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Analysis of Risk Probability in Design and Build Projects in Malaysian Construction Industry

Sabihah Saaidin¹, Intan Rohani Endut¹, Siti Akmar Abu Samah², and Ahmad Ruslan Mohd Rizduan¹

¹Faculty of Civil Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia, ²Academy of Language Studies, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

Corresponding email: sabihah@ymail.com

Article Information

Keywords

Risk Probability, Design and Build, Contractors, Descriptive Statistics.

Abstract

The aim of this study is to identify and analyze the probability of risk occurrence in design and build (DB) project on contractors perspective that affecting Malaysian construction industry. Managing risk in DB project has been recognized as a very important process in order to achieve project objective in terms of time, cost, quality, safety, environmental sustainability and customer satisfaction. The questionnaire was prepared and formulated by seeking the previous literature review in the area of DB construction management. The data were collected from the experienced personnel in DB construction project with sample amount of experience. A total of seventy eight (78) usable questionnaires were received from respondents (contractor) and analyzed using descriptive statistics in SPSS software. Armed with this information, the risk probability analyzed and which create awareness to all stakeholders' (owner, consultant and contractor) the important of implementation risk management plan in DB projects.

INTRODUCTION

Risks are inherent to any of construction projects. The success or failure of any venture depends on how risk can dealt with. Design and build (BD) project also considered to be subject to more risk than other industries. This is because of the complexities and uniqueness of design and construction process. Design and build procurement contract transfer more risk to the contractor than any other procurement in construction industry. In Malaysia, most of contractors have developed a series of 'rules of thumb' that they applied when dealing with risks (Takim et al., 2013). These generally rely on the contractor's judgment, experience and knowledge of the construction projects. The suitability of a DB project approach must be carefully undertaken by ensuring the contractor is able, willing and has relevant experiences to control the risk satisfactorily; otherwise they may pass these back to the client (Holt et al., 1995).

Common risks faced in construction projects generally include; changes in work, delayed payment on contract, financial failure of owner, labor disputes, equipment and material availability, productivity of labour, defective materials, productivity of equipment, safety, poor quality of work, unforeseen site conditions, financial failure of contractor, political uncertainty, changes in government regulations, permit and ordinances, delay in resolving litigation/arbitration disputes, inflation, cost of legal process and force majeure and etc. (Ogunsanmi et al., 2011).

In 2005, about 17.3% of 417 government project in Malaysia were reported to be delayed for more than 3 months (Sambasivan & Soon, 2007). While, Abdul-Rahman et al. (2006) reported that many project in Malaysia suffering with time and cost overrun during the construction phase. Some of the clients claimed that the DB procurement methods are subjected to poor quality of projects services (Preece and Tarawnah, 1997).

A survey conducted by Ling and Chong (2005) reported that service performance of contractor's is still lacking in DB projects. They recommended that in order to succeed, the DB contractor should capable tackle the risk in aspects of design and construction. Therefore, this study is to identify and analyze probability of risk occurrence that impacted of DB project in Malaysian construction industry.

LITERATURE REVIEW

Design and Build (DB) contracting is a project delivery method in which the owner provides information and awards for both the design and construction phases of a project by combining into one responsible entity to carried out the projects (Ndekugri and Turner, 1994, Akintoye, 1994, and Akintoye & Fitzgerald, 1995). The DB project approach has been identified to be rapidly growing and patronized in the global construction industry either Malaysian or others country. This is due to the several benefits an approach provides in the DB project itself. The benefits of DB project is offering single point responsibility, projects cost savings without sacrificing quality, schedule reduction, enhanced communication, reduced litigation associated with project delivery and risk and costs associated to design errors and omission transferred from owner to DB contractor that is best able to manage the risk (Elvin, 2003 and Saaidin et al., 2016a). However, DB is still perceived to be subjective and complicated. It is because the client is still skeptical and hesitant (Saaidin et al., 2016b).

In addition, by adopting of this DB procurement contract the most contractors in developing countries especially Malaysia is not familiar and insufficient experience to handle project effectively and could lead to the project risk. The growing of risk factors is adversely affecting the time, cost and quality of Design and Build construction projects. Risk can be defined as the event that positive to negative affects the project objectives. Risk is exposure to the consequences of uncertainty.

According to Azizan & Ibrahim, (2015), a DB project has been classified as the most risky project. This is because combination of design activities and construction process, on site supervision and participation in the actual construction project by the contractor and client exposed to a high degree of risks.

Risk management process is the best development process within industries where a high level of technical risk involved (Maylor, 2003). It will minimize losses from the occurred risks and transfer into opportunities which can generate a profit margin to the contractor. Risk management only provides an expectation of the risk involve but the implementation varies depend on project size and size of organization.

The risk source allocation technique can often be difficult to understand and it frequently associated with a high level of personnel to determine. There have several techniques in identification of risk as such brainstorming, checklist, risk register and etc.

SIGNIFICANCE OF THE STUDY

The main objective of this study is to identify and analyse the possible probability of risk occurrence in DB projects by seeking opinion from experiences contractor's perspective in Malaysian construction industry. To spread awareness to all stakeholders the important of implementation risk management plan in DB projects.

RESEARCH METHODOLOGY

The study was begins with understanding of risk management process and characteristic of DB projects. A comprehensive list of sixty four (64) risks factor has been identified and the questionnaires were prepared on probability of risk occurrence. The data were collected from the contractors registered with CIDB (Construction Industry Development Board) and directly involved with design and build projects. These respondents were selected because their strength and experience in DB projects. The data was received by mail and by personnel meeting. The questionnaires were tested with a pilot survey for clarity, understanding and value of the information that could be gathered. The respondents were done from Project Director, Project Manager, Contract Manager, Design Manager, Construction Manager, Project Engineer, Quantity Surveyor and Site Supervisor.

The questionnaires were designed based on preview literature review and knowledge discussion and to review comprehensively with all risk probability are likely to be encountered in design and build construction projects.

The questionnaire survey is divided into two parts. The first part consists with of general information likes background of respondents, experiences, positions, type of project involve and etc., the second part consists of the probability of occurrence of risks in design and build projects. A total of hundred questionnaires were sent out, and out of which seventy eight respondents were received. Thus, the response rate is 78% which is considered a good response in this type of survey. A Likert scale of 1-5 was used in the questionnaire. The scale for risk probability ranged from 1 (low), 2 (slightly low), 3 (medium), 4 (slightly high) and 5 (high). These Likert scales were produced by Rensis Likert in 1932. The results were analysed by using descriptive statistics in SPSS software.

RESULTS AND DISCUSSION

General Information

Seventy eight (78) of the structured questionnaires survey was received from the group G7 contractors involved in DB project in Malaysia construction industry. To ensure the validity of the study, the information of respondents was gather from the respondents’ working position and years of experience. The main roles and functions reported were Project Directors and Project Managers, which represented as respondents. Project Directors representing 9% of the respondents, followed by Project Managers at 17.9%, Construction Manager at 7.7%, Contract Manager was represented at 25.6%, Design Manager at 2.6%, Project Engineer at 14.1%, Quantity Surveyor at 19.2% and site supervisor was represented at 3.8% respectively.

Five categories related to the respondents’ years of experience were used in this study; < 5, 6-10, 11-15, 16-20 and > 20 years or more. Respondents with less than 10 years of experience constituted approximately 30% and the remaining more than 10 years of experience constituted approximately70% which implies that they are sufficiently knowledgeable in construction industry to answer the questions shown in Table I.

TABLE I
GENERAL INFORMATION PERCEIVED BY RESPONDENTS

Item	General Information		
	Description	Frequency	Percentage (%)
<u>Respondent Working Position</u>			
1	Project Director	7	9.0
2	Project Manager	14	17.9
3	Construction Manager	6	7.7
4	Contract Manager	20	25.6
5	Design Manager	2	2.6
6	Project Engineer	11	14.1
7	Quantity Surveyor	15	19.2
8	Site Supervisor	3	3.8
	Total	78	100.0
<u>Respondent working Experience</u>			
1	< 5 years	11	14.1
2	6 – 10 years	12	15.4
3	11 – 15 years	10	12.8
4	16 -20 years	1	1.3
5	> 20 years	34	43.6
	Total	78	100.0

Probabilities of Risk Occurrence in Design and Build (DB) Project

Table II shows the results on the descriptive statistical analysis on probability of risk occurrence in design and build (DB) projects. The results only discussed the top eleven probabilities of risk occurrence that will impact to the DB projects including (1) client financial capability, (2) inadequate cash flow by contractor, (3) lack of payment (delayed progress payment by owner to the contractor), (4) lack of design/builder knowledge / experience / competency, (5) lack of project manager competency and authority, (6) mistake during construction, (7) lack of teamwork, (8) insufficient time for completion date, (9) lack in quality control and assurance, (10) contractors lack of staff knowledge / experience and (11) complexity of the project.

Client financial capability was ranked 1st with (4.154) on probabilities of risk occurrence. Financial capability is one of important issues in DB projects. However, insufficient of financial capability will contribute to projects risky. The capability of the client pays as a very important factor influencing contractors’ in DB projects. The

client must be satisfied that the tenderer will, at the time of award, have the financial resources to implement the project satisfactorily.

Inadequate cash flow by contractor was ranked 2nd with (4.038) on probabilities of risk occurrence. Further research by Abu Mousa, (2005) supported that was ranked 1st in their study. Inadequate cash flow is the main contributing factor to delay. Besides having an experience in DB project, clients also have good insights during selection of contractor for DB project and choose main criteria on financial capability by contractor are important (Saaidin et al., 2016a).

Lack of payment (delayed progress payment by owner to the contractor) was ranked 3rd with (4.038) on probabilities of risk occurrence. According to Ahmed et al., (1999) delayed in payment become a major risk to the contractors. Delayed progress payment by client to the contractor is the main problem for contractor to run project smoothly. It is reflected to the sub-contractor for them to purchase the materials from supplier and it can cause of slow progress of work and effect to project delay.

Lack of design/builder knowledge / experience / competency was ranked 4th with (3.974) on probabilities of risk occurrence. For DB contractor, the DB knowledge / experience / competency and it are considered important. This is because inexperienced DB contractor can leave project with delay in time and cost overrun. DB contractors are required to have building techniques and design expertise, financial capability for DB project. In DB project, most of the construction works start before the total completion of shop drawing, thus causing large fluctuation in the labour force and material supply. It will in turn, require huge capital scale of DB contractor. Only the big scale companies with corresponding qualification levels can afford the financial cost (Chan et al., 2012).

Lack of project manager competency and authority was ranked 5th with (3.923) on probabilities of risk occurrence. The competency of project manager is important to determine the level of efficiency achieved at design construction site and the profitability of the project. Knowledge of staff must complement with project type and quality expectation.

Mistake during construction was ranked 6th with (3.923) on probabilities of risk occurrence. Design change or mistake of original design that contributed to the mistake during construction. Effective of communication on design in between client and contractor will reduce of probability of risk occurrence to DB projects. It is because in DB projects, normally at beginning stage of the project the design document are often change and a lot of decision making are made during execution of the project. The important of closely coordination client with contractor are also avoiding misunderstanding or conflict occurred during construction stage of the projects. The good relationship developing in between both parties will bring additional benefit to the project (Adafin et al., 2016).

Lack of teamwork was ranked 7th with (3.885) on probabilities of risk occurrence. Further research by Assaf et al., (2014) expressed that the competency of members team to execute their roles and responsibility affect to the productivity greatly. To achieve the project goals and objectives it is an important and positive relationship between team performance and commitment of members.

Insufficient time for completion date was ranked 8th with (3.885) on probabilities of risk occurrence. Delay of project contributed from insufficient time for completion. It is due to several reasons namely lack in permit approval, uncertainty of site condition, lack in design approval, lack of project manager and staff experience in DB project, lack of teamwork, lack of resources, and lack of labour productivity. To overcome this situation the stakeholders need to apply knowledge management and project learning in DB project involve.

Lack in quality control and assurance was ranked 9th with (3.833) on probabilities of risk occurrence. Quality control and assurance are important and should bear by the contractor and concern of project manager. Quality control must start at early stage during design planning phases rather than during construction phases. In DB project, Quality control is the most difficulties to control it is because design and construction concurrently running. Therefore, the conformance on quality largely depends on the original design and planning stage.

Contractors lack of staff knowledge / experience was ranked 10th with (3.821) on probabilities of risk occurrence. Staff knowledge and experience consider as the main key in DB project. Mahamid (2011) presented that contribution of the failure of construction project depends lack of experience in the project, difficulty with cash flow, lack of managerial experience, difficulty in acquiring work and low profit margin. Osama (1997) supported that contractor's lack of staff knowledge / experience due to several situations.

Complexity of the project was ranked 11th with (3.821) on probabilities of risk occurrence. Complexity can be defined as a system or component design or implementation that difficult to understand and verify. Therefore, clear project information and design will help DB contractor to achieve project objectives.

TABLE II
RISK PROBABILITY IN DESIGN AND BUILD PROJECTS PERCEIVED BY RESPONDENTS

Item	Description of risk	Mean	Std. deviation
1	Client financial capability	4.154	0.913
2	Inadequate cash flow by contractor	4.038	0.860
3	Lack of payment (delayed progress payment by owner to the contractor)	4.038	0.874
4	Lack of design/build knowledge / experience / competency	3.974	1.006
5	Lack of project manager competency and authority	3.923	0.990
6	Mistake during construction	3.923	0.977
7	Lack of teamwork	3.885	1.006
8	Insufficient time for completion date	3.885	0.837
9	Lack in quality control and assurance	3.833	0.889
10	Contractors lack of staffs knowledge/experience	3.821	1.041
11	Complexity of the project	3.821	0.785
12	Contractor's detailed design does not meet owner's expectation	3.795	0.998
13	Lack of payment (delayed progress payment by contractor to the sub-contractor)	3.769	0.852
14	Lack of communication of design/builder with end users to meet their requirements	3.769	0.867
15	Delay in commencing work because under-estimated time needed to obtain statutory	3.744	0.813
16	Lack in effectiveness of communication in design	3.731	0.801
17	Insufficient communication between team member to meet project success	3.679	0.933
18	Lack of information on safety at site	3.679	1.013
19	Unforeseen site condition	3.667	0.848
20	Errors of original design	3.667	0.848
21	Team members are not participating in technical discussions with owners	3.641	0.911
22	Lack of training on safety at site	3.641	1.057
23	Supplies of defective materials	3.615	0.841
24	Incompetent sub-contractors	3.603	0.888
25	Scope of work is uncertainty	3.590	0.889
26	Lack of coordination with sub-contractor	3.590	0.904
27	Lack on supervision of labour and works	3.564	0.815
28	Unidentified utilities	3.551	0.863
29	Lack in availability of skilled labour	3.538	0.801
30	Inadequate specification in contract document	3.526	0.990
31	Late deliveries of materials	3.526	0.817
32	High current workload to contractor	3.500	0.894
33	Insufficient of original design	3.487	0.922
34	Delay in design approval from client	3.487	0.879
35	Insufficient information in contract document	3.449	0.921
36	Lack of suitable organizational structure	3.436	1.014
37	Insufficient information of site access/right of way	3.436	0.906
38	Exchange rate fluctuation/devaluation	3.397	0.917
39	Owner lack of knowledge and experience	3.372	1.046
40	Insufficient time to evaluate tenders from sub-contractor	3.359	0.837
41	Lack of information in drafting request for proposals to sub-contractor	3.359	0.683
42	Bureaucracy in government agencies	3.346	0.991
43	Inflation	3.346	0.951
44	Difficulties in availability of materials	3.333	0.767
45	Change of original design from client	3.321	0.919
46	Lack in availability of equipment	3.321	0.890
47	Rigid specifications in contract document	3.308	0.916
48	Redesign because of over budgeted	3.269	0.963
49	Legal disputes during the construction phase among the parties of the contract	3.256	0.946
50	Insufficient time in preparing tender documents to sub-contractor	3.244	0.885
51	Insufficient time during request for proposal to sub-contractor	3.231	0.788
52	Lack in preparing method statement or shop drawings by contractor	3.231	0.836
53	Tax rate exchange	3.231	0.896
54	Lack of standardised systems during tender evaluation	3.205	0.843
55	Slow approval permit by BOMBA department	3.192	0.981
56	Catastrophes (Act of God)	3.192	1.152
57	Actual quantities differ from the contract quantities	3.192	0.884
58	Slow approval permit by local authorities	3.179	1.016
59	Poor supervision by the client	3.167	0.813
60	Slow approval permit by town planning department	3.167	0.903
61	Slow approval permit by public work department	3.103	0.906
62	Political uncertainty	3.051	1.031
63	Change in government regulations and law	3.026	1.069
64	Change in government policy	2.949	1.005

CONCLUSION

An empirical questionnaire survey was conducted in Malaysian construction industry to assess the probability of risk occurrence in design and build projects. The main probabilities of risk occurrence factors have been identified and analysed using descriptive statistics. The top eleven probabilities of risk occurrence factors ranked by all respondents have been found to be, (1) client financial capability, (2) inadequate cash flow by contractor, (3) lack of payment (delayed progress payment by owner to the contractor), (4) lack of design/builder knowledge / experience / competency, (5) lack of project manager competency and authority, (6) mistake during construction, (7) lack of teamwork, (8) insufficient time for completion date, (9) lack in quality control and assurance, and (10) contractors lack of staff knowledge / experience. This study is important as it sheds lights on the risk probability of design and build projects in Malaysian construction industry and helps equipping different project participants with better knowledge and understanding of the potentially likelihood of risk occurrence regarding DB projects. The finding present the differences of risk factors rankings that would help them to implement appropriate risk management strategies according to their perceptions of probabilities of risk occurrence.

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