An Integrated Procurement System: A Study of Construction Firm Readiness towards Implementing of Integrated Project Delivery (IPD)

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***Abstract*— The Malaysian government has taken the initiative of implementing Industrialised Building System (IBS) in which components are manufactured in mass production under a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works. It is hope that IBS can improve the performance of construction industry. However, one of the main barriers in Malaysian IBS implementation is lack of integration among stakeholder involved during the project delivery stage. In order to overcome this barrier, a new collaborative procurement or project delivery namely as 'Integrated Project Delivery (IPD)' which is using a multi-party contract (more than two parties selected) has been introduced. Integrated Project Delivery (IPD) is defined as a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all project participants to optimise the results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication and construction. Although, many researchers have argue the importance of IPD in project delivery process, but the readiness of construction industries must be established. This research has used a quantitative research process that involved a few phases including literature review stage, data collection stage, framework development stage, validation and recommendation stage. This research is to obtain data based on multidisciplinary IBS stakeholders' perspectives, respondent include project managers, resident engineers, architects and contractors are among the potential candidates. Respondents that directly involved in the construction industry mentioned that their firms are willing to change and implement IPD. The firm's readiness recorded at the moderate mean value. It can be noted that each firm involved as respondents are ready to implement.**

Keywords*— *Firm Readiness, Integrated Project Delivery; Construction Procurement; Construction Industry; Design Management; Industrialised Building System (IBS).

1. Introduction

In an attempt to develop a sustainable development in construction process, the Malaysian government has taken the initiative of implementing a new or modern construction method called Industrialised Building System (IBS). IBS (known as offsite manufacturing in UK construction industry) is a construction technique in which components are manufactured in mass production under a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works [1].

Although IBS has been introduced for over 40 years, with well-documented benefits and strong support from the government, however the pace of implementation and usage of IBS is still slow and below the government target [2]. Investigation by some researchers identified that one of the main barriers of IBS implementation in the Malaysian construction industry is related to traditional project

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delivery process [3-6]. As a result of this fragmentation, the traditional construction process tends to incur additional costs from rework stemming from errors, quality issues and inefficiency of project delivery times [7-9], poor performance [10] and client dissatisfaction of products delivery [11-12]. Furthermore, this practice allows the manufacturers and contractors to be involved only after the design stage thus creates problems for the supply chain process (such as delays, late supply, etc) and constructability related issues [13]. This practice is worsened by the knowledge that M&E is not aligned with C&S and architectural drawings thus resulting in the issue of redesign drawings during the design stage of IBS projects [14].

In an attempt to overcome this issue, many industry-led reports [8, 12, 15, 16] have all called on the industry to change from its traditional modus operandi (fragmented approach) and perform better through increased integration. Recent follow-up reports such as the [17], challenged the construction industry to create a fully integrated service capable of delivering predictable results to clients through processes and team integration.

Many researchers [18-20] have proved that 'Integrated Project Delivery (IPD)' as a project delivery system using a multi-party contract (more than two parties selected) has a major impact on the state of the industry to improve team integration in current construction project delivery. Integrated Project Delivery (IPD) is defined as a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all project participants to optimise the results, increase value to the owner, reduce waste, and maximise efficiency through all phases of design, fabrication and construction.

Despite the above benefits, IPD faced some barriers or difficulties in implementation on construction projects. According to Ghassemi & Gerber (2011) [18], a number of criteria must be implemented to achieve fully integrated projects requiring companies to have procurement ability and to be inherently structured.

Based on the literatures, it shows that the findings of the previous studies and tangible examples of readiness assessment model especially in the Malaysian construction industry are limited. By highlighting the key factors which underpin the dimension of model expectantly will help IBS stakeholders to get some overview of current practice without having to learn lessons the hard way. Furthermore, the researcher believes that this readiness assessment for IPD will provide a significant step for the IBS industry towards improving the performance of the project delivery. More importantly, IBS stakeholders need to ensure that the assessment is properly structured for effective implementation and monitoring as to avoid introducing too many new techniques at once without having identifying the current situation or level of integrated practices before implementing a new strategy in future.

This research aims to explore the development of a tool or metrics which could be used to investigate the readiness of the construction industry to improve its project delivery process through the implementation of Integrated Project Delivery (IPD), and formulate strategies for the effective implementation of IPD within the industry. This study was conducted to see the readiness of stakeholders from various aspects involved Firm Readiness.

2. Research Methodology

This research involved collecting the stakeholders perception based on their experiences in implementing IPD in their IBS projects. The study was conducted with the intention to obtain a good grasp of the IPD among the construction stakeholders in IBS projects. Narrowly, the purpose of this research is to investigate the existing tools and metrics for assessing the readiness assessment of organisations for IPD implementation, to assess the readiness of the construction industry in Malaysia for IPD implementation and develop a readiness assessment model to implement IPD in IBS construction project.This study is cross sectional where the data was gathered only one. A survey method was employed. For this study, the unit of analysis is the IBS stakeholders' perspectives. Each respondent is chosen to represent their readiness measurement to implement IPD in their IBS construction projects. The respondents consist of project managers, resident engineers, and architects, contractors and etc. The data has been collected between Mac to September 2016.

The population of this study comprised of construction stakeholders that are operating in Malaysia. The list of the companies was obtained from Real Estate and Housing Developers' Association Malaysia (REHDA), Construction Industry Development Board (CIDB), Association of Consultants Engineer Malaysia (ACEM), Board of Architects Malaysia (PAM) and Board of Quantity Surveyors Malaysia.

The survey involved the IBS companies that were located in Peninsular of Malaysia, excluding Sabah and Sarawak due to the geographical scope of the study. To be more representative, it was decided that the samples come from northern, central,

southern and eastern regions of Peninsular Malaysia. This research applied stratified data sampling. Stratified data sampling is used when to highlight a specific subgroup within the population. This technique also used when the researchers want to observe existing relationships between two or more subgroups.

There are 1 independent variable and 1 dependent variable. The dependent variable in this study is readiness assessment for implementation IPD while the independent variable is Malaysian IBS projects. All the variables are subjected to the validity and reliability tests (pilot test) before the main survey is carried out. Center for Teaching and Learning stated benefits for pilot test that are;

- It permits preliminary testing of the hypotheses that leads to testing more precise hypotheses in the main study;

- Provides the researcher with ideas, approaches, and clues that may not have foreseen before conducting the pilot study;

- Save a lot of time and money;

- The researcher may try out a number of alternative measures and then select those that produce the clearest results for the main study.

The pilot test is very important due to the facts that it is difficult to get the response from the developers to cooperate in the study. This is due to the nature of construction industry where time is very limited compared to the workload. With exception of demographic factors, all other variables included in this study will be measured by using multiple items drawn from previous research. However, phrasing of the items was modified to suit the sample and local setting.

To make sure that the dimension is applicable to the construction industry, this study had gone through the pilot test. This study employed four-point scale. 1 = strongly disagree, 2 = disagree, 3 = neutral 4= agree and 5 = strongly agree for section 2 until section 3. A five-point Likert-type scale rating from 1=strongly disagree to 5= strongly agree is used for all items. The purpose of rating scale is to enable respondents to express the direction and strength of opinion on the statements in the questionnaire. The use of five-point scale in this study is considered appropriate because it is found to increases the reliability of the measure, reduce social desirability bias among respondents, respondents aware of what was being examined, respondents are given the option to typically skip the scale in the case of ambiguity, and has been used by previous researchers (Garland, 1991).

The questionnaire design for this study is based on the single measure- five point likert scale throughout the study. A five-point Likert-type scale rating from 1= strongly disagree, 2= disagree, 3= neutral 4= agree and 5= strongly agree was designed to ensure the respondents easily capture the objectives of the questions. The items have been collected and adapted from different sources. The questionnaire was divided into 3 sections as follows;

- Section 1: General Information
- Section 2: Readiness towards Integrated Project Delivery (IPD)
- Section 3: Firm Readiness

3. Analysis of Data

3.1 Descriptive Summary of Respondents

The respondents that involved in this research consist of 36 (60%) of males and 24 (40%) of females. The respondents participated in this study consist of 57 (95%) are malay, 2 (3.3%) are chinese and 1 (1.7%) is others. There are 15 (25%) respondents, who are in the age range of 20 to 24 years old, 14 (23.3%) respondents, in the age range of 25 to 29 years old. Another 13 (21.7%) respondents, whose age are within 30 to 34 years old, 11 (18.3%) respondents are within 35 to 40 years old, 1 (1.7%) is within 41 to 45 years old, 3 (5.0%) are within 46 to 49 years old, 1 (1.7%) is within 50 to 54 years old, 1 (1.7%) is within 55 to 60 years old, and 1 (1.7%) is more than 60 years old. In term of job position, 8 (13.3%) of respondents are manager, 11 (18.30%) respondents are senior executive, 21 (35%) respondents consisting of engineer/quantity surveyor/land surveyor and 20 (33%) respondents are others. In term of education background, 2 respondents hold PhD (3.3%), 12 respondents hold Masters Degree (20.0%), 41 respondents hold First Degree (68.3%), 3 respondents hold Diploma (5.0%), 1 respondent holds Certificate (1.7%) and 1 respondent have Malaysian School Certificate (SPM) (1.7%). In term of working experience, 33 respondents (55%) have experience of 1 to 5 years, 12 respondents (20%) have experience of 6 to 10 years, 8 respondents (13.3%) have experience of 11 to 15 years, 1 respondent (1.7%) have experience of 16 to 20 years, 3 respondents (5%) have experience of 21 to 25 years and 1 respondent (1.7%) for both 31 to 35 years and more than 36 years. The type of companies participated in this study exhibited the following statistics, 8 companies (13.3%) are public listed companies, 33 companies (55%) are private limited companies, 1 (1.7%) are partnership company, 3 (5%) are corporation companies and the balance of 14 companies are others (23.3%). In term of the years of company establishment, 17

companies (28.3%) were in the construction industry for 1 to 10 years, 20 companies (33.3%) were in the industry for 11 to 20 years, 11 companies (18.3%) were in the industry for 21 to 30 years, 6 companies (10%) were in the industry for 31 to 40 years, 1 company (1.7%) was in the industry for 41 to 50 years and the balance of 4 companies (6.7%) were in the industry for more than 51 years. The companies used of IBS components the following statistics, 34 (56.7%) companies used 0 to 25% of IBS components, 13 (21.7%) companies used 25 to 50% of IBS components, 11 (18.3%) companies used 51 to 75% of IBS components and 2 (3.3.%) companies used 76 to 100% of IBS components.

Table 1 *Background Information of the Respondents*

Variables	**Companies**	
	Frequency	**Percentage (%)**
Gender		
Male	36	60
Female	24	40
Race		
Malay	57	95
Chinese	2	3.3
Others	1	1.7
Age		
20 to 24	15	25
25 to 29	14	23.3
30 to 34	13	21.7
35 to 40	11	18.3
41 to 45	1	1.7
46 to 49	3	5
50 to 54	1	1.7
55 to 60	1	1.7
60 and above	1	1.7
Marital Status		
Single	31	51.7
Married	28	46.7
Widowed	1	1.7
Job Position Level in the Company		
Manager	8	13.3
Senior Executive	11	18.3
Engineer/QS/Land Surveyor	21	35
Others	20	33
Education Level		
SPM	1	1.7
Certificate	1	1.7
Diploma	3	5
Degree	41	68.3
Master	12	20
PhD	2	3.3
Working Experience		
1 to 5	33	55
6 to 10	12	20
11 to 15	8	13.3
16 to 20	1	1.7
21 to 25	3	5
26 to 30	0	0
31 to 35	1	1.7
36 and above	1	1.7
Type of Company		
Public	8	13.3
Private	33	55
Partnership	1	1.7
Corporation	3	5
Others	14	23.3
Years of Company Establishment		
1 to 10	17	28.3
11 to 20	20	33.3
21 to 30	11	18.3
31 to 40	6	10

41 to 50	1	1.7
51 and above	4	6.7
Fulltime Employee		
1 to 10	17	28.3
11 to 20	20	33.3
21 to 30	11	18.3
31 to 40	6	10
41 to 50	1	1.7
51 and above	4	6.7
Involvement in IPD Project		
Yes	18	30
No	41	68.3
Used of IBS Components		
0 to 25%	34	56.7
26 to 50%	13	21.7
51 to 75%	11	18.3
76 to 100%	2	3.3

3.2 Existing Tools And Metrics for Assessing the Firm Readiness Towards IPD Implementation

The aims of this research is to appraise Malaysian construction stakeholders' view of their readiness to implement IPD based on Firm Readiness. A survey method has been employed for this study while the unit of analysis is the construction stakeholders' organization. Each respondent was chosen to represent his or her organization whom has involved in the operation of the organization. The respondents consist of project managers, engineers, quantity surveyors and other relevant individuals, who responded on behalf of the construction stakeholders.

To assess the readiness of the organization in implementing the IPD, this study uses the mean analysis.The scores for the variables under this study are presented based on the descriptive statistics related to mean and standard deviation. These scores give the description of the respondent's feedback from the data obtained as presented in the form of tables that follow.

Table 2 *Criticality Assessment Criteria*

Mean Factor Score Range	Significant Level
1.0 – 1.99	Least ready towards IPD success
2.0 – 2.99	Mildly ready towards IPD success
3.0 – 3.99	Moderately ready towards IPD success
4.0 – 5.0	Mostly ready towards IPD success

Table 3 *Mean Analysis for Firm Characteristics*

	Mean Factor Score Range	Items
Mostly ready towards IPD success	4.23	Teamwork is the typical way in the company to solve problems
	4.17	Directors share the company's vision and information with employees
Moderately ready towards IPD success	3.98	Co-workers have confidence in each others' abilities
	3.97	There are friendly interactions between co-workers
	3.95	There are open communication channels among company's employees
	3.95	Directors usually have sufficient knowledge about all project developments
	3.93	Directors generally have realistic expectation on any project developments
	3.90	Directors frequently communicate with project development team
	3.88	There is performance recognition among co-workers
	3.77	Directors constructively use their managers' idea
	3.77	My company has the core competencies which are capabilities that are critical to a business achieving competitive advantage in embracing IPD
	3.77	It is well known who among the employees could help solve problems associated with the IPD in

		my company
	3.75	Directors have put all their support towards IPD
	3.73	MY company has employees with the necessary levels of competence on IPD
	3.72	Directors are committed to embrace IPD
	3.72	My company has employees with the ability to quickly implement change to embrace IPD
	3.70	Company employees recognize the benefits of IPD
	3.68	My company has confidence on the company employees' skills to embrace IPD
	3.68	It is well known who are the employees could best exploit new information about the ipd in my company
	3.67	Directors have encouraged company employees to embrace IPD
	3.67	Directors have sent a clear signal the company is going to adopt the changes towards IPD
	3.67	My company is capable to develop IPD because of its strong financial resource
	3.67	My company is ready to develop IPD because this project will generate profit that can ensure the survival of my company
	3.63	My company has confidence on the company employees' knowledge to embrace IPD
	3.63	My company is capable to develop IPD with the same amount of finance as developing conventional projects procurement
	3.62	Directors have stressed the importance of the change towards IPD
	3.57	My company has the most current information associated with IPD
	3.57	Company employees fully understand the significance of training associated with IPD
	3.57	My company has to rely on external funders to finance IPD
	3.47	My company provides training to update the company employees' knowledge relating to IPD
	3.77	**Average Mean**

In addition, respondents also expressed that in terms of Firm Characteristic, they are ready to implement the IPD with the overall average mean 3.78 (moderately ready). Although the mean value still at the moderate value, in terms Firm Characteristics, the mean value recorded was satisfying. This shows that in terms of Firm Characteristics, respondent firms mentioned that they are willing to implement the IPD.

4. Conclusion

It could be summarized that most of the firms mentioned they are ready to implement IPD if necessary. Although the mean value recorded only moderate, but it's showed a good value. This research suggests that most firms already have a good readiness for implementing IPD in their construction projects. If the parties involved want IPD to be implemented, they are willing to implement it as a new project delivery approach in their projects especially that involve large-scale and complex project.

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