

Validating the Integration among Project Management Knowledge Areas in Lebanon

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Abstract—There is no best way to successfully manage a project; however, extensive effort is being made by the Project Management Institute (PMI) to establish best practices to manage projects. The output of all the eight project management knowledge areas established by the (PMI) is used as an input to make the project management plan, which is a key to a successful project. Therefore, the aim of this study is to investigate whether all the eight project management knowledge areas of time, cost, quality, scope, human resources, communication, procurement and risk are cross-linked in practice. Moreover, to discover whether all these areas are actually integrated by project managers when developing the project management plan for construction projects executed in Lebanon.

Index Terms—Construction projects, project management.

I. INTRODUCTION

In an attempt to establish the best practices, PMI identified nine different knowledge areas related to Project Management that should be considered while planning any project. These areas are divided in four Core Functions; namely: Scope Management, Time Management, Cost Management, and Quality Management, and four Facilitating Functions; namely: Human Resource Management, Communication Management, Risk Management, and Procurement Management [1]. The ninth area is the Project Integration Management area that is aimed at fusing all eight functions identified above into a comprehensive set of working tools and techniques that help Project Managers achieve the goals of their projects successfully.

II. LITERATURE REVIEW

A. Project Management Knowledge Areas in Research

There was no evidence of a past study that combined the all eight knowledge areas identified by the PMI. However there were plenty of research that studied these knowledge areas separately, Based on the literature review, criteria

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defining each knowledge area were identified and grouped to be tested. For example, Kufidu and Vouzas [2], attempted to investigate the extent to which multinational enterprises operating in Greece, and involved in different levels of quality management in project output, differ in the way they utilize their human resources. They argued that if quality acts as a core organizational principle, then the following criteria will be part of the human resources management aspects: A training policy, Quality improvement teams, Performance appraisal systems, Employee involvement, Well being & morale, Communication and information sharing. So these factors were extracted from the above study and grouped under the key indicators used to assess the human resources management area in any project. Moreover, Kaming [3] studied the factors influencing time delays & cost overruns in construction projects. They showed that the factors influencing time delays are: design changes, poor labor productivity, inadequate planning & resources shortage. They also attributed cost overruns to material price increases, inaccurate material estimation & Project complexity. Thus, these factors might be used as indicators to assess the time and cost management areas.

TABLE I: FINDINGS BASED ON LITERATURE REVIEW REGARDING EACH KNOWLEDGE AREA SEPARATELY

PM knowledge area	Indicators
Time management	Late delivery of projects [4] Incentive clauses [5] Deadlines and late penalties [5]
Cost management	Inaccurate cost estimation [4] Payment difficulties [3], [6]
Quality management	Inspection [3] Interest of top management and site personnel in quality [5] Performance appraisal systems [7] Employee involvement [7] Training policy [7]
Procurement management	Warehousing system [3] Defined Procurement policy (chosen suppliers, purchase orders & requests) [3]
Communication management	Information & documentation management [3] External communication with stakeholders [3] Internal communication [3]
Scope management	Project complexity[8], [9] Change in management [9] Change of specifications & material by client [9], [10]
Human resources	Clear definition of objectives [10] Identify & deal with cultural differences [11] Adequacy of labor resources [12]
Risk management	Risk external drivers: Weather [6], [13] Risk internal drivers : human error [12], [13] Safe work practices [12], [14]

Numerous research papers were also reviewed to extract

the criteria or indicators used by researchers to assess a certain project management (PM) knowledge area. Findings were arranged in Table I which demonstrates each PM knowledge area, the indicators used by other researchers in previous studies to test this PM knowledge areas and showing the reference. Accordingly, Table I groups the findings of past studies and may be considered as a good reference for any future study that might address any of the eight knowledge areas since it will make it easier for others to allocate reviews related to each knowledge area, all found in one study.

B. Relationship between Knowledge Areas in Research

Some of the indicators presented in Table I, were proved to be related to two or three knowledge areas at the same time. For instance, Incentive clauses, Deadlines and late penalties; according to Midler, Mahmoud-Jouini, Garel [15], showed a relationship between time, cost and Procurement. According to Meng [3], payment difficulties was proved to be in a relationship with cost and risk management knowledge areas. In addition, Sarigiannidis and Chatzoglou [7] stated that the performance appraisal systems, employee involvement, and training policy were found to be associated with quality and human resources management areas. Moreover, Boer and Blaga [14] established link between safety practices and human resources and cost.

On the other hand, there was no evidence of any of these indicators proved to be in relationship with all the eight project management knowledge areas all together. Thus, the integration of project management knowledge areas has not been tested before in any industry, which is the aim of this research.

III. HYPOTHESIS OF THE STUDY

The hypothesis of this study is that indicators chosen to be tested under each knowledge area (refer to table I) are in a relationship with other project management knowledge areas' indicators. This hypothesis should validate whether the PM knowledge areas are integrated together in construction management based on the Lebanese practice.

IV. RESEARCH METHODOLOGY

A. Survey's Questionnaire

The questionnaire survey conducted in this study is specific to residential buildings and towers projects completed in Lebanon. The questionnaire is developed based on the indicators identified from the literature review. The aim was to identify whether the developers that are expected to have knowledge about Project Management various areas as determined by PMI, are actually integrating these areas in their practice or not.

The questionnaire consists of two sections; the first one is related to project's information. The other section includes statements that are used to enquire about whether or not implementing the project management knowledge areas is taking place. The questionnaire included the following questions.

Question 1: The project execution meets schedule dates as

planned

Question 2: Penalties for late delivery of work is a major factor for executing the project on time.

Question 3: Incentive clauses in project contracts encourage contractors to finish before deadlines.

Question 4: Delayed payments by the project owners may affect the progress of the project.

Question 5: It is a common fact that the project expenditure always exceeds the estimated budget.

Question 6: Regular inspection of work activities is essential in achieving the required quality of the project.

Question 7: In some circumstances while executing the project, quality standards may be sacrificed.

Question 8: Project Management recognizes the importance of proper training for the workers.

Question 9: Project Management cares for evaluating the performance of workers and project team members.

Question 10: Project Management encourages team members to be involved in making decisions and suggestions.

Question 11: A proper procurement procedure with suppliers should be clearly applied.

Question 12: Proper storage of materials and equipment has a vital role in project execution.

Question 13: Project Management should provide direct communication channels for reporting accomplished tasks, problems.

Question 14: Project Management cares about communicating with project stakeholders.

Question 15: Documentation of all project data should be necessary.

Question 16: The project uncertainties and complexities are clarified in the project scope.

Question 17: A change in project management will likely impact the scope of the project.

Question 18: The frequent client change requests will change the scope of the project.

Question 19: The skills of workers and project team members are equivalent to their assigned tasks.

Question 20: The workers and project team members clearly know their duties and responsibilities to achieve their required objectives.

Question 21: Cultural differences among the workers hinder the successful achievement of work objectives.

Question 22: External factors such as Economy, Politics, critical Weather conditions, may cause alteration in the project.

Question 23: Internal project drivers such as human error may lead to problems in delivering the project.

Question 24: Safety standards are taken into consideration to minimize project risks and casualties.

B. Sample Size

In order to determine a suitable sample size, Bartlett, Kotrlik, and Higinis [16] stated that, "to use multiple regression analysis in a study, the ratio of observations to independent variables should not fall below five. If this minimum is not followed, there is a risk for over fitting, making the results too specific to the sample, thus lacking generalizability". Furthermore, if the researcher plans to use factor analysis in a study, the same ratio considerations discussed under multiple regressions should be used, with

one additional criterion, namely, that factor analysis should not be done with less than 100 observations [16], [17].

The questionnaire included twenty four questions to test the hypotheses of this research. Therefore, the required sample size for the survey should be at least $24 \times 5 = 120$ responses for the 24 independent variables used in multiple regressions.

C. Method of Data Collection

In this research study, a survey was used as method of data collection. Email survey, telephonic interviewing and personal one to one interviews were used, mostly with project managers, contractors, and cite engineers.

The whole process took several months, because there was no valid reference that contained updated information about the contracting and consulting companies in Lebanon. The newest directory issued by the syndicate of contractors goes back to ten years; many companies have changed their addresses and contact information. Therefore, it was hard to locate most of them. One of the methods used to track the companies was to search for construction projects being executed, and ask for contact information of the project manager. Besides, arranging meetings with the project managers took much time considering their busy schedules. Sometimes it took three or four visits to a single company to be able to fill one questionnaire for a single project. On the other hand, some project managers and project engineers were very cooperative and filled data for more than one project.

Responses were collected from leading companies in the construction industry, performing projects in different cities in Lebanon from the northern city of Tripoli, passing through Mount Lebanon and Beirut; where most of the high rise building projects are located, to the southern cities of Sidon and Tyre.

D. Analytical Survey

An analytical survey was chosen in order to test the proposed hypothesis A questionnaire was designed to target the leading contracting and consulting companies in the construction industry in Lebanon. Responses were collected about projects executed in different sites in Lebanon. The applicability of the preliminary questionnaire was tested through a pilot study. The respondents' perceptions were rated according to a five-point Lickert scale (1=Strongly Disagree; 2=Disagree; 3=neutral; 4=Agree; and 5=Strongly Agree), thus allowing a neutral opinion. Data was collected and run on SPSS™ statistical analysis package that is mostly used in Statistical Analyses. Multiple Regression Analyses were conducted for each of the dependent variables over all independent variables using STEPWISE technique in order to investigate the dependency among these variables and identify the statistically significant independent variables that affect each dependent variable.

E. Regression Analysis Results

Multiple Regression Analyses were conducted for each of the dependent variables over all independent variables using STEPWISE technique. Each time one of the indicators was chosen to be the dependent variable, and all the indicators were the predictors or the

independent variables (chosen at a statistical significance of < 0.05).

The rest of the regression analysis results are summarized and presented in Table III.

TABLE III: REGRESSION ANALYSIS RESULTS

Dependent variable	Independent variables	Coefficient
Project meets Schedule	Scope uncertainties	Positive
	Change in management	Negative
	Inaccurate cost estimation	Negative
	Cultural differences	Positive
	Clear definition of objective	Positive
	Internal communication	
	Delayed payments	Negative
	Risk external factors	Positive
	Training	Positive

The time management indicator "project meets schedule" was found to be correlated with six out of seven knowledge areas according to the Lebanese practice. It showed a positive dependency on the scope management indicator "scope uncertainties". This means that respondents believe that when the uncertainties are clarified in the scope of work, the project will more likely meet its scheduled delivery date. It also showed a positive dependency on the human resources management indicator "cultural differences". This indicates that project managers are aware of the fact that if cultural differences exist within project team, it may lead to misunderstandings or disputes between labor or team members, which might affect the progress of work. This awareness is positively correlated with finishing the project on time; which means that project managers are trying to overcome this problem.

"Project meets schedule" also showed a positive dependency on the human resources management indicator "clear definition of objectives". Indeed, it will be easier for labor and team members to accomplish their assigned tasks, when they clearly know the objectives that they are trying to accomplish. Thus, reworking of activities will be minimized and the original schedule will be maintained. Moreover, this indicator showed a positive relationship with the quality management indicator "training". This relation is logical due to the fact that the training of workers increases the chance that the work will be done as it should, thus delays will be minimized.

Furthermore, "project meets schedule" showed a positive dependency on the cost management indicator "delayed payments" and the risk management indicator "external risk factors"

Respondents agree that "delayed payments" affect the progress of the project. They also believe that "external risk factors" such as critical weather conditions may also lead to delays. These responses imply that the project managers are aware, that delayed payments and other external factors can cause delays and thus they are taking these factors into consideration, so that the project meets its scheduled date. This awareness is positively correlated with finishing the project on time.

Communication with project team members helps keep everyone updated with the project status, thus allowing the reporting of work progress and of potential

problems. However, "project meets schedule" showed a negative dependency on the communication management indicator "Internal communication" when the respondents were asked whether direct communication channels should be provided to facilitate reporting. It seems that for those managers who disagree that their projects are meeting schedule, there seems to be a tendency that they require more internal communication.

"Project meets schedule" also showed a negative dependency on the scope management indicator "change in management" & the cost management indicator "inaccurate cost estimation". This relationship is reasonable because the more there is a change in management that may affect the progress of work, the more likely that the project will not meet the schedule. In addition, accurate estimation of costs will help allocate the required budget to perform the project, while underestimating the project funds may lead to delays.

The only left area that the "project meets schedule" did not show any dependency to, is the procurement management knowledge area. The indicators of procurement management under study include "documentation management" and "procurement policy". This might indicate that the project managers when making the plan of the project, believe that whether having a defined procurement policy or not, and whether documenting the project related information or not, these areas in their consideration has no effect on meeting the assigned project schedule.

F. Factor Analysis

Factor analysis was conducted in order to describe the interdependency among the indicators. The general purpose of the factor analysis technique is to find a way to condense or summarize the information contained in a number of original variables into a smaller set of new factors [18]. The resulting data of the survey showed 8 groups or factors:

Factor 1 grouped regular inspection, scope uncertainties, and change in management. Those factors are related to verify scope and making sure it is implemented as it should.

Factor 2 grouped training policy, performance appraisal and Safety issues, which are factors related to provide the required human resources skills to avoid work risks.

Factor 3 grouped project meets schedule, delayed payments, documentation management and Risk external factors, which are related to monitor the progress of the project, and to be documented for future learning.

Factor 4 grouped penalties, inaccurate cost estimation, internal communication and cultural differences, which are related to the issues that the project may encounter during execution, i.e. execution problems.

Factor 5 grouped procurement policy, material storage, risk internal factors, which are factors related to raw material.

Factor 6 grouped external communication and client related changes. These two variables are related since the project management should care about communicating with the clients and other project stakeholders, in order to identify their needs and take their opinions and remarks into consideration, consent to the changes that they request and implement them in the best possible way. So this factor might be related to

communication with stakeholders.

Factor 7: grouped employee involvement, adequacy of labor resources and clear definition of objectives. When project management cares more to involve the project team members and encourage them to participate in decision making and giving suggestions, then this same management will make sure that the project team members are already know their responsibilities and have a clear definition of the work objectives. Thus this factor can be related to the aware human resources.

Factor 8: grouped incentive clauses and Interest in quality which are related to the project management policy towards project execution. For example, when incentive clauses are given to a contractor, he is expected to fulfill the required quality.

V. CONCLUSION

The results showed that the project management knowledge areas were not fully integrated together. The time management knowledge area appeared to be linked to 6 out of the rest 7 knowledge areas, the only area which almost showed a full integration among all the eight project management knowledge areas, except for the procurement management area. The rest of the areas showed partial integration based on the responses of the interviewed project managers. And that could be due to the difference in the practice between those project manager.

Upon assessing the status of construction projects in Lebanon, numbers revealed that 57% of project managers agree that executed projects met the scheduled completion date, while 67% agreed that project expenditures exceeded the planned budget. These numbers imply that there is room for improvement. At the end, this study showed that the project management knowledge areas are cross-linked in real practice. Therefore, one can conclude that they have partially been integrated together. Future research could be conducted towards validating the required integration among all factors that are grouped in table I and found under the core and support project management knowledge areas, for the purpose of consolidating the knowledge base of the practice.

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