIS both as customized software and in information output, and in influencing managers when planning and implementation, PMIS optimizes performance of UAE's construction projects.

### 11.2. Recommendations

Finally, based on the foregoing research process, findings and conclusions on the use of PMIS to optimize performance of construction projects in UAE, it is recommended that:

1. Project managers in UAE need the best available tools for managing complex, dynamic and time-sensitive constructions projects. It is therefore recommended that PMIS should be customized by each organization, to accurately captivate the ideology, focus, and needs of specific companies, during the implementation process.
2. It is recommended that future research should recruit a larger sample and then triangulate the data collection instruments to generate more reliable findings.

**Table 3: Overall findings (categorization of independent variables of PMIS as rated by construction project managers in UAE**

Respondent	Quality of PMIS			Quality of Information Output			User Influence			Overall category (out of possible 15)
	High quality and best available (Rating 3)	Good and relatively competitive (Rating 2)	Good but not the best available (Rating 1)	High quality (Rating 3)	Competitively reliable (Rating 2)	User-based quality (Rating 1)	Control and costing (Rating 3)	Planning and scheduling (Rating 3)	Project objectives (Rating 3)	
1	✓			✓			✓	✓	✓	15
2	✓			✓			✓	✓	✓	15
3	✓				✓			✓	✓	11
4	✓			✓			✓	✓	✓	15
5	✓			✓			✓	✓	✓	15
6	✓			✓			✓	✓	✓	15
7	✓			✓			✓	✓	✓	15
8		✓		✓			✓	✓	✓	14
9	✓			✓			✓	✓	✓	15
10	✓			✓			✓	✓	✓	15
11	✓			✓			✓	✓	✓	15
12			✓	✓				✓	✓	10
13	✓			✓			✓	✓	✓	15
14	✓			✓			✓	✓	✓	15
15	✓			✓			✓	✓	✓	15
16			✓	✓			✓	✓	✓	13
17	✓					✓	✓		✓	10
18	✓			✓			✓	✓	✓	15
19	✓			✓			✓	✓	✓	15
20	✓			✓			✓	✓	✓	15

PMIS: Project management information systems, UAE: United Arabs Emirates

3. Finally, it is recommended that future research should focus on establishing how PMIS improve project management while in actual practice, rather than exclusively relying on the self-reports of company-biased project managers.

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