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The Contractor Perception Towers Industrialised Building System Risk in Construction Projects in Malaysia

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Abstract: The use of IBS (Industrialised Building System) has attracted a lot of countries like Singapore, Sweden, Germany, Japan and the United Kingdom. This system can replace the conventional building system which is labour oriented. However, since the first project of IBS in year 1964 till today, IBS in Malaysia is not well accepted by the construction parties because of failure to adequately deal with risks in the IBS projects. To address this matter, this study had identified the risks faced by contractor in IBS construction projects. The risk identification techniques used were brainstorming, analysis of journal and conference papers and discussion with practitioners and data were collected by a questionnaire survey on contractors. It was found that there are twelve major risks in construction using IBS which are; acts of God, change in work and defective design, changes in government regulation, contractor competence, delayed payment and resolving contractual issues, financial failure-any party, labour and equipment productivity, labour, equipment and material availability, quality of work, safety, site access/right of way and suppliers/manufacturers poor performance. Therefore, it is hoped that the finding of this research could assist Malaysian contractors in making risk management planning besides improving decisions making to achieve project.

Key words: Industrialised building system, risk management, Malaysia construction industry

INTRODUCTION

The construction industry is one of the most dynamic, risky, challenging and rewarding fields. It involves numerous uncertainties and widely associated with a high degree of risk due to the nature of construction business activities, processes, environment and organization[8]. Complexities of the project, location, type of contract, familiarity with the work and breakdown in communication are some of the significant contributors to risks in construction industry.

Risk has been defined in various ways. Risk can be expressed as an exposure to economic loss or gain arising from involvement in the construction process[2,6,10,11]. Some researchers describe risk in relation to construction project whose variation results in uncertainty in the final cost, duration and quality of the project[3,4]. In order to emphasize the major objectives of survey on risk management action, risk has been defined as the probability of occurrence of some uncertain, unpredictable and even undesirable event(s) that would change the prospects for the profitability on a given investment.

Failure to adequately deal with uncertain, unpredictable and undesirable event has been shown to cause serious effects of risk that can be summarized as:

- Failure to keep within cost estimate
- Failure to achieve the required completion date
- Failure to achieve the required quality and operational requirements

The IBS is an industrialised building system which all building components are mass produced either in factory or at site under strict quality control and minimal on site activities[16]. It is an industrialisation essentially as an organisational process-continuity of production implying a steady flow of demand; standardisation; integration of the different stages of the whole production process; a high degree of organisation of work; mechanisation to replace human labour wherever possible; research and organised experimentation integrated with production. It can speed up construction process and with less labour on site and, if possible, at less cost and minimized effects of risk. With these advantages, a lot of countries have chosen to use the IBS in their construction industries including the Malaysia government[15].

However, since the first project of IBS in year 1964 till today, IBS in Malaysia is not well accepted by the construction parties because of failure to adequately deal with risks in the IBS projects. Failures to keep in

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cost estimate in the IBS projects are still common in Malaysia and it is one of the reasons that limit the development of IBS[9]. In fact that there are risks in IBS such as technical risk and quality risk that cause aesthetic and functional faults, like cracks, blemishes, moisture penetration and poor thermal insulation in completed buildings[18]. Hence, there is need to have systematic identification, analysis and assessment of risk that will contribute significant success of projects[2].

The success of a project management exercise depends very much on the efficient and effective management of the risks involved[12]. If we are to manage the risks, we must first identify those risks. However, attempts to consider every risk is doomed to failure: the time taken would be enormous, delaying the possibility of formulating managerial strategy until after the risked consequences had actually occurred and the whole exercise is a waste of resources[16]. Thus, in practice, the primary aim should be to identify the key, critical, important risks in the project so that they can be analysed and an appropriate response can be determined.

Naturally, the objectives of construction projects differ among nations and all nations and regions of the world may have their own characteristics. Just as there are differences in ways of living, the value systems and the ways of thinking, there are also differences ideas on management of construction risks. In other words, the managements of risks is greatly influenced by the uniqueness of the construction industry in a specific country. So far, little is known about risk and its management in the Malaysian construction industry especially in IBS project. This study assesses these issues.

This study presents the perceptions of Malaysian contractors towards IBS risks in housing construction in Malaysia since there is no concrete study about it in the past. The results of this survey should further clarify the perceptions of contractors regarding IBS in construction project and current circumstances in the industry. A thorough understanding of current trends will aid contractors in risk management.

MATERIALS AND METHODS

The research was conducted by means of interview and questionnaire survey. The questionnaire design were undertaken in the phase consisted of literature review of past research focused on risks in construction and IBS housing project. 27 construction risks were compiled from previous similar studies conducted in the USA[7] and Hong Kong[1] and from an interview with experienced personnel involved in IBS projects it was reduced to 12 risks based on IBS project in Malaysia construction situation. Table 1 shows 12 risks types in IBS project included in the questionnaires. A total of 80 questionnaires were sent out to the IBS construction contractors. Out of 80 questionnaires, the researcher gathered 39 usable questionnaires. However, 3 responses could not be used in the analysis because they were incomplete. Thus, only 36 responses were used. Hence, the ultimate response rates were 45%. The questionnaire is described below.

Questionnaire design and distribution: The questionnaire was designed with two sections. The first section solicited general information about the respondent and the organization. The second section required the respondents to express their perception toward the importance of 12 construction risks that are listed in their entirety in column 1 of Table 1.

Table 1: Summary of level of impact and level of frequency of IBS risks perceptions by contractors

		Impact				Frequency			
No.	Risk description	(Average) 1-10	Low 1-3 (%)	Mid 4-7 (%)	High 8-10 (%)	(Average) 1-10	Low 1-3 (%)	Mid 4-7 (%)	High 8-10 (%)
1	Act of God	6.0	19	75	6	6.1	25	35	40
2	Change in work and defective design	7.9	0	18	82	8.9	0	19	81
3	Changes in government regulation	5.4	7	62	31	6.2	21	35	44
4	Contractor competence	7.3	62	19	19	7.5	20	36	44
5	Delayed payment and resolving contractual issues	9.1	5	5	90	8.6	25	31	44
6	Financial failure-any party	8.7	0	37	63	6.5	13	37	50
7	Labour and equipment productivity	6.2	6	36	58	6.8	25	25	50
8	Labour, equipment and material availability	7.7	0	42	58	7.3	13	31	56
9	Quality of work	7.1	50	31	19	7.8	6	56	38
10	Safety	8.1	0	22	78	8.2	6	25	69
11	Site access/Right of way	6.5	56	31	13	7.2	31	31	38
12	Suppliers/Manufacturers poor performance	8.2	0	27	73	8.0	0	31	69

The respondents were requested to indicate the importance of each risk, low importance is accorded a value of 1 while the greatest importance is accorded a score of 10. The range of 1-3 denotes risk that is not important, 4-7 denotes important risk categories and 8-10 denotes very important risk categories. Although the degree of importance varies from project to project, the questionnaire is expected to elicit a general assessment of the importance of risk. The degree of importance was related to the overall impact these factors have on meeting the project's objectives of being within budget, on schedules and meeting the performance requirements of the clients.

Approach of analyses: A number of authors[12,17] adopted expected value, as a result of multiplication of probability and impact, to rank risks. This rank of expected value is usually perceived as the degree of importance of a risk. However, the proper consideration of project risk requires consideration of both impact and probability[14]. Moreover, 'multiplying the impact and uncertainty to 'rank' risk is misleading, since the correct treatment of the risks requires both dimensions'.

In this research, to measure the importance of each risk, contractors were requested to indicate separately the level of frequency (indicating the intensity of the risk's occurrence) and the level of impact (determining the severity of the consequences if it does occur) using a five point rating scale, wherein the greater rating, the higher the risk would be. Statistical analysis method that was used for this study is descriptive analysis.

RESULTS

Responses to Section II of the questionnaire yielded three sets of results; impact level of risk, frequency level of risk and IBS construction risk ranking.

Impact level of risk: In the 2nd, 3rd, 4th and 5th columns of Table 1, 'Average' denotes the mean score received by each risk; range of 1-3 denotes low impact, 4-7 represents the risk that is (mid) impact and 8-10 represents highly impact risk.

Frequency level of risk: Even though the frequency of a particular risk varies from one project to another, the questions were designed to derive a broad-based evaluation of the frequency level of risk. On a scale of 1-10, 1 referred to the particular risk category being of least frequency and 10 referred to extreme frequencies. In the 6th, 7th, 8th and 9th columns of Table 1, 'Average' denotes the mean score received by each risk, range of 1-3 denotes low frequency, 4-7 represents the risk that is (mid) frequency and 8 - 10 represents highly frequency risk.

Analysis of results:

Impact level of risk: The most impact and least impact risk categories (for Malaysian contractors) are shown in Table 2 which was developed based on the data in the 2nd column of Table 1. The result shows that Malaysian contractors consider delayed payments and resolving contractual issues to be the most impact construction risk giving it an average score of 9.1 on a scale of 1-10, as shown in Table 1. It was followed by risk of financial failure, with an average score of 8.7. The average score of the four most impact risks range between 8.1 and 9.1.

The least impact risk, from the Malaysian contractor's perspective is the risk of changes in government regulation, with an average score of 5.4. It is followed by the risk of acts of God, with an average score of 6.0. The average scores of the four least impact risks range between 5.3 and 6.5.

From Table 2 it can be observed that the contractors have given high impact to the risks of delayed payment and resolving contractual issues, financial failure, suppliers or manufacturers poor performance and safety. Changes in government regulation, acts of God, labour and equipment productivity and site access or right of way received very low impact. This shows the greater concern in the industry towards the problems of delayed payment and resolving contractual issues, financial stability, suppliers or manufacturers performance and safety. It may be that the industry id capable of transferring the risk of acts of God (force majeure) by way of insurance cover. Furthermore, it could be that the industry is less dependent on legal processes.

Table 1 shows that Malaysian construction industry contractors had ranked the majority of the risks as highly impact. Almost all the rest were ranked as medium impact. This demonstrates the concern prevalent within the industry.

Table 2: Most and least impact IBS risk categories as perceived by Malaysia contractors

Impact	Risk
High (Most impact ranked first)	Delayed payment and resolving contractual issues
	Financial failure-any party
	Suppliers/Manufacturers poor performance
	Safety
Low (Least impact ranked first)	Changes in government regulation
	Acts of God
	Labour and equipment productivity
	Site access/Right of way

Table 3: Most and least frequency IBS risk categories as perceived by Malaysia contractors

Impact	Risk
High (Most frequency ranked first)	Change in work & defective design
	Delayed payment & resolving contractual issues
	Safety
	Suppliers/Manufacturers poor performance
Low (Least frequency ranked first)	Acts of God
	Changes in government regulation
	Financial failure-any party
	Labour & equipment productivity

Frequency level of risk: The frequency analysis in Table 3 which was developed based on the data in the 6th column of Table 1 illustrates that contractors perceived change in work and defective design as the most recurrent risk in IBS projects, with mean values of 8.9. According to several professionals during interviews, this risk was mainly as a result of design information, impractical designs, inconsistent information among design documents and coordination problems between design disciplines. Design changes due to unstable client's requirement were also pointed out to cause the risk to some extent. It was followed by the risk of delayed payment and resolving contractual issues, with an average score of 8.6. The average scores of the four frequency risks range between 8.0 and 8.9.

The least frequent risk, from the Malaysian contractor's perspective is the risk of acts of God, with an average score of 6.1. It is followed by the risk of changed in government regulations, with an average score of 6.2. The average scores of the four least frequent risks range between 6.1 and 6.8.

From Table 2 and 3 it can be observed that both impact and frequency have given high level to the risks of delayed payment and resolving contractual issues, performance of supplier or manufacturers and safety. Acts of God, labour and equipment productivity and changes in government regulation received very low score. This shows the greater connection between the impact and the occurrence of risks in the construction project. The high frequency risk to be occurring the high impact the risk will exist.

IBS construction risk ranking: The degree of project objectives (within budget, on schedule and archive client requirements) varies from project to project, the questionnaire was expected to bring out a broad assessment of the ranking of risk obstacle in achieving the IBS project objectives which is completion within budget, on schedule and achieve the required quality and operational requirements. Each respondent was required to rank each risk on a scale of 1-10 by considering its contributions to an achieving the project objectives. Rank 1 is assigned to a risk that would give the lowest contributions while Rank 10 is allotted to a risk that would cause the highest contribution.

The findings of the survey concerning the relative contribution of risk to project's objectives in the local construction practice are summarized in Table 4. The figures within the table represent the number of respondents who gave the relative contribution rank to each risk. For example, there are seven respondents who ranked the risk delayed payment and resolving contractual issues, with the highest rank value of 10.

In order to quantitatively demonstrate the contribution of each risk to project's objectives, a weighting approach is adopted. The principle is that the risk with the highest contribution rank would be assigned the largest weight. The figures in brackets in Table 4 are weighted scores for each risk at different contribution rank. Each individual's weighted score is obtained by multiplying the number of respondents with the corresponding weight. The figures in the last column of the table give the total weight scores for each risk. Figure 1 shows the rank of the 12 risks obtained from the survey results in the descending order.

From this section, the first rank of risk factor is financial risks. Financial risks to contractors include whether the contractor has enough cash flow on time to enable him or her to progress with the IBS work, or financial failure of the owner or subcontractors. This result might be attributed to the reversionary period that Malaysia has been experiencing in the 1990s. More contractors are currently failing. As the probability of financial failure increases contractors, understandably, prefer to share this uncontrollable risk. However, as the economy of the country improves, the contribution of this risk towards project's objectives is expected to decrease.

Delayed payment and resolving contractual issues, the second highest allocation score in favour of the contractor. The literature review indicates that the contract clauses tend to be biased in favour of the owners. This has resulted in possible delay of payments becoming a major risk to the contractors. Unless clear and fair terms of payment are specified at the very beginning and enforced, contractors will be leaving a margin for this risk when quoting for jobs and the owners eventually will be paying extra.

Site access and right of way was the least contribution risk category toward project's objectives as shown in Fig. 1. It should evaluate the needs or constraints during the planning phase before the construction phases begin. This situation can in effect, reduce contractor productivity and slow down the construction process.

Table 4: Contribution of risks to project's objectives (within budget, on schedules and meeting the performance)

Risk description	Contribution rank to project's objectives										Total weighted Score
	1	2	3	4	5	6	7	8	9	10	
Acts of God	7(7)	11(22)	7(21)	4(16)	2(10)	3(18)	2(14)	0(0)	0(0)	0(0)	108
Change in work and defective design	4(4)	3(6)	3(9)	0(0)	9(45)	8(48)	2(14)	0(0)	0(0)	7(70)	196
Changes in government regulation	3(3)	4(8)	8(24)	3(12)	9(45)	5(30)	1(7)	1(8)	0(0)	2(20)	157
Contractor competence	2(2)	1(2)	4(12)	10(40)	7(35)	6(36)	0(0)	4(32)	0(0)	2(20)	179
Delayed payment and resolving contractual issues	0(0)	0(0)	1(3)	2(8)	0(0)	4(24)	2(14)	5(40)	5(45)	17(170)	304
Financial failure-any party	0(0)	0(0)	0(0)	0(0)	2(10)	1(6)	2(14)	9(72)	3(27)	19(190)	319
Labour and equipment productivity	2(2)	0(0)	0(0)	0(0)	1(5)	3(18)	7(49)	10(80)	5(45)	8(80)	279
Labour, equipment and material availability	0(0)	0(0)	2(6)	5(20)	2(10)	4(24)	12(84)	8(64)	0(0)	3(30)	238
Quality of work	1(1)	5(10)	7(21)	12(48)	3(15)	1(6)	0(0)	0(0)	6(54)	1(10)	165
Safety	0(0)	0(0)	7(21)	3(12)	12(60)	5(30)	4(28)	3(24)	2(18)	0(0)	193
Site access/Right of way	5(5)	9(18)	6(18)	5(20)	7(35)	0(0)	3(21)	1(8)	0(0)	0(0)	125
Suppliers/Manufacturers poor performance	0(0)	0(0)	3(9)	11(44)	6(30)	5(30)	2(14)	3(24)	2(18)	4(40)	209

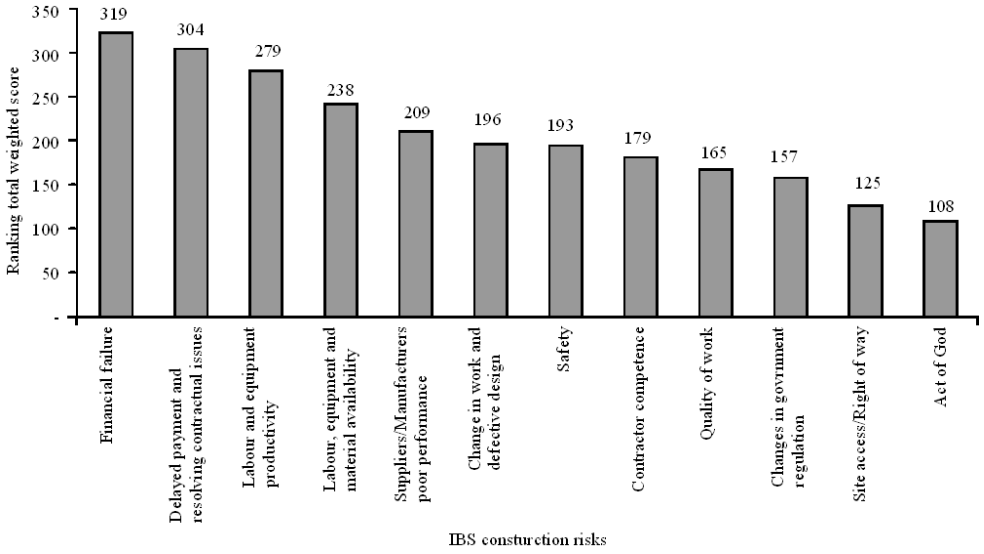

Fig. 1: Results of the survey on IBS risk ranking

CONCLUSION

This study described the current views of contractors in Malaysia regarding the impact and the frequency of 12 risks which are acts of God, change in work and defective design, changes in government regulation, contractor competence, delayed payment and resolving contractual issues, financial failure-any party, labour and equipment productivity, labour, equipment and material availability, quality of work, safety, site access/right of way and lastly suppliers/manufacturers poor performance presented in a questionnaire survey. It also rank the risk based on the contribution of risk to project's objectives which is completion within budget, on schedule and achieve the required quality and operational requirements.

Financial failure has been considered to be the most significant risk category a contractor could suffer from IBS construction in Malaysia. Actually, due to high allocation of fund in the IBS construction projects and there are a few government projects (that use IBS) for bidding by contractors, this may forces them to bid in a highly competitive construction industry market. They normally minimize their mark-ups to maximize their chances of winning projects but it will exposed them to the highly risk during the construction period. From this point, it could also be understand why most of the contractors in Malaysia refuse to involved in IBS projects.

The contractors have given among high ranking to the risk of delayed payments on contract and resolving contractual issues which expose the need for contracts that are fairer to the contractor, incorporate better terms of payment to them and the need for improvements to methods for dispute resolution such as meditation and arbitration.

The contractors had ranked the majority of the risks considered in this survey as highly contribution to project objectives. This demonstrates the concern prevalent within contractors and the dire need for improved strategies of risk management. Through this survey the risks identified in the IBS construction project could be used as a guide for contractors in making a better and wiser decision when dealing with risk management in the projects that use the industrialised building system. It is recommended that a formal study to be conducted in future to investigate the allocation of this issue on the risks among parties involved in the IBS construction projects in Malaysia.

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