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IDENTIFYING ENVIRONMENTAL RISK IN CONSTRUCTION PROJECTS IN MALAYSIA: STAKEHOLDER PERSPECTIVE

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Abstract: Construction projects are unique and face many different types of risks even though every business endeavor is known to contain risks, construction related risks are unique. There are two major categories of risks faced by any construction project; they include internal and external environment risk. This study was carried out to identify the construction environment risks facing construction projects. A questionnaire survey was conducted where 70 questionnaires were sent out and only 24 were of them were returned, yielding a response rate of 60%. However, questionnaires were for non-compliance and 31 were analyzed. This paper was attempted to identify the environment related risk in the construction projects, and rank the environment risks according to their significance in relation to project objectives. In addition, it intended to measure the use of risk management in construction companies. A questionnaire survey was carried out to get the opinions of stakeholders with regards to ranking of factors, and use of risk management. As results, it was found that there were 10 construction environment risks, and the three most ranked significant factors according to the analyzed results were 'variation by client', 'tight schedules' and 'lack of enough trained professional managers'. In measuring the use of risk management, 61.3% of construction companies surveyed were found to apply risk management and this helped them in improving their business profits while those who did not apply risk management had lower profits. As conclusion, professionals in the industry should provide effective leadership through the proper identification and management of construction.
Keywords: Environment risk, Construction project, Stakeholder, Malaysia x

1. INTRODUCTION

In today's construction business and with the increase of today demand on perfection in addition to the high amount of competitions, professionals need to balance their organization needs with the contingency of the risk in their firm, and in order to achieve this balance a proper risk identification and analysis required to mitigate the potential of loss. One of the problems for the professional's is understanding the risk impact on the operation and look at the risks indivisibly with a narrow-minded scope without realization the possible impact of associated risk on the operation and the business. When using a comprehensive approach, the business and boost, the probability of risk mitigation and may achieve the goal of total risk elimination. As their working environment becomes diverse in the globalized world, there is a need to emphasize on risk management techniques. Long periods of construction projects, unique activities and complex processes exposes construction industry to higher risks compared to other industries. The internal risks associated with construction projects include (1) Quality and safety; (2) Cost management, (3) Time management, (4) information management, (5) Procurement and contracts, (6) People management, (7) Scope and change management, and (8) External influences. When risks associated with the above aspects are not managed, companies are likely to suffer loss or reduction of profit, reputation and in the worse scenario leads to a complete bankruptcy and eventually insolvency of the firm. While projects may differ in size and scope, their risk elements are similar in nature. Therefore elements of effective project management such as project control become significant. In today's competitive environment, construction companies face many challenges internally and externally. The inherent risks associated with projects, they undertake directly influence their long term profits, and with a look over the past few years, many construction companies have loss high profits due to ineffective risk management. Since firms are in business to maximize profits in a sustainable manner, it is important that these risks be managed effectively. Uher(2003) defined risk management as systematic way of looking at areas of risks and consciously determining how each should be treated. It is a management tool that aims at identifying all sources of risks and uncertainty determining their impact and developing management responses (Uher, 2003). The main aim of this paper was to identify the environment risk factors in construction projects from stakeholder perspective. It was specifically focused on achieving these objectives (i) identify the environmental risk in the construction project, (ii) rank the environmental related risks accordingly to their significance in relative to project objectives, and (iii) measure the uses of risk management plan in construction companies.

2. LITERATURE REVIEW

Construction projects are subject to many risks due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organization structures (Flanagan and Norman, 1993; Akintoye and MacLeod, 1997; Smith, 2003).Managing risks in construction projects has been recognised as a very important management process in order to achieve the project objectives in terms of time, cost, quality, safety and environmental sustainability (Zou et al., 2006). Previous research has mainly focused on examining the impacts of risks on one aspect of project strategies with respect to cost (Chen et al., 2000), time (Shen, 1997) and safety (Tam et al., 2004). Some researchers investigated risk management for construction projects in the context of a particular project phase, such as conceptual/feasibility phase (Uher and Toakley,1999), design phase (Chapman, 2001), construction phase (Abdou, 1996), rather than from the perspective of a project life cycle. Other detailed studies have been done in the field of risk management for construction projects, a significant outcome of which is the identification of many risks that may influence the construction project delivery. For instance, Chen et al. (2004) proposed 15 risks concerned with project cost and divided them into three groups: resources factors, management factors and parent factors. Through a case study on the West Rail Project of Hong Kong, Chen found that "price escalation of material" pertaining to resource factors, "inaccurate cost budget" and "supplier or subcontractors' default" pertaining to management factors, and "excessive interface on project management " pertaining to parent factors are the most significant risks in this particular project. Shen (1997) identified eight major risks accounting for project delay and ranked them based on a questionnaire survey with industry practitioners. Shen also proposed risk management actions to cope with these risks and validated their effectiveness through individual interview surveys. Tam et al. (2004) conducted a survey to examine the elements of poor construction safety management in China and as a result, identified the main factors affecting safety performance including "poor safety awareness of top management", "lack of training", "poor safety awareness of project managers", "reluctance to input resources to safety" and "reckless operation". In Malaysia, little research has probed risks from the perspectives of project stakeholders within the construction projects. Therefore, this paper was aimed to identify the construction environment risks facing construction projects in Malaysia.

3. RESEARCH METHOD

Semi-structure questionnaire was established from the previous where the researchers had adapted some items from studied carried out by (Chapman, 2001; Wang and Liu, 2004; Zou et al., 2006, 2007) which were used in this study.Seventy questionnaires were sent out. However, 39 questionnaires were returned and only 31 of the returned questionnaires were completed and analyzed. The study was conducted in Penang State in Malaysia. The targeted respondents were the professionals. The scope of this study was attempted to cover the risk management in construction industry; highlight different risks faces by construction projects, with focusing on environmental risk that effect projects from the life cycle of project and stakeholders aspects. Relative Importance Index (RII) was used as the indicator corresponding to each statement. The value of (RII) was ranged from 0.9 as highest degree of response to 0.4 as lowest degree of responses.

4. RESULTS ANALYSIS

4.1. Respondent Background

The analysis showed that most of the respondents who participated in this survey hold a position as a contractor (45.2%), followed by engineer (22.6%). The range of respondents working experience was varied from 1 year to more than 10 years in the construction industry and the majorities of the respondents had a working experience and involved in the construction industry more than 10 years with a 45% from the total sampling. Most of the participants were registered in CIDB with different Grade of Registration where the highest participants came from Grade 7 (54.8%) and the lowest came from registered Grade 3 and 4 with (3.2%).

Table 1. Respondents Background

Items	Frequency	Percent
Position		
Contractor	14	45.2%
Engineer	7	22.6%
Others	4	12.9%
Architect	3	9.7%
Consultant	3	9.7%
Work Experience		
1 - 3 years	2	6.5%
4 – 6 years	7	22.6%
7 – 10 years	8	25.8%
Above 10 years	14	45.2%
CIDB Grade		
Grade 7	17	54.8%
Grade 6	7	22.6%
Grade 5	5	16.1%
Grade 4	1	3.2%
Grade 3	1	3.2%

4.2. Companies Implementation of Risk Management in their Projects

Table (2) shows the percentage of respondents' firms that implement risk management in their projects which was sixty one percent, while respondents firms that do not implement risk management in their projects was 39%.In addition, from the analysis, it was seen that the number of projects in years from the analysis is that the companies have an average of 6 projects for each company performed in a single year.

Table 2. Companies Implement Risk Management in Projects

Items	Frequency (%)
Yes	19 (61.3%)
No	12 (38.7%)
Total	31 (100%)

Table 3. Relationship between implementing risk management and amount of risk occurrence in their projects

Factors	Percentage
Companies Implement Risk Management in their Projects	61%
Percentage of Risk Faced in projects	22%
Companies do not Implement Risk Management in their projects	39%
Percentage of Risk Faced in Projects	41%

4.3. Problems in projects due to uncalculated risks

Participants were asked to specify the problems which usually faced in projects due to uncalculated risks. However, analyzed data did show that companies that have and implement risk management face 22% risks in their projects, while companies that do not implement risk management faces up to 41% risks in their projects in one year as shows in Table (3).

4.4. Risk Identifications

The questionnaire identified ten environmental risks that are facing the construction projects in general. However, based on the respondents' feedback and after analyzing the occurrences of these environmental risk factors using the Relative Importance Index (RII), "variations by the client" with (RII = 0.871) was ranked as the most significant environment risk followed by "tight project schedule" with (RII = 0.858) and unavailability of sufficient professional and managers (RII = 0.806) was ranked in the third place. The 10 Construction Environment Risk Factors ranked in descending order in Table (4).

Table 4. Ranking of environment construction risk identification factor

Risk Factors	RII	Rank
Variation by the client (VC)	0.871	1
Tight project schedule (TPS)	0.858	2
Unavailability of sufficient professionals and managers (UPM)	0.806	3
Variation of construction programmes (VCP)	0.800	4
High performance or quality expectations (HPQE)	0.794	5
Inadequate program scheduling (IPS)	0.639	6
Low management competency of subcontractors (LMCS)	0.587	7
Excessive approval procedures in administrative government departments (EAP)	0.542	8
Inadequate or insufficient site information (Soil test and survey reports) (ISI)	0.484	9
Serious noise pollution caused by construction (SNP)	0.419	10

4.5. Discussion of the survey results

The discussion was divided into three parts; each part discussing one of the objectives that this paper had investigated. With regards to the first objective which was to identify the environment related construction risk, these 10 environment construction risks were identified through and in-depth literature review. They are included (1) Tight project schedule, (2) Variation of construction programmes. (3) Unavailability of sufficient professionals and managers, (4) Excessive approval procedures in administrative government departments, (5) Variation by the client, (6) Inadequate or insufficient site information (soil test and survey reports), (7) Low management competency of subcontractors, (8) High performance or quality expectations, (9) Inadequate program scheduling, and (10) Serious noise pollution caused by construction.

Ranking of the environment risk factors facing construction projects was done based on the analysis of the responses and feedback from respondent to the research questionnaires; using the Relative Importance Index (RII) which shows the significance of each risk based on its ranking by respondents from the different firms, as below:

1. Variation by the client (RII = 0.871).
2. Tight project schedule (RII = 0.858).
3. Unavailability of sufficient professionals and managers (RII = 0.806).
4. Variation of construction programmes (RII = 0.800).
5. High performance or quality expectations (RII = 0.794).
6. Inadequate program scheduling (RII = 0.639).
7. Low management competency of subcontractors (RII = 0.587).
8. Excessive approval procedures in administrative government departments (RII = 0.542).
9. Inadequate or insufficient site information (soil test and survey reports) (RII = 0.484).
10. Serious noise pollution caused by construction (RII = 0.419).

The results of the present study corroborates the results and ranking done by Zou et al. (2007) who also identified 10 construction environment risks which they ranked according to their importance. While the present research and theirs coincided in 4 out of the five most significant factors, they differed with regards to one factor; the present study had high quality expectation as its fifth most significant factor while Zou et al. (2007) had excessive approval procedure by government administrative departments as its

fourth most significant factor. This single difference in relative importance is understandable since both studies relate to two different countries with different but similar environment risk as was observed by Chua et al. (2003)who conducted a study on East Asia cross-border construction identified five groupings of obstacles as business environment risk, regulatory restrictions, contractual arrangement, and differences in standards and culture. If the problems and/or obstacles are not solved swiftly, they can cause delays and cost overruns in projects, harm cooperative relationships, reduce efficiency, lead to claims and disputes, and probably invoke litigation proceedings". With regard to third objective of this study; which was to measure the use and implementation of risk management in construction companies and projects, 19 out of 31 total respondents representing 61.3% of the total of the respondents confirmed using risk management in their companies; while 13 out of total study sample representing 38.7% of the respondents declared that they do not apply or use risk management in their companies.

5. CONCLUSION AND RECOMMENDATIONS

While most of researches has focused on some general aspects of construction risk management, this paper endeavored to identify key environment risks associated with the achievement of all projects objectives. On the basis of the questionnaire survey with the respectable construction industry practitioners and owner's robust experience and knowledge of construction projects, 10 key risks were highlighted on a comprehensive assessment of their highly likely occurrence and level of impact on construction projects. "Variation by the client", "Tight project schedule" and "Unavailability of sufficient professionals and managers" was found to have higher relative importance index showing that they have most significant impact on construction projects. On the other hand, the results showed that most of the respondents agreed that adequate environment risk management should be carried out to mitigate the occurrence of environment risks in construction projects. This study fulfilled all the objectives for which it was embarked upon, the first objective which was to identify the environmental related risk in the construction project, the study identified 10 environmental related construction risks from literature review. In fulfilling the second objective, the respondents ranking of the identified environmental risks was subject to "Relative Importance Index" to determine the most significant of all identified risks and this was achieved successfully where, "Variations by the client", "Tight project schedule" and "Unavailability of sufficient professionals and managers" were ranked as the most significant environment risk. The third objective, which was to Measure the use of risk management in construction companies was achieved through the use of the questionnaire survey, where respondents answered based on their organization's use of risk management. And finally, with regards to the last objective of the study, which was to Measure the need for risk management in construction companies, this was achieved from the results of the findings as those companies that perform risk management had better profit margins than the companies that do not perform risk management. Based on the obtained results and conclusion, few recommendation were made which will help the professionals and companies in the construction industry better manage their construction environment risk and improve profitability, which is why every entrepreneur goes into business. The designers should ensure that clients brief are well understood and clearly defined before embarking on design as this will limit the number of changes that take place during the actual construction. Adequate planning with enough information and floats should be provided to ensure realistic schedules. The architect and engineer should ensure they carry out all necessary site investigation prior to preparing contract documents and finally, they should engage competent and proven subcontractors wherever they need to outsource any part of the work.

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