

Investigation of Acceptance Level of Adoption towards Early Contractor Involvement (ECI) in Malaysia Construction Industry

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Abstract: Every construction project required a complete and efficient project cycle and management to ensure the project can be under control and reach its goals and Design-Bid-build method (DBB) and Design-Build method (DB) as most common used project delivery system but still has risks that may cause conflict during the project life cycle and lead to time and cost overrun. This study is focus on determine the awareness and acceptance level of adoption towards Early Contractor Involvement (ECI) in construction of Malaysia for both public and private sector of construction industry. A survey has been done with questionnaire distributed to determine the awareness of Malaysia construction industry towards ECI and their acceptance level towards adoption of ECI in Malaysia and quantitative data has been collected. The analysis results shows that only 19.2% of respondents aware about ECI but the other 80.8% never learn about ECI and a majority 51.9% of respondents are willing to accept ECI if it is implemented in Malaysia construction industry. The results shows that ECI is not well promoted in Malaysia yet but the majority of the industry is ready to accept ECI implementation in Malaysia and this study able to benefit in raising more awareness of ECI in Malaysia construction industry towards ECI and enhancing transparency and increase effectiveness of communication between stakeholders if ECI is implemented in Malaysia.

Keywords: Construction Industry, Project Delivery System, Early Contractor Involvement, Awareness, Quantitative, Acceptance level

1. Introduction

Performance and result of a construction project may be different with the selection of type of delivery system. The construction project team always has different characteristics like temporary in nature, task-oriented, inconsistent core competencies, and having different team goals [1]. Traditional project delivery methods with open bidding phases, unit price contracting, and owners' quality control can provide transparent balances and checks, mostly when met the lowest bid of award criterion [2]. For most cases in Malaysia, design consultants may influence clients' selection of project delivery

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method and made the selection of DBB system because it allows them to give suggestion to the design, plan and construction processes on behalf of the clients opposite to the DB (design and build system), where for DB method the design consultants would have to work under the command of Contractors [3]. As research result by Khairuddin, throughout 20 random selected construction projects as research objects, about 70% of the projects used DBB method as the procurement method which proved DBB is the most common selected and preferred method in construction industry of Malaysia.

1.1 Problem statement

Contractor's experience in the construction projects is sometimes necessary and will contribute and provide benefits on the project outcomes including quality for the design phases. Professional suggestion of the contractor during early phase of design process improves time schedule, risk management, cost and safety due to the contractor's professional knowledge [4]. However, since contractor only involved after design stage, their experience are unable to contribute to the design of the plan. This may cause conflict between contractor and client against the when proceeding to the construction phase since contractor are always wanted to gain maximum profit so they will try to argue with clients in order to change the design to their favorite according to their experience.

Traditional contract method with late contractor involvement can lengthen the overall project duration and the contractor has no input against the planning of the project done by designer team [5]. However, contractor single-handedly hold the responsibility against any defects during construction process and must be responsible for any extra cost that related to defective or unsuitable plans. From there, contractor sometimes will try to apply changes with client and designer in order to save more cost or lower the probability of defect happen. Sometimes these decisions require good communication and bad communication may result in happen of conflicts. Such conflicts can result in differences in organizational structure and organizational size, changes in project goals [6]. It may cause delay of the project schedule and chain effect to cost overrun, conflict and at last, the contractor give up the contract separation of design from construction, lack of effective contact, changing the goals and expectations of customers and so on are the problems frequently faced in the construction project [7].

On the other hand, DB system has more advantages if compare with DBB such as decrease the chances of different opinions to the construction design with clients since contractor already involve in the design phase and are the one in charge with design. However, DB method has its own risks also such as not enough transparency at pricing that contractor may earn bigger profit by playing with the price in pricing stage. A new method is required to eliminate the disadvantages caused by DBB and DB method. ECI is a new method but not implemented in Malaysia yet and it may lack of awareness by the industry. A new method is required to eliminate the disadvantages caused by DBB and DB method. ECI is a new method but not implemented in Malaysia yet and it may lack of awareness by the industry. Therefore, this study is to determine the awareness of Malaysia construction industry towards (ECI) and the acceptance level of Malaysia construction industry towards adoption of early contractor involvement (ECI).

1.2 Importance of Study

The study able to benefit in raising more awareness of ECI in Malaysia construction industry towards ECI and enhancing transparency and increase effectiveness of communication between stakeholders if ECI is implemented in Malaysia.

2. Literature Review

Early Contractor Involvement (ECI) is a relationship-based procurement model that allows the client, the designer, and the contractor to work collaboratively, which results in improved performance [8]. The name Early Contractor Involvement (ECI) comes from the principle of taking the contractor on board early during a construction project. ECI is first being introduced, studied and adopted by

British Highway Agency in 1998 in United Kingdom for infrastructure projects [9]. ECI is similar to a design and construction contract model, the main difference being that ECI aims to gain the advantage of the expert expertise of the contractor early in the planning and design phase of the project, as opposed to innovating a design created by the owner to the contractor [10]. It is also known as the informal involvement at the design stage of the main contractor/service provider and also the formal process of obtaining productivity and value for money from the early engagement of the contractor [11].

In ECI, the early involvement of the main contractor at the preconstruction phase could have the same contractor for early planning and carrying out works on site or different main contractors for planning phases and different contractor for construction works [12]. During the contractor selection or bidding stage, a target price system is used for determining the contractor's payment as specified in the contract. Besides, contractors also need to prepare certain documents such as their financial position, human and other resources strength, completed projects tracking records during a prequalification practice.

2.1 Benefits of ECI

ECI has many benefits which included risks identification, reduce and allocate the risks, and priced during the initial stage to eliminate a number of risks [10]. Besides, as only one design phase is needed, where the value of money can also be achieved, also claimed that ECI can help reduce tendering costs [10]. It also makes the costs and documentation transparent and allow the discussion for further project requirements. Most importantly, ECI can optimize construction efficiencies and increase the profitability by reduce the operating costs and make the delivery process more efficient. stated that Projects risk can be detected earlier, and the joint risk management can solve the problems and prevent delay on site which will save overall expenses of both client and contractor [13]. Besides, transparency brought by ECI can reduce risk as well because contractor, client and designer team can discuss and design together to prevent any bias situation happened that may lead to conflict due to different goal of different party [14]. When ECI is used, the information based on contractor experiences and knowledge can help subcontractors to prepare responsive bids earlier unlike traditional method where subcontractors does not have enough information to bid for the best price [15]. Main contractor can infuse latest construction technology and knowledge into ECI [13]. This help to improve the productivity, encourages innovation and successful project execution [11]. When contractor involved early, the professional discussion can reduce opposing relationship between project team after design phase and reduce the conflict at all phases of the projects [16]. When the discussion is made and projects risks are detected and resolved, the construction program can be well-developed and followed by all party [15].

3. Research Method

Usage of quantitative method provides a broader view of reliability and validity of research results by respondents' offering [12]. Population's trends, awareness, or opinions can be analyzed through a certain population with questionnaire survey [12]. Random sampling method is acceptable in this study since it generates a sample that is representative of the population while at the same time eliminating voluntary response bias [17]. For this study, 200 questionnaires were distributed to 100 construction companies in Malaysia construction industry. The respondents who successfully fill out the questionnaire are 52 practitioners out of 200 from the target. The respond rate of the questionnaire is 26% as calculated in Eq. 1.

$$\text{Responses rate} = N \text{ of respondents} / \sum \text{questionnaire distributed} \times 100\% \text{ Eq. 1}$$

$$\text{Responses rate} = \frac{52}{200} \times 100\% = 26\%$$

3.1 Questionnaire

The questionnaire consists of three (3) parts. The first part are questions to collect personal information including ages, position, working age and working under which company (private or government). Part two (2) of the questionnaire asked about the part to study about the awareness of respondents against and their normal involvement ECI, DBB, and DB. Part three (3) focus on the opinions of respondents against implementation of ECI method in Malaysia construction industry and their acceptance level towards ECI. Pilot study and review has been done for the questionnaire by distributed to 10 engineers working in Malaysian industries including Professional engineer from engineering consultancy. The review was overall acceptable only changing for keywords are needed in the questionnaire is required.

3.2 Cronbach's Alpha

Cronbach's alpha (Table 1) is a measure of internal consistency, or how closely a group of things is related to one another (Cronbach, 1951). It is regarded as a scale dependability indicator. The presence of a "high" alpha value does not imply that the measure is one-dimensional.

Table 1: Cronbach's Alpha

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 \geq \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Table 2 shows the reliability statistics of dichotomous type of question in this study. Cronbach's Alpha is generated in SPSS are similar with manual calculation. The value of Cronbach's alpha is 0.726 is categorized as acceptable internal consistency as stated in Table 1.

Table 2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on	
	Standardized Items	N of Items
0.726	0.678	6

4. Results and Discussion

In this research, Descriptive Statistical Analysis method is used and questionnaire is constructed and spread along the government and private sector of construction industry. The collected data from the questionnaire survey were discussed in this section as following.

4.1 Respondents general information

Table 3 present the demographic data of organizations, which includes the age, the type of the category of organization, company sector, qualification, position and years of experience of respondents. Throughout this survey, 44 respondents or 85.6% of respondents are working at private sector while only 8 respondents are from government sector. Almost all respondents are construction

related position from assistant engineer to manager level position. Over 80% of respondents are degree holder which means they have enough fundamental knowledge for this survey.

For the age category, 24 respondents are in between 20 to 30 years old which 46.2% out of 52 respondents is. This means nearly 50% of the respondents are young. 18 respondents or 34.6% of respondents reach 31-40 years old range while the rest 10 respondents or 19.2% reach 41-50 years old range. No respondents older than 50 years old participated in this survey. For the years of experiences, 28 respondents have less than 10 years of working experiences which already reach 53.8% of the whole survey. 22 respondents have worked above 10 years but below 20 years and only 2 out of 52 respondents worked above 30 years. Since both age and working experiences nearly or exceed 50%, this means that the respondents' comments and recommendations are more represented to a younger and fresh generation.

Table 3: Participant's demography for the study Category

Category	Items	Frequency	Percentage (%)
Age	20-30	24	46.2
	31-40	18	34.6
	41-50	10	19.2
Years of experiences	below 10 years	28	53.8
	10-20 years	22	42.3
	21 years or above	2	3.8
Years of experiences	10-20 years	22	42.3
	21 years or above	2	3.8
Highest level of education	Master	1	1.9
	Degree	34	80.8
	Diploma	13	15.4
	STPM	1	1.9
	SPM	2	3.8
	Certificate	1	1.9
Workplace sector	private	44	85.6
	government	8	15.4

4.2 Respondents awareness about ECI

In part 2 of the questionnaire, the respondent are first being asked if they understand what PDS in a project is. 50 or 94.2% of respondents understand PDS and 2 answers are no. From the detail of the respondents, it is found that 2 of the respondents that provided answer no are drafter with SPM level and with diploma level only. This means they only learn about drafting skill using software but not professional skills about construction life cycle. Table 4 represent the awareness of respondents against project delivery system.

Table 4: PDS awareness

Responses	Frequency	Percentage (%)
No	2	3.8
Yes	50	96.2

Respondents are asked about the PDS they normally involved along with if they encounter conflict or problems with other party in a project and those conflict or problems are related to the PDS they involved. In Table 5, a table about PDS involvement of respondents is shown and 20 respondents or 38.5% are involved with Design and Build method while 32 respondents or 61.5% of respondents are

involved in traditional method. The results are similar to the Khairuddin (2017) research which proved the DBB method is still the most common method adopted by Malaysia construction industry.

Table 5: PDS involvement

Type of PDS	Frequency	Percentage (%)
Design & Build	20	38.5
Traditional method	32	61.5

For the respondents who encounter problems or conflict with other party are 28 respondents or 53.8% which exceed 50% of the respondents' encounter conflict before where 24 respondents or 46.2% of the respondents never encounter conflict with other party. The results are shown in Table 6.

Table 6: Respondents that encounter problems or not

Responses	Frequency	Percentage (%)
No	24	46.2
Yes	28	53.8

For question that asked to confirm if respondent encounter conflict because of the PDS they involved, when the respondents who did not encounter conflict have been exclude, there are 17 respondents or 60.7% out of 28 respondents which the majority of the respondents responded that the conflicts they involved are caused by PDS (Table 7).

Table 7: Responses of conflict caused by PDS

Responses	Frequency	Percentage (%)
Yes	17	60.7
No	11	39.3

Next, the respondents are asked about the willingness to change to another type of PDS different from the current type they involved. 24 respondents or 46.2% of respondents answer yes but the majority or 28 out of 52 respondents answer no (Table 8).

Table 8: Willingness to change current PDS

Responses	Frequency	Percentage (%)
No	28	53.8
Yes	24	46.2

From the responses, first the result is categorized according to type of PDS involved by respondents. 20 respondents are Design & Build method while 32 respondents are traditional method. For design & build method, 5 respondents out of 20 or 25% of the respondents wish to change their current type of PDS involved to another. Among the 5 respondents, only 2 of the respondent's encounter conflict related to the PDS. This can be concluded that most respondents that involved in Design & Build method are satisfied with current PDS of Design & Build method. For traditional method, however, 23 respondents out of 32 encountered conflicts with other party and 15 of the conflicts are related to the PDS. This means that there is a percentage of 65.2% or the majority of conflicts are related to PDS but no other influences. There are 26 respondents out of 32 wish to change their current PDS to other system and the frequencies already exceed 50% of respondents involved in traditional method reaching 81.25% and also exceed the number of respondents who encounter conflicts with other party. This can be concluded that the respondents are not satisfied with traditional method and wish to change to adopt another method. The data are extracted from the raw data attached at appendix B.

The respondents are asked about their awareness against ECI. From the results shown at Table 9, only 10 respondents knew about ECI before this. 4 respondents learned from workplace, 2 from social media, 3 from journal and 1 is from friends. The percentage of the respondents knew ECI only involved 20% out of the 52 respondents which is very less. This result shows that the awareness level of ECI in Malaysia is very low even though there are many ways to learn about it including social media, journal, workplace and friends.

Table 9: ECI awareness and learning resources

Awareness & resources	Frequency	Percentage (%)
friends	1	1.9
journal	3	5.8
never heard of it	42	80.8
social media	2	3.8
workplace	4	7.7

4.4 Acceptance level of ECI adoption in Malaysia

The respondents are being asked about their opinions if ECI is better than DBB method. In Table 10, 14 out of 52 respondents or 26.9% think DBB method and DB method are better than ECI but a majority of 38 respondents or 73.1% think ECI are better than DBB and DB method.

Table 10: Respondent's opinion of ECI better than DBB and DB

Responses	Frequency	Percentage (%)
No	14	26.9
Yes	38	73.1

The respondents are then asked with acceptance level of Likert scale of 1-5 where from 1 is totally unacceptable to 5 is perfectly acceptable and the result is shown at Table 11. There is only 2 respondents or 3.8% answer with totally unacceptable, scale (1) and 4 respondents answered with unacceptable scale (2). The percentage of respondents that unacceptable is 7.7%. The cumulative percentage of both scale (1) and (2) are 11.5% which is the minority and the smallest percentage for this survey. 19 respondents or 38.5% of 52 respondents filled neutral (3) because they are not familiar with ECI. There are 19 respondents also answered scale (4) that ECI are acceptable for them. The 8 respondents left can accept ECI perfectly.

Table 11: Acceptance level of ECI

Likert scale	Frequency	Percentage (%)
1 (totally unacceptable)	2	3.8
2 (unacceptable)	4	7.7
3 (neutral)	19	36.5
4 (acceptable)	19	36.5
5 (perfectly acceptable)	8	15.4

Although the respondents are asked about the acceptance level with Likert scale, they are also asked about if they will adopt ECI if the implementation is started. A total of 40 respondents or 76.9% of majority will adopt the ECI if it was implemented in Malaysia Industry however 12 respondents or nearly a quarter of respondents did not want to adopt ECI method (Table 12).

Table 12: Willingness of adoption of ECI

Responses	Frequency	Percentage (%)
No	12	23.1
Yes	40	76.9

When compare of respondents current PDS and satisfaction of the current PDS with the willingness of adoption of ECI, the 20 respondents with DB method and 5 out of them or 25% of them are wish to change to another PDS and only 6 out of 20 respondents are not willing to adopt ECI in Malaysia. This means that even when they are satisfied with the DB method, they also felt that ECI is a good PDS and can be adopted. For traditional method respondents, there are only 6 of them not willing to adopt ECI. From the willingness to change the current PDS, 13 of them are satisfied with the current PDS. 4 respondents out of the 13 respondents that are satisfied with traditional method are not willing to adopt ECI in Malaysia and 2 of the rest are from the respondents who did not satisfy with traditional method and did not think ECI is suitable for them.

5. Conclusion

This study has investigated and assessed the awareness level of Malaysia construction industry towards ECI. There is only 10 respondents or 19.2% knew ECI before this survey but the resources for them to learn about ECI is actually not less which are from friends, journal, workplace and social media. This shows that the ECI is not well promoted in Malaysia construction industry. There are 20 respondents involved in DB method and 32 respondents involved in DBB method. There are 53.8% of respondents encounter conflict and problems with other party and 17 respondents out of 28 respondents or 60.7% of the 28 respondents are involved in conflicts that PDS is the main factor of causing the conflict. A majority of 76.9% respondents accept and will adopt ECI if ECI is implemented in Malaysia which means even they are satisfied with the current situation, they are willing to accept and adopt a new project delivery system.

5.1 Recommendation

The following list is the recommendation on a purpose for further study to complete the research on title about Early Contractor Involvement.

- Design and construct interview session with several professional experts to receive more detail information for analysis.
- Having collaboration with Singapore experts for further and deeper study.

5.2 Limitation

For this research, the pandemic MCO caused by Covid-19 has forced many companies or government departments to shut down temporary or reduce human resources to go to office. This cause the distribution and responses rate of the questionnaire to become harder and resulting only 26% of responses rate when no reply or hard to contact with the companies for feedback or responses. Besides, due to the lockdown, it is hard to conduct face to face meeting so if the respondents have any question about the questionnaire, it is hard to explain clearly for them with only description on the questionnaire.

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