Identification of Supplier Selection Criteria and Risk Approach for Egyptian Contractors

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Abstract - In construction sector, contractors in general are facing unprecedented challenges to comply with the estimated time and budget of their projects. These challenges increased due to political unrest in Egypt since 2011. As a result, contractors need to apply more strict approach to risk management to avoid cost overruns and expected delays of payments especially in governmental projects. The goal of this research is to identify the current risk management approach for Egyptian contractors. The paper emphasizes the contractor criteria for supplier selection to reduce expected risks. The study involves a questionnaire survey and a series of interviews with contractors. Main elements identified include supplier selection criteria, suppliers’ qualifications, logistics, common risks, and the application of formal risk management methods.

Keywords - Construction Supply Chain, procurement management process, procurement risk, risk management, supplier selection criteria.

1. INTRODUCTION

This section sets the background to the research area and discusses the problems the study deals with. The aim, objectives and research questions are presented and delimitations are described. Finally, the structure of the paper is outlined.

1.1. Background and Problem Description

Project management is defined as planning, directing, and controlling resources to achieve specific goals and objectives of the project (Fan, Lin, & Sheu, 2008). Managers need to ensure delivery of projects to cost, schedule and performance requirement. In recent years, the application of supply chain management (SCM) philosophy to the construction industry has been widely investigated as an effective and efficient management measure and strategy to improving the performance of construction, which has suffered from high fragmentation, large waste, poor productivity, cost and time overruns, and conflicts and disputes for a long time. SCM can be considered as the coordination of distributed decision making of organizations or participants on material flow, information flow, human flow, and cash flow in supply chain from systems perspective. According to Lau et al. (2004), SCM is defined as “coordination of independent enterprises in order to improve the performance of the whole supply chain by considering their individual needs”. This definition describes the main function and principle of SCM, i.e., coordination. [11]

Construction industry faces a lot of inherent uncertainties and issues. As this industry is plagued by risk, risk management is an important part of the decision-making process of these companies. [1]

Risks cannot be eradicated, but can be managed; it is better to be proactive rather than reactive. They, however, need to be identified, quantified and understood to be managed.

Risk management is an iterative process consisting of well-defined steps which, taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts. The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Decision makers need to know about possible outcomes and take steps to control their impact.
Risk management is recognized as an integral part of good management practice. To be most effective, risk management should become part of an organization's culture. It should be integrated into the organization's philosophy, practices and business plans rather than be viewed or practiced as a separate program. When this is achieved, risk management becomes the business of everyone in the organization.

Risk management enables continual improvement in decision-making. It is as much about identifying opportunities as avoiding or mitigating losses.

Risk identification is the first step of risk management for construction projects. Considering that for a typical industrial facility 10% to 15% of the total cost is for engineering design and 50% to 60% is for equipment and materials, it is obvious that obtaining the equipment and so it can be concluded that if the procurement process is successfully managed a great deal of the success of the project can be achieved and successfully management of the process include the development of a clear policy to materials at the lowest possible cost will provide the greatest savings.

The motivation behind this research is the lack of an accurate system for procurement Management with clear and specific steps in most construction companies in Egypt as well as failure to follow a scientific approach in identifying the risks in this process and therefore its effects on the project.

1.2. Aim, Objectives, and Research Questions

The overall aim of this paper is to increase the understanding of risk management and its relation with procurement management. Deeper understanding is expected to contribute to effective risk management process and, therefore, a better project output and better value for both clients and contractors.

Fellows and Liu (2003) defined the objectives of any research papers as statements that translate the strategic aim into coherent, operational statements and concern how the study will be implemented. For this study there are two objectives:

1. To determine to what extent the procurement management and risk management are applied in construction companies in Egypt.
2. To come up with recommendations, those contribute to more effective procurement risks management in construction companies.

On the basis of the aim and the objectives three research questions have been formulated.

1. In what ways and to what extent are the principles of risk management and procurement management are applied in Egyptian companies?
2. What are the most probable risks facing construction companies?
3. What are the main factors that contribute to more effective risk management in the construction projects?

2. RESEARCH METHODOLOGY

The research methodology is divided into four main parts that describe the research design, literature review, data collection, and data analysis.

2.1. Research Design

Research design is about turning research questions into the research project (Robson 2002). The research questions in this study focus mainly on "what" questions. To answer this type of question, a survey strategy is suggested (Yin 1994). The research presented in this study is of descriptive type. Descriptive research aims at identifying and recording a phenomenon, process or system and may be conducted using surveys (Fellows and Liu 2003).
The work has been done in the following sequence:

1. Literature review
2. Choice of company category
3. Preparation of a questionnaire
4. Questionnaire survey and interviews
5. Analysis of data
6. Conclusions and Recommendations

2.2. Literature Review

Project risk management is a fairly broad subject. In the very beginning of the study, the main authors of textbooks in the field of risk management in construction were identified. The books were reviewed in order to get a general understanding of the research area. The next step was a search for articles in the databases, e.g. Elsevier Science Direct. The search was made by using the following keywords: risk management, procurement risk management, and construction supply chain management. This review helped in reaching to information presented in theoretical framework.

2.3. Data Collection

Survey is a suitable method of data collection for descriptive purposes (Robson 2002). As one of the study’s objectives was to analyze how risk management and procurement management worked in the construction companies, a questionnaire survey was chosen as one of the methods of data collection.

The questionnaire is aimed to explore the following:
1. The company type description (Sector, specialization).
2. Source selection criteria.
3. Suppliers’ qualification criteria.
5. To what extent the company applies the concepts of procurement and risk management.
6. The most probable risks that face the company.
7. The followed methods to reduce procurement risks effects.

The sample was selected from first class contractors (according to Egyptian Federation for Construction & Building Contractors classification) in great Cairo. The sample selection is built on the next assumptions:

1. The first class companies have more experience than the others, so they can give more useful data.
2. Because of the big size of the first class companies’ projects, and the great risks that they face, they most likely to apply the management principals.
3. The great Cairo contains most of the first class companies and they present nearly the case of the whole country.

2.4. Data Analysis

After the completed questionnaires had been collected, the data was analyzed using the Statistical Package for Social Science (SPSS).

To analyze the data some of statistical tests were used such as:
1. Mode test to determine the most commonly occurring value.
2. Correlation test to determine a relationship/association between two variables.

3. THEORETICAL FRAMEWORK

This section presents the main theoretical framework for the research. The definitions of some terms as Risk, Risk Management, Procurement, Procurement Management, Selection Criteria of Suppliers, Expediting, Construction Supply Chain, Construction Supply Chain Management.

3.1. Risk

Construction Industry Development Board Pretoria defined risk as it is the chance of something happening that will have an impact upon objectives. [3]

The traditional view of risk is negative, representing loss, hazard, harm and adverse consequences. But some current risk guidelines and standards include the possibility of upside risk or opportunity, i.e. uncertainties that could have a beneficial effect on achieving objectives (Hillson, 2002). Project risk is defined by Project Management Body of Knowledge (PMBOK) published by the Project Management Institute (PMI) as an uncertain event or condition that, if it occurs, has a positive or a negative influence on time, cost, span or quality, which implies an uncertainty about identified events and conditions. [1]
3.2. Risk Management

Due to Construction Industry Development Board Pretoria risk management is the logical method of establishing the context, identifying, analyzing, evaluating, treating, monitoring and communicating risk associated with any activity, function or process in a way that will enable losses to be minimized and opportunities to be maximized. [3]

Risk management can lead to a range of project and organizational benefits including: (Bannerman, 2008)
- Identification of favorable alternative courses of action.
- Increased confidence in achieving project objectives.
- Improved chances of success.
- Reduced surprises.
- More precise estimates (through reduced uncertainty).
- Reduced duplication of effort (through team awareness of risk control actions).[1]

3.3. Procurement

The Online Business Dictionary defines procurement as the complete process of obtaining goods and services – from preparation and processing of a requisition through to receipt and approval of the invoice for payment. Also called sourcing, procurement commonly involves purchase planning, standards determination, specifications development, supplier research and selection, value analysis, financing, price negotiation, making the purchase, supply contract administration, inventory control and stores, and disposals and other related functions. Three common methods of procurement are competitive bidding, direct negotiations, and single-source acquisition. [8]

3.4. Procurement Management Process

Damodara U. Kini, P.E. define procurement process management as a management system that integrates the traditional areas of purchasing, expediting and controlling the progress of the vendor. It is an essential part of project management and can be integrated with engineering to provide an end product that meets the client's needs and is cost effective.[4]

Project Procurement Management includes the contract management and change control processes required to develop and administer contracts or purchase orders issued by authorized project team members. [9]

Some researchers tried to state the benefits of procurement process management, and the research is demonstrating some of these researches. Lansford C. Bell and George Stukhart found that the benefits associated with improved labor productivity on projects that use integrated materials management systems are believed to be due to two interrelated factors: Materials are more likely to be available when needed, and craft supervision can plan the work around material availability. Computer controls play a very important role in tracking material deliveries, but they are even more essential for effective craft work planning. One craft superintendent estimates that two computer reports used for craft work planning, the open purchase order report and the trial allocation report, produce a 5% savings in project labor costs.

On projects lacking a materials management system, craft foremen have reported spending as much as 20% of their time hunting materials and another 10% tracking purchase orders and expediting. These foremen admit that leaving their crews unsupervised for long periods of time has a detrimental effect on labor productivity. So it is stated that, Materials management is a clearly defined task that, when properly planned and executed, provides project management with an invaluable tool to optimize schedules and improve labor productivity. [7]

B.H.W. Hadikusumo et al. stated that more than 50–60% of total project cost is spent on materials and equipment. An effective material management can increase a company’s profit by reducing unnecessary costs such as those from delays, claims, etc.

Hence, an effective material management is important for project success.

Inefficient procurement practices can result in costly delays, loss of profit, and possible litigation. [2]

3.5. Selection Criteria of Suppliers

Ka-Chi Lam et al. stated that the cost of the construction project could be broadly divided into three major groups, namely: materials, labor and overhead. The materials can typically account for around 40% to 45% of the total cost in construction industry. In addition, the labor cost in construction industry is generally governed by the availability of workers within the proximity; only the construction materials can provide the greatest flexibility in seeking the lower cost for the construction companies.
Therefore, an effective and efficient material supplier selection model which can help the developers to select the "best" suppliers at the right cost, in the right quantity, with the right quality at the right time has a significant effect in the business success of property developers. [5]

According to Ka-Chi Lam et al. some of the specific criteria for the construction industry were determined as follows: cost; delivery; quality; payment terms; past performance; reliability; flexibility; and technical characteristics, and they stated supplier selection criteria for their proposed model as shown in figure number (2).

Fig.(2). The proposed selection criteria system according to Ka-Chi Lam et al.[6]

From above it has appeared clearly the importance of the supplier role in success of procurement process. That leads to the importance of Expediting which according to Keith A. Willoughby represents an approach for managing the materials used in a given project. Specifically, it monitors the performance of suppliers and sub-contractors so that required products are manufactured to appropriate quality levels, within contractual deadline dates. Therefore, one could postulate that the manner in which the expediting function is executed plays a substantial role in the performance of all types of projects.

Keith A. Willoughby illustrated that Expediting problems appear to occur due to two main reasons: the mismanagement of expectations and poor communication.[6]

3.6. Construction Supply Chain

Xiaolong Xue et al. said that CSC consists of all construction processes, from the initial demands by the client/owner, through design and construction, to maintenance, replacement and eventual demolition of the projects. It also consists of organizations involved in the construction process, such as client/owner, designer, GC, subcontractor, and suppliers. CSC is not only a chain of construction businesses with business-to-business relationships but also a network of multiple organizations and relationships, which includes the flow of information, the flow of materials, services or products, and the flow of funds between owner, designer, GC, subcontractors, and suppliers. According to Muya et al., there are three types of CSC: the primary supply chain, which delivers the materials that are incorporated into the final construction products; the support chain, which provides equipment and materials that facilitate construction, and the human resource supply chain which involves the supply of labor. Figure number (3) presents a model of construction supply chain.[11]

3.7. Construction Supply Chain Management

Xiaolong Xue et al. said that in recent years, the application of supply chain management (SCM) philosophy to the construction industry has been widely investigated as an effective and efficient management measure and strategy to improving the performance of construction, which has suffered from high fragmentation, large waste, poor productivity, cost and time overruns, and conflicts and disputes for a long time. SCM can be considered as the coordination of distributed decision making of
organizations or participants on material flow, information flow, human flow, and cash flow in supply chain from systems perspective.

According to Lau et al. (2004), SCM is defined as "coordination of independent enterprises in order to improve the performance of the whole supply chain by considering their individual needs". This definition describes the main function and principle of SCM, i.e., coordination. [11]

4. DATA ANALYSIS

The data analysis will be presented according to the main items of the questionnaire.

4.1. Sample Description

The descriptive analysis shows the sample profile as following: regarding the company type; the sample consists of 50% of public sector, 46.7% of private sector and 3.3% of governmental sector. And regarding to the companies' specializations consists of 73.3% general contractors, 10% roads, bridges and airports contractors, and the remain percentage was distributed between the other specializations.

4.2. Source Selection Criteria & Suppliers’ Qualification Criteria

The questionnaire’s answers about the volume of manufacturing in the companies show the Low percentage of manufacturing versus purchase during the discussions it is clarified that this situation is not the normal case, but as a result of reduced work volume of most of the companies as a result of the economic crisis and unstable political status in the country at the present time. And they stated the reasons lead the companies to manufacturing as follows: 1) quality assurance, 2) mass usage of the product, 3) achieve more profit for the company, 4) schedule compatibility assurance, 5) sufficient usage of company assets as empty land and permanent labors and 6) the ability to control the cost which help in reducing the price in the bids.

Then a question about the followed method of tendering, revealed that both public and limited tenders are the preferred methods than request quotes and direct order purchase. That means low dependence on the idea of partnership between contractors and suppliers.

By making correlation test between the types of company data and selected tendering method data the results were as shown in table (1).

<table>
<thead>
<tr>
<th>Choose company type</th>
<th>Pearson Correlation</th>
<th>Request quotes</th>
<th>Purchase direct order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
<td>-0.367</td>
<td>-0.4153</td>
<td>0.1938</td>
</tr>
<tr>
<td></td>
<td>0.0459</td>
<td>0.0224</td>
<td>0.3048</td>
</tr>
</tbody>
</table>

Table (1): the results of correlation test between the types of company data and selected tendering method data.

And by linking them in crosstabs format to determine the relation, it was found that the most of governmental and public sector companies choose the public and limited tender, while the private sector companies prefer the request quotes. But when asking about direct order purchase, high percentage (about 60%) of the sample refuses it and this percentage was a mix of public and private sector as shown in the following charts fig. (4). To fig. (6).

And in accordance with the discussions and observations reported during completing the questionnaire was main factor in choosing the method bidding is the volume of business in accordance with the law and is not in accordance with the administrative or policy vision of how to manage that in the company.

Fig. (4) Usage of Public Tender
One of the questions asks about the effect of contractor-suppliers relationship on new project selection and the answers stated that it isn’t considerable factor because the long relations are rarely occur.

The answers of questions about the suppliers’ qualification criteria clarify that about 50% of the companies depend on fixed lists of suppliers, and it is mentioned in comments that registration is through the official papers are met, which increases the chances of repeating the same risk in most projects, such as non-compliance with the required specifications and lack of commitment timetable.

4.3. Factors Affecting Logistic Method Determination

These second part of the questionnaire asks about the factors affecting the chosen method of logistics and the answers were indicated the most effective factors and order them as shown in fig. (8)

The companies which make evaluation stated the most influential factors as shown in fig. (7)
4.4. The Appliance of Risk and Procurement Management within the Companies

The answers of the questions those ask about the application of risk and procurement concepts clarify that bulks studying the risks during the preparation of bids and setting prices, but small percentage of them who apply quantitative analysis after the qualitative one. Also the answers and the discussions reported that about 90% do not depend on recording the historical and accurately documented information on risks to be considered as inputs in the following projects and this leads to a lack of accurate information and values about the type and the amount of risks in different types of projects.

4.5. The most probable risks facing construction companies

The answers to questions that ask about the most probable risks clarify the high impact of the risks associated with quality, schedule, and the low impact of each of the cost of transport and the proportion of spoilage, but with a note about these factors which told that it may be influential in the case of a company which import a particular resource by itself.

Then it defines the difficulties that face the construction companies as bellow:
1- Incompatibility with schedule.
2- Unavailability of cash
3- Low level of quality.
4- The uncertainty of the commitment to implement the contractual conditions and technical specifications
5- The difficulty of achieving a competitive price
6- Instability of the materials prices.
7- Unavailability of some materials which leads to high prices of it.
9- Not confirm previous experience (non-credibility in the papers previously rehabilitation)
10- Unavailability of experienced labors.
11- The limited number of available projects as a result of the economic recession.
12- The legal obligation rating category for subcontractors (the lack of a classification of subcontractor in the Consolidated Contractors)
13- Flexibility in payment conditions.

4.6. Factors Contributing to Effective Risk Management in the Construction Projects

The answers to the questions about the factors contributing to effective risk management followed by contractors include:
1- Purchase the high value materials at early project stage to avoid risk of price increase.
2- Use down payment in contracting and procurement for the proportion of the required materials.
3- Apply fines for delay in supply contracts.
4- Apply delivery tests and state explicit requirements in the supply contracts regarding the rejection of products that does not conform to specifications.
5- Apply equations of change prices within the terms of the contract.
6. Facilitate proactive expediting instead of reactive approach for long-lead items to avoid delays to the schedule.

5. CONCLUSION

1. The main criteria used by contractors to qualify suppliers include: price, schedule compatibility, and product quality. Each of the three factors nearly has equal degree of importance. The fourth ranked factor used by contractors is the flexibility in payment conditions offered by supplier.

2. There are some methods contributing to effective risk management in the construction projects and they are stated in part (4-6).

3. There is a lack of cooperation and long-term relationship between contractors and suppliers.

4. The absence or weak practice of the quantitative analysis of risks to know the estimated value of it in case of occurrence, while depending only on qualitative analysis. This behavior may lead to the loss of the tender because of the high price or exposure to losses for the miscalculation of the cost of risk.

5. The in-house manufacturing could be an effective option to avoid the most repeatable risks which are price, quality and schedule incompatibility.

References


