Risk management: looming the modus operandi among construction contractors in Malaysia

Othman Mohamed, Saipol Bari Abd-Karim, Nur Hazwani Roslan, Mohd Suhaimi Mohd Danuri & Norhanim Zakaria

Department of Quantity Surveying, Faculty of Built Environment, University of Malaya, 50603 Kuala Lumpur, Malaysia

Published online: 02 Dec 2014.


To link to this article: http://dx.doi.org/10.1080/15623599.2014.967928

PLEASE SCROLL DOWN FOR ARTICLE
Risk management: looming the modus operandi among construction contractors in Malaysia

Othman Mohamed, Saipol Bari Abd-Karim*, Nur Hazwani Roslan, Mohd Suhaimi Mohd Danuri and Norhanim Zakaria

Department of Quantity Surveying, Faculty of Built Environment, University of Malaya, 50603 Kuala Lumpur, Malaysia

Construction projects are commonly afflicted by risk due to their uncertainty and complexity in nature. Thus this requires the contractor to have an effective risk management approach. Previous studies revealed that there was no formal risk management being used by the contractors in Malaysia. Hence, the study concentrated on the types of risk involves during construction project, the application of risk management by contractors in Malaysian construction industry and the strategy taken by them to mitigate risks. The research conducted surveys to the contractors registered with the Construction Industry Development Board, Malaysia (CIDB). The finding shows that there is a lack of standardization in the practice of risk management. Risk management has been mandated by the company and that the application has improved project performance. Besides formal approach and educating the people to conduct risk management, it is recommended that a standardized guideline of risk management is needed to improve the application of risk management among contractors in Malaysia.

Keywords: risk management; Malaysian contractors; construction project

Introduction

The construction sector is a very important and productive sector in the Malaysian economy. It contributes between 3% and 5% to the total Gross Domestic Product (GDP) (Khan et al. 2014). As an industry, construction is made up of various components such as the client organizations, design consultants, cost consultants, developers and contractors. According to Kamal et al. (2012), the Malaysian construction industry is fragmented and is facing problems with the implementation of policy set out by the government. The government aimed for the construction industry to achieve the world-class status, innovative and knowledgeable solution provider. The government through its Ministry of Works and the Construction Industry Development Board (CIDB) has put many efforts to achieve this aim. CIDB Malaysia is a statutory body enacted under the Laws of Malaysia (Act 520). Established in 1994, CIDB coordinates all the activities and effective steps to enhance the competitiveness in the construction industry. Under this Act, no person is allowed to undertake any construction works unless he is registered and hold valid certificate of registration issued by CIDB. Contractors are entitled to be registered in particular categories of construction works such as civil engineering, building and mechanical and electrical works. Table 1 show that there are seven specified registration grades for each category, differentiated by tendering capacity.

A contractor is not entitled to undertake any construction project which exceeds the value of the construction works specified in the registration grade. From the record, there are more than 44,500 registered contractors in Malaysia (PKK 2011). One of the major roles of CIDB is to promote, stimulate and solve the important issues and problems faced in the construction industry. Thus, any failure or risk in the construction works need to be handled with the appropriate actions (CIDB 2006). Risk management is crucial to ensure the accurate decision making and planning be made on time in construction industry. Mohd Yusufan et al. (2008) assert that the Malaysian construction industry still suffers from the low awareness and application of formal risk management. The risks arise in construction projects give impacts to the project performance thus risk management is essential in influencing the successful of project performance (Siang & Ali 2012).

Risk and uncertainty is common in construction project regardless the project size (Carr & Tah 1999). According to Akintoye and MacLeod (1997), risk in construction has been the object of attention because of time and cost overruns. The construction industry is continuously faced with a variety of situations involving unknown factors. Risk management is the process of decision making that will reduce the adverse effects of risk on an organization and become as part of organization’s strategic management. The main purpose of risk management is to improve project performance (Chapman & Ward 2002) via the systematic process of identifying, analyzing and responding to the risk in order to achieve project objectives (Project Management Institute 2007). It ensures the levels of risk and uncertainty are effectively managed, so that the project is completed successfully (JKR 2008). Additionally, it also enables the participant to identify and quantify

*Corresponding author. Email: saipolbari@um.edu.my

© 2014 Taylor & Francis
all risks exposed to the project and how this risk can be managed and the likely cost of mitigation strategies (JKR 2008). It must be practical, realistic and also cost effective.

Risk is often rising more frequently during the construction phase of a project. This situation required the contractor to apply risk management in order to manage the associated risks. Starting from the awarding the contract until its completion, the contractor is responsible to manage any event or risk associated in order to achieve project objectives. Generally the project objectives are based on the three-fold constraint in project which is the time, cost and quality. Construction projects are commonly involving risk due to their nature of activities which consist of construction activities, organization and environment (Akintoye & Macleod 1997). They also claimed that construction projects can be complex and high probability of uncertainty. Flanagan et al. (2006) agreed that construction project with risk and uncertainty may lead to project failure while Loosemore et al. (2006) argued that it is impossible to have a zero risk. Studies by Olsson (2008) and Kululanga and Kuotch (2009) indicated that there is a lack of standardization and low implementation of risk management in most construction projects. It is not easy to achieve effective risk management and therefore it can be argued that a formal approach of risk management is a major challenge to influence the successfulness of the construction industry. Chapman and Ward (2002) assert that many people who are not familiar with the formal risk management approach see them as a process whose concern is just to measure the risk. As such, the important benefits of risk management approach will not be fully appreciated. Lee and Ali (2012) have highlighted that different risk management practice will have different effects on projects. Thus, it needs to be promoted among the practitioner in Malaysian construction industry in attempt to deal effectively with uncertainty and unexpected events in order to fulfil project success.

A formal approach to risk management in projects is often demanded by customers and there are varying possible approaches to choose from (Bartlett 2004). In Malaysia, formal risk management in construction projects is introduced as a proactive approach to achieve the project objectives. By applying formal risk management, it can make sure the participants will always alert and make sure their eyes open, so that they can expect the unexpected thing. A proper planning can be established in order to treat the events that could go wrong and make sure it is not affecting the ultimate success of the project (Adnan 2008).

**Risk management in construction project**

A risk is basically whatever may stand in the way to success, and is currently unknown or uncertain. Risk defined by Janjadi and Almishari (2003) as a combination of probability, severity and exposure of all hazards of an activity. This is supported by Mehr and Cammack (1961) by stating risk as the chance of injury, damage or loss. Usually, a risk is qualified by the probability of occurrence and the impact in the project, if it occurs. On the other hand, Kwakye (1997) have stated that risk is a negative impact that is unneeded in certain situation. The impact of the risk is usually predictable and can be identified. Usually risks may causes loss to the company. Based on these definitions, it can be concluded that the risk is a condition in which the proportion cannot be ascertained with precision, and it is a possibility that the results is differ from those anticipated. Its presence can also bring negative effects such as loss or destruction. No construction project is risk free. Risk can be managed, minimized, shared, transferred or accepted. It cannot be ignored (Latham 1994).

In Malaysia, the Public Works Department or known as JKR found that the adoption of formal risk management process will strategize the implementation of risk management at all levels of project management. It is also used as a planning tool as it helps to recognize the possible alternatives of a project may take to minimize damages. Risk management process by JKR (2008) is based on seven (7) sub-processes:

1. Established the context
2. Risk identification

<table>
<thead>
<tr>
<th>Registration Grade</th>
<th>Tendering Capacity Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>MYR 200,000.00 and below</td>
</tr>
<tr>
<td>G2</td>
<td>MYR 200,001.00 – MYR 500,000.00</td>
</tr>
<tr>
<td>G3</td>
<td>MYR 500,001.00 – MYR 1,000,000.00</td>
</tr>
<tr>
<td>G4</td>
<td>MYR 1,000,001.00 – MYR 3,000,000.00</td>
</tr>
<tr>
<td>G5</td>
<td>MYR 3,000,001.00 – MYR 5,000,000.00</td>
</tr>
<tr>
<td>G6</td>
<td>MYR 5,000,001.00 – MYR 10,000,000.00</td>
</tr>
<tr>
<td>G7</td>
<td>MYR 10,000,001.00 and above</td>
</tr>
</tbody>
</table>
Established the context is about knowing what is actually at risk before identifying the risk. In this phase, the organization’s aim, objectives and scope of risk management is defined together with the criteria, resource, and authorities for risk treatment are ascertained. Status of the project can be shown in several forms such as resource usage, equipment, requirements, budget availability, stakeholder involvement, contract deliveries, strategic goals and schedule (Ahmed et al. 2007).

The risk identification stage reveals an organization’s possible risk. It provides basic information for the right future works of the organization regarding the evolving and the application of new programs for the risk control (Tchankova 2002). The method used for risk identification differs among organizations because of the different culture and practices. Furthermore, Chapman (1997) asserts that the list of risk should incorporate the identified risk together with its response method to be able for it to be considered deliverable. On the other hand, Cervone (2006) view risk identification as a team work which detecting various risk categories and selecting those which could have negative impact on the project. There are various techniques can be used during risk identification process which include brainstorming, Delphi technique, expert interview, checklists, decision tree analysis, flowchart, and etc. However, based on previous research done, there are several techniques used in risk identification. The most effective methods to identify the risk are personal experience, brainstorming and judgment made from project manager (Baker et al. 1999). The other tools proposed by researcher, Lyons and Skitmore (2004) are case-based approach, checklist, flowcharts, influence diagram and questionnaires. However, the most common risk identification technique used is checklist (Simister 1994). The better the understanding of the sources, the better the outcomes of the risk assessment process and the more meaningful and effective will be the management of risks. This paper is only focusing on only several tools that are mainly acknowledged by the contractors in past research such as brainstorming, analysis from previous project (case-based approach), checklist and forecasting.

1. **Brainstorming**

Brainstorming is a term used to define a group session or attempt to gather as many ideas and possible solutions to a problem (Boussabaine & Kirkham 2004). The outcome is usually depends on the objectives of the discussion and the individuals participating the session. A successful brainstorming session is highly depends on the capability of the leader to bring out the ideas and viewpoints of the participants and discover those ideas into great detail. As a result of a successful brainstorming session, a solid action plan which can be implemented, analyzed and assessed will be presented at the end of the session. Most of the time, brainstorming session is carried out as part of the standard project meetings. Every participant may give out ideas on the risk available at every stage of the construction project. The leader play an important role to control the session and making decision to determine which opinion given by the group members to be accepted either by attaining the majority vote or by using veto power. Moreover, it is a responsibility of the leader to ensure that the discussion is only involves the relevant topic. All identified risks will be recorded and compiled in a file.

2. **Case-based approach (analysis from previous project)**

Case-based approach is a problem-solving model that solves a new problem based on a previous similar situation and by reusing information and knowledge of that situation (Aamodt & Plaza 1994). Usually this approach is rarely done by practitioner in the construction industry because it is very time consuming. It is a method that learned from previous experience and solve similar problem by referencing earlier solution. It searches the relevant information to find similar previous projects, reuses the risks identified, and revises these risk lists to come up with suggested risks for the current project in question. Human expertise is needed to review this preliminary suggestion, and then a new final report of identified risk for the current project is generated.

3. **Checklists**

This is a trivial method for identification of risk where pre-determined crucial points are examined for symptoms of potential risk situation (Webb 1994). Basically this method is usually developed based on historical information and previous project experience. As for the current project is similar in nature with the previous one, list of risks should be compiled.
This will allow the previous risks to be converted to a checklist on future projects. However, this method may miss out some of the important risk because it is not possible for a single checklist to be exhaustive source or all projects. The checklist can be improve at the end of the process by adding the newly identified risks or modifying old ones if need be.

4. Forecasting

In order to identify quantifiable risks and opportunities, forecasting technique has been widely used. It predicts future trends by analyzing and evaluating past information. Life cycle cost of building components is one of the examples that can be forecast by using discounted cash flow techniques (Loosemore et al. 2006).

According to Loosemore et al. (2006), forecasting method has three (3) main types:

a. Extrapolate forecasts: based upon the trust that history recurrences itself.

b. Causal forecasts: based on using cause and effect relationship to predict the picture.

c. Normative forecasts: undertake that people take an active role in determining the future and try to take their goals and values into account when forecasting it.

Even though this forecasting method is useful in identifying trends, however Loosemore et al. (2006) has listed down numbers of limitation of this technique. They are:

a. The quality of historical data and records kept by an organization is very important because this technique is highly dependent upon this data. For example, haphazard record keeping means haphazard forecast.

b. It is very useful in identifying trends not for identifying specific event.

c. It is unable to explore or identify unique problems that have never happened before. Only limited to previously identified risks.

d. It is agreed by many that numerous assumption is made by managers in making forecasts which may resulted in bias predictions and self-fulfilling prophecy.

Risk analysis is conducted after the identification of risks to regulate their characteristic whether they are worth for further analysis or not (Ahmed et al. 2007). At this stage, the identified risk is assigned with a significant rating to help in better understanding the possible impact to the project and its likelihood of occurring. Standard Australia (2004) stated that risk analysis helps the business owner in making decision about priorities and treatment. There were various types of risk analysis tools to evaluate the identified risks. A correct approach selected will be dependent upon project size, type and opportunity (Ashworth 1999).

Risk evaluation determined which action plan is better to be implemented. However, the evaluation stage is depending on the number of risks detected. According to Standards Australia (2004), when there are only a few risks, the evaluation stage become simple, but if the situation are complex, then the evaluation process become difficult. The organization will have to decide whether to accept or reject a risk based on the assessment conducted. An acceptable risk is one that the organization believes that they can be managed effectively while unacceptable risk is the one that gives huge impact on the project and cannot be monitored or managed effectively (Ahmed et al. 2007).

Risk treatment is the most important phase in risk management process (Ahmed et al. 2007). The risks that are worth for further investigation due to their impact to the project are treated by the risk mitigation plan. Ahmed et al. (2007) explained that risk can be treated either through proactive approach or through reactive approach. Proactive approach refers to an action initiated based on chance of the occurrence of certain risks while reactive approach refers to action initiated after the eventuation of the risks event (Ahmed et al. 2007). In order to manage risk effectively, it may necessary to adopt a combination of strategies to treat it (JKR 2008). The selection process is iterative until the most effective treatment strategy is developed. Standards Australia (2004) identifies the following options for the treatment of risks:

(1) Reduce the likelihood
(2) Reduce the impact
(3) Transfer the risk
(4) Accept the risk
(5) Avoid the risk

According to the Australian Risk Management Services Guidelines (2011), monitoring and review is very much similar with communication and consultation. Often this step is not given full attention and attention which makes risk
management programs become irrelevant and ineffective over time. This step ensures that all information generated by risk management process is captured, used and maintained throughout the construction period. All identified risk must be monitored including the new risk and their impact on the construction project must be taken into account. Operating environment will determine the review period but however, it is normally taken by the industry as a norm is every five (5) years. This stage is important to validate that the risk management process and the documentation whether it is still valid or not anymore.

Communication and consultation are vital to the whole risk management process. It may lead to the effectiveness of risk management process adopted by the contractors which normally depends on involving the right people at the right time and ensuring they understand, involved and contribute to the process (Risk Management Services 2011). In terms of consultation, it is a process that makes use of communication to decide an effective decision. It gives participants a chance to influence decisions and an effective way to obtain beneficial input and make sure that all appropriate viewpoints are taken into account in identifying and evaluating the risks.

**Types of risk**

Edward and Bowen (1998) classified into two categories; natural risk and human risk. Natural risk occurs beyond the control of the parties involved or organizations. It is defined as an act of god and has been divided into geology system and

![Image of Risk Classification](image-url)
weather system (Edward & Bowen 1998). Meanwhile, human risk arises in the system where it can be controlled by human
and not by nature. Although this risk cannot be avoided, but they can be controlled easily compared to inherent risks.
Human risks are including social risk, political risk, economic and financial risk, legal risk, health and safety risk, manage-
ment risk and technical risk.

Research problems
According to Mohd Yusuwan et al. (2008), construction projects in Malaysia involves high risk and the level of construc-
tion risk during construction phase is considered much higher than other types of economic activities. This research is
driven by the following questions: ‘what are the risks that are most likely to occur and will impact the construction proj-
et?’ and ‘what are the current practices adopted by the contractors during construction project to manage the risks and
to reduce the impact to their projects?’ Based on the literature reviews conducted, a formal risk management process have
been introduced in Malaysia but, most of them are ill structured and not being implemented in formal manner (Adnan
2008). Risk management is one of the new management concept and requires longer time to be accepted by participants in
this industry because most of them are reluctant to change and comfortable with their traditional culture (Lee & Ali 2012).
This is because of the limited skills and lack of knowledge to develop strategy to mitigate the risk (Adnan 2008). More-
over, there is still low awareness among the Malaysian construction industry’s participant about the application of risk
management (Mohd Yusuwan et al. 2008). Therefore, a formal risk management application is needed by the Malaysian
contractors as a planning tool to identify the possible alternatives a project may take to avoid or minimize damages (JKR
2008).

Methodology
The objectives of this research are to explore the risk associated during construction; to examine the application of risk
management during construction and; to assess the strategies taken by the contractors in managing risk during construc-
tion. In achieving these objectives, the research was conducted into 4 stages; preliminary stage, information gathering
stage, analysis stage and final stage. The research problems were identified and the aims and objectives were established at
the preliminary stage. During the information gathering stage, all the information was collected through literature reviews,
questionnaire survey and interviews. The questionnaire survey consists of 18 questions and was categorized into four sec-
tions comprising closed-ended and open-ended questions. The questionnaire is answered in the form of checklist and Lik-
ert scale and was distributed by email and by hand. The respondents are selected among Malaysian contractors registered
with Construction Industry Development Board, Malaysia (CIDB) with G7 grade; registered within the Federal Territory
of Kuala Lumpur based on the CIDB directory; and those with at least five years of experiences in managing projects. The
G7 grade contractors are chosen due to the high tendering capacity which allows them to be involved with large construc-
tion projects which deemed to have more risks.

Based on the CIDB’s registration record, there are 1915 of G7 contractors registered in the Federal Territory. Due to
the limitation of time in conducting this research, only 116 active local contractor companies with business office in Kuala
Lumpur are selected according to CIDB Directory of Contractors. The questionnaire surveys were sent by email as well as
hand delivered to the quantity surveyors, engineers, architects, project managers involved in the construction projects. The
respondents are given one week to answer the survey.

The questionnaire survey was designed based on the literature review of this research. The survey consists of four sec-
tions. Section A is about the demographic and background of the respondents and Section B asks for the types of risk
involved during construction. Meanwhile, Section C focuses on the approaches to risk management and Section D consists
of questions relating to the methods used to manage and mitigate the risks.

The collected data are analyse by using Statistical Package for Social Science (SPSS). Methods used in analyzing
these data are mean, one sample t-test, Cronbach’s Alpha and frequency table. The questionnaire is developed using four-
point Likert scale ranging from ‘strongly agree’ (1) to ‘strongly disagree’ (4) to measure the individual’s survey form for a
particular question depended on the weightage average of the frequency which is called Likert Score. This method pro-
vides the mean for each option given thus will be easily to analyse by comparing the results. One sample t-tests is used to
test whether the mean for a variable has a particular value. It is also used to test whether the various categories variables
identified earlier were significant in the questions analysed. The test value is set at 1.0 which is mean population used to
compare the mean of variables. The way to interpret the results of the t-test is to compare the test significant level against
the level of significant, which was set at 0.05 at 95% confidence level. Cronbach’s Alpha is a test conducted to analyze the
reliability of the data. The reliability analysis procedure calculates a number of commonly used measured of scale reliabil-
ity and also provides information about the relationships between individual items in the scale. According to Nunnaly
(1970), a value of 0.70 or greater generally indicated a reliable instrument. Displaying frequency tables for variables helps to understand how many respondents are in each level of a variable and how much missing data of various types is involved. For nominal variables, most descriptive statistics are meaningless. Thus, having a frequency table is usually the best way to understand your nominal variables. The findings from analysis are discussed next.

**Findings**

From the 116 questionnaires distributed to the respondents, 38 or 44% of them were returned. Thirty-four sets of questionnaire were collected by hand while four of them were received by email. One of the returned questionnaires is incomplete which made the total valid questionnaires to be 37. The low-response rate were due various factors such as some of the company had moved; no longer in operation as contractor’s firm; and simply do not accept any conducted survey.

The respondents were asked on the types of risks associated during the construction of project and their impact towards construction time and cost. The mean score is used to show the probability of risk from happening during construction project.

Table 2 shows the results of the main risks encountered by the respondents during the construction of the project. Safety and health risk has highest possibility to happen during the construction with mean score of 2.24 while weather and political risks have the lowest possibility to happen during construction project with mean score of 2.89, respectively.

Meanwhile, Table 3 indicates the results of the risk impact towards construction time which resulted financial risk as the highest impact with mean score of 1.97, left the political risk as the lowest impact with average mean score of 2.61.

In the meantime, the results of risk impact towards the construction cost are tabulated in Table 4. Financial risk has the highest impact with a mean score of 1.95, followed by technical risk (2.11), management risk (2.16), legal risk (2.34),...
weather risk (2.45), safety and health risk (2.47) and political risk (2.57). Economic risk scores the highest, which is 2.61, indicating that it has the lowest impact towards construction cost.

The respondents were also asked on their application of risk management during construction project by their company. The aim is to identify how formal is risk management being applied by the company. The result shows that not all risk management process is applied during construction project. Generally, the application of risk management is very much dependent on the management of the respondent’s company. Table 5 narrates that the application of risk management is important for companies that was established for more than 10 years with total response of 54 followed by 3 to 6 years of establishment (24.3%), 7 to 10 years (18.9%) less than 3 years (2.7%). On the other hand, the top three (3) methods of risk management process in respondent’s company were very significant on risk identification, followed by risk treatment and risk evaluation. This shows a proper risk management process is implemented company with more experiences in managing project. Additionally, the respondents were asked to identify how frequent is the method of risk identification is being used by their company.

The results obtained from the Table 6 shows that brainstorming and analysis of historical data is the most preferred method with mean score of 1.68 and 2.03 respectively. On the other hand, industrial checklist is the least preferable method to identify risk with mean score of 3.16.

The respondents were also asked questions relating to the problems in implementing risk management and the results are tabulated in Table 7. Majority of the respondents recognized the lack of competent workers in identifying the risk at early stage as the most common problem, followed by lack of sufficient data of on-going project. Increase in cost and time consuming were the least significant problem to the respondents in implementing risk management.

Meanwhile, Table 8 indicates the strategy taken by the respondent in managing risk. The research found that the most frequent method used for risk response is by reducing the risk likelihood from happening with mean score of 1.89. Next is reducing the risk impact (1.95), followed by avoiding or refusing the risk (2.11), and transferring the risk (2.32). Accepting the risk is found to be the least frequent method of risk response.

Table 4. The impact of risk towards construction cost.

<table>
<thead>
<tr>
<th>Category</th>
<th>Types of risk</th>
<th>1 High Impact (N)</th>
<th>2 Average (N)</th>
<th>3 Low Impact (N)</th>
<th>4 Never (N)</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Risk</td>
<td>Finance risk</td>
<td>13 (33.3)</td>
<td>16 (41)</td>
<td>7 (17.9)</td>
<td>2 (5.1)</td>
<td>1.95</td>
</tr>
<tr>
<td></td>
<td>Technical risk</td>
<td>8 (20.5)</td>
<td>18 (46.2)</td>
<td>12 (30.8)</td>
<td>0 (0)</td>
<td>3.11</td>
</tr>
<tr>
<td></td>
<td>Management risk</td>
<td>5 (12.8)</td>
<td>22 (56.4)</td>
<td>11 (28.2)</td>
<td>0 (0)</td>
<td>2.16</td>
</tr>
<tr>
<td></td>
<td>Legal risk</td>
<td>1 (2.6)</td>
<td>25 (64.1)</td>
<td>10 (25.6)</td>
<td>2 (5.1)</td>
<td>2.34</td>
</tr>
<tr>
<td>Natural Risk</td>
<td>Weather system</td>
<td>3 (7.7)</td>
<td>17 (43.6)</td>
<td>16 (41)</td>
<td>2 (5.1)</td>
<td>2.45</td>
</tr>
<tr>
<td>Human Risk</td>
<td>Safety risk and health</td>
<td>2 (5.1)</td>
<td>17 (43.6)</td>
<td>18 (46.2)</td>
<td>1 (2.6)</td>
<td>2.47</td>
</tr>
<tr>
<td></td>
<td>Political risk</td>
<td>2 (5.1)</td>
<td>14 (35.9)</td>
<td>19 (48.7)</td>
<td>2 (5.1)</td>
<td>2.57</td>
</tr>
<tr>
<td></td>
<td>Economic risk</td>
<td>1 (2.6)</td>
<td>15 (38.5)</td>
<td>20 (51.3)</td>
<td>2 (5.1)</td>
<td>2.61</td>
</tr>
</tbody>
</table>

Table 5. Cross tabulation between risk management process and company years of establishment.

<table>
<thead>
<tr>
<th>Risk Management process</th>
<th>Less than 3 years</th>
<th>3–6 years</th>
<th>7–10 years</th>
<th>More than 10 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Identification</td>
<td>2.7%</td>
<td>21.6%</td>
<td>10.8%</td>
<td>51.4%</td>
<td>22.7%</td>
</tr>
<tr>
<td>Risk treatment</td>
<td>2.7%</td>
<td>18.9%</td>
<td>13.5%</td>
<td>51.4%</td>
<td>22.7%</td>
</tr>
<tr>
<td>Risk evaluation</td>
<td>0%</td>
<td>18.9%</td>
<td>10.8%</td>
<td>35.1%</td>
<td>17.0%</td>
</tr>
<tr>
<td>Monitoring and Review</td>
<td>2.7%</td>
<td>8.1%</td>
<td>5.4%</td>
<td>35.1%</td>
<td>14.2%</td>
</tr>
<tr>
<td>Risk analysis</td>
<td>2.7%</td>
<td>8.1%</td>
<td>2.7%</td>
<td>21.6%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Communication and consultation</td>
<td>2.7%</td>
<td>8.1%</td>
<td>5.4%</td>
<td>13.5%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Establish context of risk</td>
<td>2.7%</td>
<td>5.4%</td>
<td>5.4%</td>
<td>10.8%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Total</td>
<td>2.7%</td>
<td>24.3%</td>
<td>18.9%</td>
<td>54%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 9 below shows the opinion among respondents regarding the results after implementing risk management process in their construction project. It shows that majority the respondents (89.5%) indicate that risk management provides effective results towards achieving project objective and only 10.5% of the respondents reported that risk management did not contribute on the achievement of the project objective.

The respondents were also asked on the barriers in implementing risk management by the contractors. The research found that lack of knowledge about risk management, ineffective of risk identification strategies and lack of familiarity with the risk management process top three (3) barriers in implementing risk management (refer Table 10). They were

Table 9. Results of application of risk management towards project objectives.

<table>
<thead>
<tr>
<th>Results</th>
<th>Frequency (N)</th>
<th>Percentage (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very effective</td>
<td>5</td>
<td>13.2</td>
<td>3</td>
</tr>
<tr>
<td>Effective</td>
<td>24</td>
<td>63.1</td>
<td>1</td>
</tr>
<tr>
<td>Slightly effective</td>
<td>5</td>
<td>13.2</td>
<td>2</td>
</tr>
<tr>
<td>Not effective</td>
<td>4</td>
<td>10.5</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 6. Methods of risk identification.

<table>
<thead>
<tr>
<th>Rating of respondents</th>
<th>(N)</th>
<th>%</th>
<th>(N)</th>
<th>%</th>
<th>(N)</th>
<th>%</th>
<th>(N)</th>
<th>%</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>19</td>
<td>48.7</td>
<td>14</td>
<td>35.9</td>
<td>3</td>
<td>7.7</td>
<td>2</td>
<td>5.1</td>
<td>1.68</td>
<td>1</td>
</tr>
<tr>
<td>Analysis</td>
<td>11</td>
<td>28.2</td>
<td>17</td>
<td>43.6</td>
<td>8</td>
<td>20.5</td>
<td>2</td>
<td>5.1</td>
<td>2.03</td>
<td>2</td>
</tr>
<tr>
<td>Forecasting</td>
<td>1</td>
<td>2.6</td>
<td>14</td>
<td>35.9</td>
<td>22</td>
<td>56.4</td>
<td>1</td>
<td>2.6</td>
<td>2.61</td>
<td>3</td>
</tr>
<tr>
<td>Industrial Checklist</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>23.1</td>
<td>14</td>
<td>35.9</td>
<td>15</td>
<td>38.5</td>
<td>3.16</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 7. Problems faced by contractors in applying risk management in their company.

<table>
<thead>
<tr>
<th>Problems</th>
<th>Frequency (N)</th>
<th>Percentage (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of competent worker in identifying risk at early stage</td>
<td>26</td>
<td>38.8</td>
<td>1</td>
</tr>
<tr>
<td>Lack of sufficient data of on-going project</td>
<td>16</td>
<td>23.9</td>
<td>2</td>
</tr>
<tr>
<td>No proper guidelines or standard procedure</td>
<td>13</td>
<td>19.4</td>
<td>3</td>
</tr>
<tr>
<td>Time consuming</td>
<td>8</td>
<td>11.9</td>
<td>4</td>
</tr>
<tr>
<td>Increase overall cost</td>
<td>4</td>
<td>6.0</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>100</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 8. Tools and techniques for risk response.

<table>
<thead>
<tr>
<th>Tools/ Techniques for risk response</th>
<th>1 Often</th>
<th>2 Sometimes</th>
<th>3 Seldom</th>
<th>4 Never</th>
<th>Mean</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of respondents</td>
<td>(N)</td>
<td>%</td>
<td>(N)</td>
<td>%</td>
<td>(N)</td>
<td>%</td>
</tr>
<tr>
<td>Reduce the likelihood</td>
<td>16</td>
<td>41</td>
<td>13</td>
<td>33.3</td>
<td>4</td>
<td>10.3</td>
</tr>
<tr>
<td>Reduce the impact</td>
<td>16</td>
<td>41</td>
<td>11</td>
<td>28.2</td>
<td>6</td>
<td>15.4</td>
</tr>
<tr>
<td>Avoid/ refuse the risk</td>
<td>18</td>
<td>46.2</td>
<td>11</td>
<td>28.2</td>
<td>6</td>
<td>15.4</td>
</tr>
<tr>
<td>Transfer the risk</td>
<td>7</td>
<td>17.9</td>
<td>16</td>
<td>41</td>
<td>9</td>
<td>23.1</td>
</tr>
<tr>
<td>Accept the risk</td>
<td>2</td>
<td>5.1</td>
<td>6</td>
<td>15.4</td>
<td>24</td>
<td>61.5</td>
</tr>
</tbody>
</table>

Table 9 below shows the opinion among respondents regarding the results after implementing risk management process in their construction project. It shows that majority the respondents (89.5%) indicate that risk management provides effective results towards achieving project objective and only 10.5% of the respondents reported that risk management did not contribute on the achievement of the project objective.

The respondents were also asked on the barriers in implementing risk management by the contractors. The research found that lack of knowledge about risk management, ineffective of risk identification strategies and lack of familiarity with the risk management process top three (3) barriers in implementing risk management (refer Table 10). They were
also asked on the implementation of risk management in the Malaysian construction industry. The results in Table 11 show that 20 respondents (51.3%) said that it is good while only 1 respondent (2.6%) indicated that it is excellent. On the other hand, 11 of them said it is fair (28.2%) and another 5 (12.8%) mentioned that the implementation of risk management is still poor.

Table 10. Barriers in implementing risk management among contractor’s company.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Frequency (N)</th>
<th>Percentage (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of knowledge about risk management</td>
<td>22</td>
<td>26.5</td>
<td>1</td>
</tr>
<tr>
<td>Ineffective of risk identification strategies</td>
<td>21</td>
<td>25.3</td>
<td>2</td>
</tr>
<tr>
<td>Lack of familiarity with the process</td>
<td>15</td>
<td>18.1</td>
<td>3</td>
</tr>
<tr>
<td>Lack of support from top management</td>
<td>8</td>
<td>9.6</td>
<td>5</td>
</tr>
<tr>
<td>Difficulty in seeing the benefits</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 11. Implementation of risk management in the Malaysian construction industry.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Frequency (N)</th>
<th>Percentage (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>1</td>
<td>2.6</td>
<td>4</td>
</tr>
<tr>
<td>Good</td>
<td>20</td>
<td>51.3</td>
<td>1</td>
</tr>
<tr>
<td>Fair</td>
<td>11</td>
<td>28.2</td>
<td>2</td>
</tr>
<tr>
<td>Poor</td>
<td>5</td>
<td>12.8</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Discussion on the findings

Based on the results, it is apparent that not all contractors are actually implementing a formal risk management in their company. Formal risk management is used by companies with high reputation, stable financial status and involved in huge construction projects only. This is in accordance with Mohd Yusuwan et al. (2008), stated that only a small number of companies applied risk management in the process of construction activities. The highest possibility of risk to occur during construction project is safety and health risk, which demonstrates that the construction site is an accident prone area. Among most popular accident at construction site are falling from height, excavation accidents, being struck by falling object, electrocution and mishandling machines. The lowest possibility of happening is weather risk. This is because of Malaysia is located in tropical region with two seasons all the year, wet season and dry season.

Financial risk has the most significant impact towards construction time and cost while political risk and economic risk have the least impact. Financial risk usually associated with the delay in payment for claims, cash flow difficulties and lack of financial resources which may cause the contractor to have problems in completing the project. Edwards and Bowen (1998) has indicated that in the construction industry, the financial effect is in linear with the project duration. Meanwhile, political risk and economic risk hardly ever happened in Malaysia and therefore the construction industry is not affected.

Based on the analysis, the research found that risk management process consists of five activities namely, risk identification, risk analysis, risk evaluation, risk treatment and monitoring and review. This result is significant to the construction industry because it reveals that the current understanding and practise of risk management is found to be different from what JKR is practicing for public projects. JKR (2008) produces a formal risk management process which contains seven sub-processes namely, communication and consultation, establish the context, risk identification, risk analysis, risk evaluation, risk treatment, and monitoring and review.

It was also found out that the common practice of risk identification methods are brainstorming and analysis of historical data from previous project. Brainstorming is one of the most effective methods of identifying risk specified by Baker et al. (1999). The least popular method used is industrial checklist, an utterly contrary with the one suggested by Sinister (1994).

On the other hand, most of them adapt reducing the likelihood and impact technique in treating identified risk. Another common method used is avoiding the risk if only the risk can be identified at the early stage. Risk identification is a
continuous process and conducted for the whole of construction project duration. A team member of risk management is being selected at the early stage and usually consists of individuals with interests on the project. Brainstorming session is being carried out by identifying as many risks as possible and risk which might have significant impact towards construction project will be evaluated for further investigation. However, due to the complex nature and uniqueness of a project, risk happened during past project may not help much as references in identifying future risk for a new project.

The results of the analysis revealed that the main problem in applying risk management is lack of competent workers in identifying risk at early stage due to several barriers. Being a relatively new management concept in the Malaysian construction industry (Mohd Yusuwan et al. 2008), the main barrier to implement risk management are lack of knowledge and ineffective of risk identification strategy. Insufficient knowledge among practitioner is because Malaysian construction industry players do not reveal such urgency in application of risk management. Besides, contractors are unwilling to apply risk management in order to lessen the operational cost of projects. The awareness among contractors on benefits and importance of risk management is relatively low.

Risk management should be applied at early stages of a project where the major decisions were usually made (Eskesen et al. 2004). The benefits of the risk management process comprise identifying and analyzing risks, enhancement of construction project management developments and effective use of resources. It also prevents additional costs and potential for budget overruns due to unforeseen events (JKR 2008).

Conclusion
This research is conducted with a defined scope and limitation. It only covers the G7 grade contractors registered with CIDB in the Federal Territory of Malaysia. The analysis presented here does not attempt to generalize its findings to populations beyond the scope. This research discovers that construction project always involves with risks due to their complex and dynamic nature. Construction site is the most dangerous work place which usually involving heavy machinery, height and accident. These factors have caused safety and health risk to happen every time the construction process is carried out. However, the risk can be forecasted at an early stage which enables the contractors to take action to mitigate or to prevent it from happening. It is apparent that political and economical risks have the least impact to the construction projects compared to the financial risk, which has significant impact towards construction time and cost. Financial risk may cause the construction budget burst and might delayed the project completion.

From the analysis, it can be concluded that there are five common processes in risk management: identification, analysis, evaluation, treatment and monitoring and reviewing. Additionally, it is commonly held that reducing the likelihood and impact of the risk as well as avoiding the risk are the best risk treatment methods. The research also concluded that there is no formal guideline being adopted by the contractor in managing risk. Most of them do not implement the whole process of risk management and do not carry out an adequate process of reporting, reviewing, and monitoring activities. These issues are driven by the lack of knowledge of risk management which resulted to the unwillingness to implement the processes.

Therefore, in achieving the project objectives successfully and dealing with uncertainty and unexpected events effectively, risk management must remain to be a major characteristic of the project management in construction. It must be carried out at the early stages of a project where the major decisions were made and the Malaysian Government should make it mandatory to implement risk management not only for the government projects but also private projects for a better future.

References
Constr Archit Manage. 5:339–349.
Group No. 2-1. 19:217–237.
linked to numerical scores. Eng Constr Archit Manage. 17:336–351.
Latham, M. 1994. Constructing the team: final report of the government/industry review of procurement and contractual arrangements in
the UK construction industry. The Stationery Office, London.
(UK): Taylor and Francis.
1:51–61.
Project Management Institute.
Yusuwan, NM, Adnan, H, Omar, AF, Jusoff, HK. 2008. Clients’ perspectives of risk management practice in Malaysian construction