

PROJECT MANAGEMENT INFORMATION SYSTEMS (PMIS) FACTORS: AN EMPIRICAL STUDY OF THEIR IMPACT ON PROJECT MANAGEMENT DECISION MAKING (PMDM) PERFORMANCE

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ABSTRACT

The 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.

Initially, this research was subject to consults 28 Project Managers from different industries in different countries to review the proposed PMIS model which was constructed based on different models developed by different authors.

Then the constructed PMIS conceptual model was assessed through a survey, and the questionnaire was designed and distributed to 170 employees who were a member in at least three project teams, and statistical analyses was used to evaluate the impact of developed factors of the proposed Project Management Information Systems (PMIS) model on Project Management Decision Making (PMDM) process.

The result showed a significant contribution of PMIS 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 life-cycle.

JEL CLASSIFICATION & KEYWORDS

■ M1 ■ O22 ■ Project Management Information Systems ■ Project Management Decision Making ■ Performance

INTRODUCTION

The evolution of worldwide competitive markets has led to a fact that projects in an ordinary business such as engineering, information technology, construction, etc. need to be highly managed, in terms of planning, scheduling, organized, monitored, and controlled (Liberatore and Johnson, 2003). In order to accomplish this, organizations must manage projects within selected time, budget, and in high performance while managing project risk.

Projects are most often used in information technology (IT), software development, business process reorganization and research and development (White D, Fortune J., 2001; Besner C., Hobbs B, 2009). Project management is a multifaceted process concerning different project related activities such as planning, monitoring, control. It is utilized for years as a discipline of planning, organizing, securing and managing resources that helps an organization achieve its business results.

The work breakdown structure (WBS), critical path method (CPM) and the program evaluation and review technique (PERT) and Gantt chart are technical solutions that helped project managers in project planning, cost management, risk analysis, control and monitor projects. However, these techniques need high skills which may take a while to build, as well as need to be restructured as the project and technology are evolving. These limitations may decrease the chance of utilizing these techniques, provided that

projects are managed within a limited time, cost, and performance condition. Thus, projects which are established by enterprises, which operate on different lines of industry, share one thing in common: they need to be effectively managed, that is, they need to be planned, staffed, organized, monitored, controlled, and evaluated. (Liberatore et. al., 2003).

Many of these projects exceed the original cost, got cancelled prior to completion, while others fail on terms of the delivered functionality. Thus, "project management remains a highly problematical endeavor", (White and Fortune, 2001).

Further, some project managers does not clearly identify the risks of the project which may lead to fails in accomplishing the project objectives toward success achievement in an satisfactory way, in terms of elapsed time, accumulated cost, and/or functionality. Projects Information Systems are same as any other projects, may simply turn into "a monster of missed schedules, blown budgets, and flawed products" (Brooks, 1987, p. 10).

Although project management assists an organization decrease product and service development time to market, exploit restricted resources, and enlarge global market rivalry, project managers still needs to utilize tools that helps in overcoming various challenges such as: uncontrollable time and budget restrictions; inconsistent project teams; unpredictable of firms resources; lack of clarity in prioritizing projects; delays in project decisions making; and lack of clarity in collaboration among project team members.

Therefore, while projects managers continue to struggle with these problems, they are obligated at the same time to make decisions in such a way that risk is controlled, uncertainty minimized and where every decision made by them is ideally be beneficial to the project. This can accomplish when the enterprises usually acquire a Project Management Information Systems (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.

The development and successful implementation of a new Project information system (PIS) is a disreputably complex mission. Once started, it is very difficult to manage (Havelka & Rajkumar, 2006; Iacovou & Dexter, 2004).

Powerful project management software has become a prerequisite to manage the projects more efficiently and effectively, and to aid the project managers in their decision-making. With an estimated \$255 billion being spent on IS/IT applications annually, it is significant that Information Systems projects should effectively managed (Havelka & Rajkumar, 2006).

PMIS provides the framework for collecting, organizing, storing, and processing project information. It provides the basis for assessing the status of the project with respect to

time, cost, and performance goals and objectives. It also provides some sort of business intelligence on how the project contributes to the organization's strategy and success. It enhances improving the project success by 75%. Hence quality and use of PMIS are highly essential (Raymond L., Bergeron F., 2008).

Without using any PMIS software, engineers and project managers wouldn't be able to communicate project status adequately with functional departments and upper management as well, however, PMIS provides upper management with adequate information about all the projects in the organization's portfolio.

The objective of this paper is to explore and measure the impact of PMIS factors on project management decision making performance. The paper presents and measures a conceptual research model containing the most important factors of PMIS which are significant in ascertaining the project decision making during the phases of project life-cycle. This conceptual model extended and adjusted the IS Success Model (ISSM) introduced by DeLone and McLean (2003) to adapt its purpose in decision making applications that influence various levels of project life-cycle.

The constructing of conceptual research model was subject to consults 28 Project Managers from different industries in different countries to agree on the proposed PMIS model which was constructed based on different models developed by different authors. Then the model was assessed through a survey, utilizes data analysis using SPSS software, collected through the questionnaire, which was designed and distributed to 158 employees who were a member in at least three project teams, to measure the hypothesis of research model. The results expand our knowledge about the factors that encourage applying of Project Management Information System and how it affects on project management decision making process.

The remainder of this paper is organized as follows. Section 2 present literature review and 3 discusses the research model and hypothesis. In Section 4 we discuss the research methodology which will be used for this research. In section 5 result analysis and discussion will be presented. Finally, the conclusion will be presented in sections 6.

Literature review

Interdependence between information technologies and project management has been reached its highest level since many years. It is perceptible in the increase number of project management packages and the adoption of various management solutions such as Executive Support Systems (ESS), Decision Support Systems (DSS), Knowledge Management System (KMS), Management Information Systems (MIS), Supply Chain Management (SCM), Business Intelligent Systems (BIS), virtual reality (VR), and risk management (RM) tools.

In the project management literature, the definition of project has been discussed by numbers of literatures, for instance, PMI (2000) define projects as 'a temporary (definitive beginning and definitive end) endeavor undertaken to create a unique (projects involve doing something that has not been done before) product or service'.

Dave Cleland and Lew Ireland (2004) describe a project as "a combination of organizational resources pulled together to create something that did not previously exist and that will provide a performance capability in the design and execution of organizational strategies".

Some authors described Project Management tool as "software for project management" (Fox, Murray et al.,

2003), while others view them as "systematic procedures or practices that project managers use for producing specific project management deliverables" (Milosevic, 2003). Thus the core of a PMIS is usually project management software which involves wide alteration, configuration or customization before to its applied.

Besner C., Hobbs, (2009) declared that -projects nowadays are most often used in information technology (IT), software development, business process reorganization and research and development.

Meredith and Mantel (2006) found that utilizing Information technology (IT) has major impact in solving all difficulties, which may appear during project life-cycle phases, by presenting a crucial computer application, project management software such as, which may help in decreasing the time and cost that are required to use precise clarifications for project planning, scheduling, monitoring, and controlling. Thus, retailers provided extra support for the key phases of the project life-cycle such as project risk management and created knowledge management to strength not only individual but the monitoring and controlling the whole organization (Ahlemann 2007).

Essentially, the task of Project Management Information System have been described as "subservient to the attainment of project goals and the implementation of project strategies", it supply project managers by "essential information on the cost-time performance parameters of a project and on the interrelationship of these parameters" (Raymond L., 1987).

In the information technology (IT) industry, Gartner Research estimates that 75% of large IT projects managed with the support of a project management information systems (PMIS) will succeed, while 75% of projects without such support will fail (Light M., et.al., 2005).

However, the literatures still shows only a small number of researches on the utilization of PMIS that highlighting the demographics of project management tools management and to assessing particular functions of these tools to maintain a particular tasks during project management life cycle such as planning, communicating and reporting, managing risks, scheduling, estimating costs, and managing documents (Herroelen, 2005; Love and Irani 2003). One exception from the literatures was by an author named Ahlemann (2008). He presented an extensive research about requirements of PMIS in which he recommends the M-model as a support for the requirement description in different phases of project life cycle.

Wilcox and Bourne (2002) indicated that while ultimately all decision making is about the future, therefore if we are to use data to improve decision-making we need to build a model that provides some predictive support. It is insufficient for data to merely contribute to an understanding of current performance; it must also allow the development of predictive management capabilities. While Hemmingway (2006) confirm the need to build analytic capabilities in order to improve decision-making.

Davenport and Harris, 2007 imply that there is research evidence suggesting that better use of information can improve decision making.

DeLone and McLean (1992), introduced the first IS success model which was based on Shannon and Weaver's (1949) theory of communication.

DeLone and McLean's model present different features differentiated by the two essential concepts: system quality and information quality. The utilizing of the system has a

clear impact on the way individuals accomplish their performance. This impact may eventually effect on the organizational performance.

The model that explores the impact of PMIS on PMDM uses DeLone and McLean's (2003) model as a source for the structuring the proposed PMIS conceptual model. Other models presented by other literatures were also estimated such as Sabherwal et al. (2006), Urbach et al. (2009), and Almutairi and Subramanian (2005). From these modules, we agreed on the standard tasks of PMIS that ascertaining the usage states in which to assess the effective and efficient use of the decision making process during different phases of project life-cycle.

To agree on final selected indicators (measurements) from the above literatures and complete structuring the conceptual research model, the author accomplished a qualitative research design through a number of interviews with different project management expertise from diverse organizations. Therefore, our conceptual model was based on the factors that have been approved by the expert consensus, that have a basic role and direct impact on the project management decision-making process.

The literatures evaluated project management as a significant feature for the success of any organization. It is considered as highly essential to support project managers for developing efficiently decision-making process.

However, notwithstanding these literatures highlighted some examples in the use of PMIS, they did not obviously recommend which tools were more suitable to be used at what which phase in the project management life cycle, and thus may lead to an efficient and effective decision making process.

Research Model and Hypotheses

The proposed PMIS model is mainly constructed based on the review of literatures that is related and a number of qualitative empirical materials, which were based on the model of DeLone and McLean as well as Sabherwal et al. (2006), Urbach et al. (2009), and Almutairi and Subramanian (2005).

This model will be empirically tested to measure the PMIS factors that influencing the Project Management Decision Making (PMDM) process through a survey which was conducted and analyzed during the first quarter of year 2011.

The conceptual research model presented in Figure 1 shows that the dependant variable: effective and efficient project management decision making process is influenced by set of independent variables: Information quality, analytical quality, system quality, technical quality, communication quality, decision maker's quality and problem characteristics.

The independent variables are believed to be the variables that have association with the dependent variable (Effective and efficient Project Management Decision Making) in a positive manner.

Hypotheses

The following are the main four out of the eight hypotheses that we select measure from the above proposed research model:

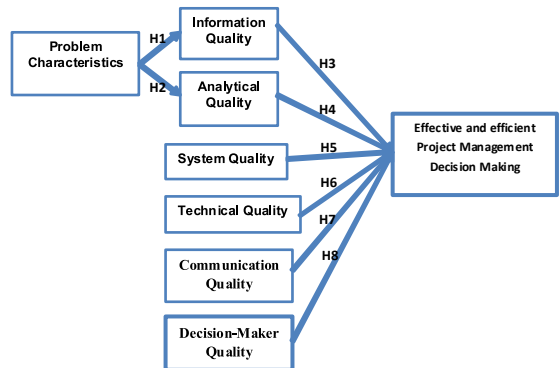
Hypothesis 3: There is a significant positive relationship between information quality and effective and efficient project management decision making process.

Hypothesis 4: There is a significant positive relationship between analytical quality and effective and efficient project management decision making process.

Hypothesis 7: There is a significant positive relationship between communication quality and effective and efficient project management decision making process.

Hypothesis 8: There is a significant positive relationship between decision-maker quality and effective and efficient project management decision making process.

Figure 1: The Schematic Diagram of the Research Model



Source: Author

Research methodology

A questionnaire were designed and distributed to 170 employees who were a member in at least three project teams. The respondents were also selected from different industry services, different age groups, and different educational level from different countries.

Survey Instrument

The questionnaire we prepared for this research was divided into 2 sections. The first section concentrates on the general profile of the respondent including his/her age group, education level and profession and income group.

In the second section we were interested in measuring the selected factors that affecting the Project Management Decision Making (PMDM) process.

The respondents were provided with a list of sixteen questions; two for each variable: problem characteristics, information quality, analytical quality, system quality, technical quality, communication quality, decision making quality and project management decision making process.

The participants were asked to indicate their perception on a likert scales (1- 5) with response ranging from "strongly disagree" to "strongly agree". The collected data were analyzed based on correlation and regression analyses using the statistical package for social sciences (SPSS) version 17computer program.

Data collection

The questionnaires were distributed directly among the right people through the researchers' friends and relatives, a sample of 170 people was randomly chosen from different communities, we received only 158 and all participants are project team members selected randomly from more than organization around the world.

A digital online form was created using "Google Documents" for the questionnaire style, then the link was shared and publicized through email as well as posting it on discussion forums. Once a subject would answer the questionnaire, the raw data will automatically be logged in a spreadsheet which can be only accessed and downloaded by the researcher.

Since the questionnaire form was to be submitted online it guaranteed two things: First, it targeted people who really

access the internet. Second, because all questions are need to be answered before submitting. The collection of data will be done automatically, efficiently and there won't be any loss of data

The questionnaire we prepared and used had been pre-tested initially with a few numbers of people (2 users) to ensure consistency, clarity and relevancy.

Reliability

To find out whether the questionnaire is reliable or not we measured the internal reliability, which is the most popular methods of estimating reliability. Cronbach's alpha test will be used (Nunnally and Bernstein, 1994).

She suggested that a minimum alpha of 0.6 sufficed for early stage of research.

The Cronbach alpha estimated was 0.748 which is higher than 0.6, thus the constructs were therefore deemed to have adequate reliability.

Table 1: Cronbach alpha estimation

| Case Processing Summary | | | |
|---|-----------------------|------------|------|
| | | N | % |
| Cases | Valid | 158 | 84,9 |
| | Excluded ^a | 28 | 15,1 |
| | Total | 186 | 100 |
| a. Listwise deletion based on all variables in the procedure. | | | |
| Reliability Statistics | | | |
| Cronbach's Alpha | | N of Items | |
| 0,748 | | 5 | |

Source: Author

Result analysis and discussion

Correlation analysis

Table 2 present the results of correlation analysis which used to describe the strength and direction of the linear

Table 2: Results of correlation analysis

| Correlations | | | | | | |
|-------------------------|---------------------|---------------------|--------------------|-----------------------|------------------------|--------------------------|
| | | Information Quality | Analytical Quality | Communication Quality | Decision Maker Quality | Efficient decisionmaking |
| InformationQuality | Pearson Correlation | 1 | .541** | .567** | .432** | .222** |
| | Sig. (2-tailed) | | .000 | .000 | .000 | .005 |
| | N | 158 | 158 | 158 | 158 | 158 |
| AnalyticalQuality | Pearson Correlation | .541** | 1 | .552** | .485** | .260** |
| | Sig. (2-tailed) | .000 | | .000 | .000 | .001 |
| | N | 158 | 158 | 158 | 158 | 158 |
| CommunicationQuality | Pearson Correlation | .567** | .552** | 1 | .527** | -.005 |
| | Sig. (2-tailed) | .000 | .000 | | .000 | .949 |
| | N | 158 | 158 | 158 | 158 | 158 |
| DecisionMakerQuality | Pearson Correlation | .432** | .485** | .527** | 1 | .511** |
| | Sig. (2-tailed) | .000 | .000 | .000 | | .000 |
| | N | 158 | 158 | 158 | 158 | 158 |
| Efficientdecisionmaking | Pearson Correlation | .222** | .260** | -.005 | .511** | 1 |
| | Sig. (2-tailed) | .005 | .001 | .949 | .000 | |
| | N | 158 | 158 | 158 | 158 | 158 |

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

Source: Author

relationship between the selected four independents variables and the dependent variable.

The result of correlation reveals that there was a strong, positive correlation between information quality and affecting Project Management Decision Making (PMDM) process, which was statistically significant ($r = .222$, $n = 158$, $P < .005$).

There was also a strong, positive correlation between analytical quality and affecting Project Management Decision Making (PMDM) process, which was statistically significant ($r = .260$, $n = 158$, $P < .001$).

A strong and positive correlation between decision-makers quality and affecting Project Management Decision Making (PMDM) process, which was statistically significant ($r = .511$, $n = 158$, $P < .0005$).

However, the results, surprisingly, showed that we have a weak and negative correlation between communication quality and affecting Project Management Decision Making (PMDM) process ($r = -.005$, $n = 158$, $P > .05$).

5.1 Regression analysis

Table 3 and 4 illustrates the results of linear regression:

Table 3: Regression (ANOVA)

| ANOVA ^b | | | | | |
|--|----------------|---------|-------------|--------|-------------------|
| Model | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 65,962 | 4 | 16,491 | 25,941 |
| | Residual | 97,259 | 153 | 0,636 | .000 ^a |
| | Total | 163,222 | 157 | | |
| a. Predictors: (Constant), DecisionMakerQuality, InformationQuality, AnalyticalQuality, CommunicationQuality | | | | | |
| b. Dependent Variable: efficientdecisionmaking | | | | | |

Source: Author

The ANOVA result in table 3 indicates the statistical significance of the regression model that was applied. Here, $P < 0.0005$ which is less than 0.05 and indicates that, overall, the model applied is significantly good enough in predicting the outcome variable.

The results of the regression (Coefficients) in table 4 exposed that information quality ($\beta=0.155$, $p < 0.05$), analytical quality ($\beta=.148$, $p=0.07$, $t>1.8$), Decision Maker quality ($\beta=0.643$, $p < 0.05$) found to be affects the project management decision making process.

The respondents answers in the questionnaire show that most of them consider Internet banking as an alternative for going to the bank and useful to conduct their banking activities more quickly, which support the seven factors model preformed by Liberatore et. al. (2003), White and Fortune (2001), Havelka & Rajkumar (2006), Wilcox and Bourne (2002), Davenport and Harris (2007), and DeLone and McLean (2003).

However, the analytical results of the regression shows communication quality ($\beta=-0.513$, $p < 0.01$) is seriously unaffacting the project management decision making process.

Table 4: Regression (Coefficients)

| Coefficients ^a | | | | | |
|---------------------------|-----------------------------|------------|---------------------------|--------|-------|
| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| | B | Std. Error | Beta | | |
| (Constant) | 0,622 | 0,504 | | 1,234 | 0,219 |
| Information-Quality | 0,287 | 0,149 | 0,155 | 1,924 | 0,05 |
| Analytical-Quality | 0,196 | 0,108 | 0,148 | 1,815 | 0,071 |
| 1 Communication-Quality | -0,588 | 0,097 | -0,513 | -6,052 | 0 |
| DecisionMaker-Quality | 0,912 | 0,109 | 0,643 | 8,366 | 0 |

a. Dependent Variable: efficientdecisionmaking

Source: Author

Thus, based on the above correlation and regression results, we reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1) of all measured independent variables (H_3 , H_4 and H_8) except H_7 .

It seems that there is a highly significant relationship between information quality, analytical quality, and Decision Maker quality and the efficient and effective project management decision making process.

CONCLUSION

The paper presented the expression of PMIS and how it affects PMDM process. The qualitative and qualitative research design presented in this paper will support project managers, project team members, and even researchers in assessing the main functions of a project management information system's introduction into an organization and how it affect the project management decision making process.

Thus, this research expand the literature by reviewing, identifying and introducing the factors of PMIS which affects PMDM used in each phase of the project life cycle based on the empirical research method using big sampling population across various industries and various countries.

The constructed PMIS conceptual model which is more suitable to measure the impacts on project management decision making process was based on selection high suitable factors from the reviewed major PMIS models

presented by famous authors such as DeLone and McLean (2003), Sabherwal et al. (2006), Urbach et al. (2009), and Almutairi and Subramanian (2005), and incorporated other factors such as communication quality and decision maker quality to make more appropriate for decision making process.

Although the compatibility of the chosen factors of the proposed PMIS's model was consulted by a number of expert's people during the process of qualitative method, our survey surprisingly showed that communication quality factor was insignificant impact on PMDM. Thus, subsequently, the current research of selecting communication quality as a factor in PMIS conceptual model should be revised and consideration should be directed regarding the project manager's quality and consultancy.

This research also denotes that the PMIS plays a part to project success events in each phase of the project life cycle. Thus, to facilitate manage decision making effectively; project managers should consider using the PMIS that corresponding the characteristics of phases and with qualified and highly professional decision makers in each phase of the project life cycle.

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