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Research paper

Innovative Procurement Adoption for Industrialised Building System (IBS) Projects

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Abstract

Industrialised Building System [IBS] is a new method that used prefabrication components in building construction as an alternative towards enhancing construction performance. The Construction Industry Development Board [CIDB] embraced the IBS method to enhance productivity and building quality, reduce wastage on site, increase occupational safety and health, and reduce overall cost of construction. Currently, most of the IBS project developments in Malaysia are still adopting traditional procurement system. However, traditional procurement system has been criticised for its fragmented procedure to project delivery in terms of integration and collaboration of the project team. As a result of that problem, a number of issues have recently arisen such as reworks, time delay, rising costs, lack of communication and coordination, and wastages. The purpose of this research is to identify challenges of the current procurement system and to investigate the possibilities of implementing innovative type of procurement method for IBS implementation. A deductive research approach was adopted. Reviewing relevant literature before embarking into any academic research project is one way of exploring a known theory in a holistic manner. It also appears to be one of an essential feature to create a firm foundation for the research. Based on extensive literature reviews; this paper describes what are initiatives that have been taken from developed nations which are known as earlier IBS adopters and through the findings these experiences may shed some light on the type of procurement that have been adopted. This study was conducted among Grade 7 IBS contractors in Malaysia to gain further clarification on the immensity of the issues as well as assessing the research instrument. The findings from this study reveal that financial matters, lack of early involvement, lack of integration and coordination, knowledge and understanding, role and responsibility, risk liability, communication and information, attitude and relationship matters are challenges embedded in the existing procurement approach in adopting IBS. Suggestion on how innovative type of procurement method such as Separation of IBS from Main Contract, Partnering and Integrated Project Delivery [IPD] will be able to minimise the fragmentation gaps will be concluded.

Keywords: *Industrialised Building System [IBS]; Procurement; Innovative; Malaysia*

1. Introduction

The construction industry is an important productive sector that contributes towards the economy and develops the social welfare, infrastructure and building of the country [1]. As proven by CIDB [2] who stated that the construction industry provides job opportunities for 1.2 million people representing 9.5% of Malaysia's total workforce. Generally, 4% of the Malaysian Gross Domestic Product [GDP] is contributed by the construction industry, estimated to increase to 5.5% of the Malaysian GDP in 2020 [2]. This reflects that the demand of construction is key to the economy development compared to others sector [3].

In the 8th Malaysia Plan, the country aims to achieve construction of 600,000-800,000 houses as the conventional method of construction is not sufficient to address the huge demands, as mentioned by Kadir, Lee [4]. Nevertheless, the industry is trying to improve its performance in order to move towards industrialisation. One of the methods to solve this problem is to adopt the Industrialised Building System [IBS] in Malaysia, in order to improve productivity, reduce dependency on foreign labour, provide adequate housing [5], quality of works and others. The aim was set by IBS Roadmap 2011-2015, but only 24% of public projects RM 10 million and above achieved 70 IBS score and only 14% of private projects RM 10 million and above achieved 50 IBS score [2]. The demand of IBS components is less compliant in Malaysian construction industry. The government have been promoting various programs, training and documents, proving advantages of IBS implementation.

Normally, there are a minimum of four or five parties directly involved with the process of a construction project such as clients, design consultants, contractors and material manufacturers or suppliers. These parties have different levels of involvement and contributions at different stages in the whole of construction process. Bower [6] identified that current methods of procurement have a major impact on the state of the industry by their approach to project delivery and in particular to risks distributions, contractual terms incorporated in the document and the relationships between parties involved in the overall process.

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The major issue that arise for contractors not anticipating the IBS system in the project is due to lack of efficiency on current procurement, which is the traditional procurement method [2]. There are some challenges arising on the contractor's side while procuring via the traditional method which prevents them to use IBS. A number of studies have proven that traditional procurement method is an important barrier in IBS implementation in Malaysian construction industry [7-9]. Yet, innovative procurement is one of the alternatives to overcome the challenges and problems faced by contractors. According to many in the field, the innovative procurement separates IBS from the main contract [2], supply and chain principles [10] and integrated project delivery [IPD] [11]. All innovative procurement mentioned above is ways to increase demand of IBS system in construction industry.

The objective of this paper is to identify challenges in current procurement and innovative procurement suited for IBS implementation. Scope of research would focus registered IBS contractors under Grade 7 in Malaysia construction industry, whether in private or public sector. The study will improve our understanding on procurement criteria for IBS project implementation.

2. Literature Review

IBS have begun since early 1960s after the Ministry of Housing and Local Government of Malaysia visited several European countries and evaluated their housing development program [12]. IBS system became popular due to efforts by CIDB who were at the forefront in encouraging its implementation. Benefit of IBS implementation can improve the growing demand for housing, increase productivity, reduce waste on site, improve quality of building and acquisition of foreign workers.

After visiting in 1964, the Government start its first pilot project of IBS in order to speed up the delivery time, construct economically and quality structure. There was 22.7 acres of land to be constructed in seven blocks of 17-stroey flat comprising of 3000 units of low-cost flat and 40 shops lot along Jalan Pekeliling, Kuala Lumpur. This project was constructed by using Danish System of large pre-cast concrete wall and plank slabs. Furthermore, the completion of this project was 27 months from 1966 to 1968 along with the time construction of RM 2.5 million casting yard at Jalan Damansara [CIDB, 2003b, Thanoon et al., 2003, Din et al., 2007].

In 1968, the Government had started to launch the second housing project which consist of six block of 17-stroey flats and three block of 18 stories flats at Jalan Rifle Range, Penang. This project was using a large panel system which are huge concrete panel assembly in the factory, then transport to the site for installation. Generally, the cost of project was slightly high but the construction speed was much faster [CIDB, 2003b, Din et al., 2007]. Next, the 1000 units of five stories walk up flat was be constructed at Taman Tun Sardon in Penang. This project was using the pre-cast components and system which designed by the British Research establishment for low priced housing [BRECAST system]. Besides that, about 20,000 BRECAST residence was constructed at Edmonton, North London from 1964 to 1974 [Din et al., 2007].

Development in 1970s to early 1980s, another 1200 units of housing constructed with prefabrication technology in Penang State Government. After two years, a huge prefabricated panel construction system was adopted by the Ministry of Defense. As result, 2800 unit of living quarters at Lumut Naval Base was been constructed [Din et al., 2007]. Nonetheless, this system was never being sustained in the early 1960s. This was because of the failure fabricated system cause the parties in the construction industry afraid innovate their construction procedure. Despite of it, this system was not suitable used in Malaysia due to the climate and social practices. Thus, new technologies was introduced in order to suit for the used in climate Malaysia [Abedi et al., 2010].

In the period of early 1980s to 1990s, the steel structural components were higher demand in high rise building in Kuala Lumpur. For instance, one of the project was built consist of 36-storey Dayabumi complex in 1984 [CIDB, 2003b]. In 1990, the usage of pre-cast concrete system was widely used in high rise building. The Perbadanan Kemajuan Negeri Selangor [PKNS] was using pre-cast concrete system to construct low price house and high price bungalow in the townships in Selangor [CIDB, 2003b, Din et al., 2007].

During the period of early 1990s to 2000s, the IBS components was widely used to be constructed national landmark. For instance, Bukit Jalil Sport Complex, Kuala Lumpur Convention Centre, Lightweight Railway Train [LRT], KL Sentral Station, KL Tower, Kuala Lumpur International Airport and Petronas Twin Towers. Eventually, the Construction Industry Development Board create the IBS Steering Committee in 1999 in order to promote the usage of IBS in construction industry. As result, this committee have been success to establish the IBS Strategic Plan. Moreover, Modular Coordination Guideline for Building Design ["MS1064"] was important to adopt the IBS implementation in early 2001. It is a public and private joint guideline in order to standardization via modular coordination.

Apart for this, the Construction Industry Master Plan 2006-2015 had been highlighted the importance of IBS implementation and promote the usage in construction industry. According to CIMP 2006-2015, the importance of IBS was strongly recommend under the Strategic Thrust 5 which innovate through R&D to adopt the new construction method like IBS [CIDB, 2003a]. In consequently, the IBS Roadmap 2003-2010 was established in order to encourage implement the IBS system, guidance to the construction players and policy makers. This roadmap is a document that separate the IBS programme into 5-M strategy which are Manpower, Materials, Management, Monetary and Marketing [CIDB, 2003b].

Last but not least, the Construction Industry Development Board [CIDB] was developed a new IBS Roadmap 2011-2015 with the aims to tabulate the method toward for IBS industry. According to this roadmap, it has four strategic thrusts aims which are quality, safety and professionalism, environmental sustainability, productivity and internationalization in order to leading the construction industry with sustainable IBS industry [CIDB, 2015]. In additional, the main objective of this IBS Roadmap 2011-2015 was achieving the 70% of usage IBS components for public sector building project in 2015 and achieving 50% of usage IBS components for private sector building project in 2015 [CIDB, 2015, Din et al., 2007]. The revolution of IBS implementation from the early 1960 until 2016 is a huge process to undergoes. However, the success and efficiency implementation of IBS in Malaysia construction industry can be contributed a numerous of merits compare to conventional method.

In Malaysian construction industry, the current procurement used in IBS implementation is the conventional procurement method. Conventional procurement method is a separated procurement method that separates the design and construction stage [13]. Current traditional procurement method in IBS project lack incorporation and arrangement among IBS construction players [10]. To produce a successful IBS project, it is important to choose the right procurement method which involves all parties [10]. In short, the suitable procurement approach is fair and suitable in coordinating the project.

Procedures of IBS project delivery in current procurement approach has arisen the barriers of fragmentation which consists of professional's segregation, lack of cooperation between design and construction stages and leading to time delay, conflicts or miscommunication between consultants and contractors, cited by Nawia, Haronb [11] and Nawi, Lee [14]. Both researchers suggested that an innovative procurement shall be reviewed [11, 14].

The definition of innovation is defined as "an idea, practice or object that is anticipated as new by an individual or others unit of acceptance cited by Walker and Hampson [2003]. Besides that, he mentioned that innovation is a need to change from an "old" status to a new status. Innovation is about the endurance and development, market niches which have been fulfil by the wealth of life force [Walker and Hampson, 2003]. He also saying that innovation is a decision-making procedure in order to take action revolution in technology, procedure, services or others management

method. Hence, the aim of innovating is to obtain competitive advantage or good relationship-based with others parties.

Walker and Hampson [2003] were found that the characteristic of innovative organisations have a longer-term perception and willing to accept the development obstacles. Besides that, he also stated that innovative organisations will take a widen view on risk and adopt integration method where the implication of innovation in all stages of projects. The importance of planning was recognised in innovative organisations with flexibility being a priority [Walker and Hampson, 2003].

However, the project based method in construction industry are comprising more routine procedure for development [Walker and Hampson, 2003]. Besides that, he comments that the demand of cost, time and quality shall be meet the client's expectation in the project which restrict the opportunities for innovation. Furthermore, the timeframe of construction work in project based method is limited that is discourage the innovations because it may disturb authorised plans. Therefore, the planning flexibility and innovative method are combine with construction time performance achievement [Walker and Hampson, 2003].

There is a need of leader in an project management say by Walker and Hampson [2003]. This is a person who has the experienced and personality to drive the project success or failure [Walker and Hampson, 2003]. Empowerment is an essential social issue in assisting to create innovation. For instance, the good empowerment with leadership in developing excellence via ensuring the employee are not monopolize to follow the leadership of an organisation. Hence, it will disturb the experimenting with new ideas via a lack of motivation. As the result, empowerment require a knowledge sharing dimension resulting in understanding of aims and program between leaders and followers.

In additional, a relationship-based procurement system requires information and communication technologies [ICT], supportive environment form within organisation demanding leadership qualities that encourage diversity so that people are open minded. Walker and Hampson [2003] say that the individual in the relationship-based procurement system is needed to be open and share the information or ideas. Moreover, the leadership qualities of an organisation in this type of procurement system is not involvement of "control or command" in the construction organisation [Walker and Hampson, 2003]. In contrast, the power leadership driver is consisting of supportive or trust and commitment among the party.

In conclusion, a relationship-based of procurement system is comprising an good collaboration each other's, sharing risk and profit, contribute in new ideas and information, all parties are work together in the organisation with different background and profession. Hence, there is various of advantages in procuring a relationship-based procurement method in the construction industry.

In conclusion, enhancing the IBS project delivery needs collaborative working relationship among all construction parties. Many researchers highlighted that the new method of procurement implemented shall consist of financially good relationship of parties in the project. Researchers commented that since methods of construction is innovated from traditional to IBS, hence procurement for IBS shall also be changed.

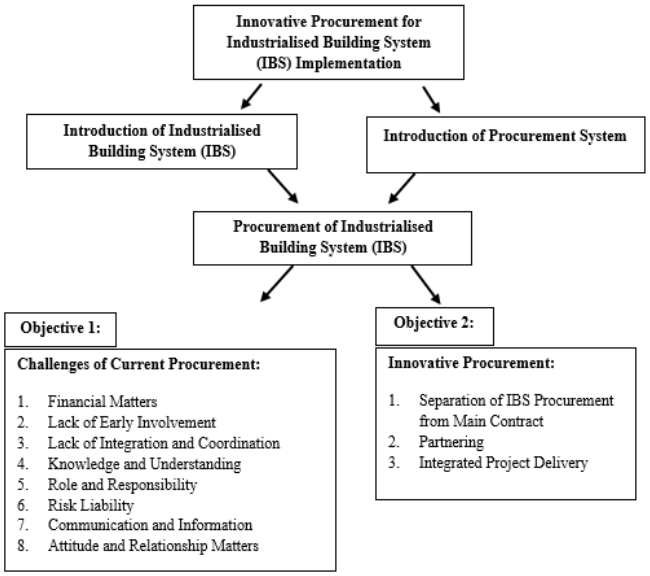


Fig. 1: Framework of Literature Review

3. Methodology

Research methodologies were included in the literature review and qualitative semi-structured interviews. Literature review was the first phase of the research which would collect secondary data derived from books, journal, thesis and dissertations, articles, reports and conference proceedings. The second phase comprises of collection of primary data through semi-structured interviews. Semi-structured interview was conducted in order to achieve both objectives of the research, which is to identify challenges of current procurement and innovate procurement suitable for IBS implementation. Data analysis for this research uses a coding analysis method. All interviews were recorded and transcribed out into wording. Each interview would take approximately one hour.

Respondents of this research were selected from those registered under IBS contractors under Grade 7 in Malaysian construction industry both private and public sectors. Respondents were selected based on their past experiences on IBS project and their general perception. Letters were posted and e-mailed to IBS contractors. A follow-up phone call secures the interview arrangement. Overall, there were six [6] contractors under Grade 7 registered under CIDB involved in IBS project who agreed to be interviewed.

4. Results and Findings

At the beginning, the interviewees were asked about their general information. The table below show the respondents designation, experiences, types of IBS components in the project, types of procurement and project categories.

Table 1: Current Post, Experiences and Project Characteristics

Company	Designation	Experiences [years]	Types of IBS Components	Type of Procurement	Project Categories
A	Quantity Surveyor	7	Precast Concrete	Traditional	Hospital, Education Buildings
B	Professional Engineer	15	Precast Concrete	Traditional	Education Buildings
C	Senior Quantity Surveyor	10	Precast Staircase and Beam	Traditional	Quarters, Hall, Recreational Buildings
D	Business Development Manager	12	Steel Structure	Traditional	Pinewood Warehouse, Warehouse
E	Assistant Contract Manager	5	Steel Structure	Traditional	Warehouse
F	Assistant Contract Manager	9	Precast Concrete	Traditional	Education Buildings, Media Studio Facility

4.1. To Identify the Challenges on Current Procurement for Industrialised Building System [IBS] Implementation

Based on the result of the interviews that obtain challenges on current procurement were presented as follow:

4.1.1. Financial Matters

Financial matters were one of the major challenges that faced by the main contractors. All respondents claimed that Industrialised Building System [IBS] was an expensive construction method than the conventional method. This is because IBS system involving a high initial and set up costs. Besides that, all of the respondents claimed that the traditional method of payment in IBS system also present barriers. The contractors have to find an excessive of capital to pay the specialist or manufacturer in a huge amount of payment in the beginning stage in order for the specialist or manufacturer to proceed with their IBS components order. For instance, most of IBS manufacturer should get an advance payment in 10% of the total cost of IBS components from the main contractor to secure their financial.

4.1.2. Lack of Early Involvement

Traditional procurement method only allows main contractors involved after tender stage. As the result, most of the interviewees were complaint that design problems would be occur in the construction stages. Most of the design discrepancies were came from structural part due to IBS components were more toward structural element such as beam, column, slab and others. Half of the respondents were strongly agreed that early involvement of the contractor in design stage could lead to reduce the creating design that inefficiently built, deceasing design rework, enhancing project schedule and created better construction cost saving, labour saving and reduce wastage in construction site. They were view that main contractors shall join together from initial design to allow the integration of IBS pre-casters, designers and engineers. In short, design, manufacturing and construction are the elements in IBS which cannot be separated.

4.1.3. Lack of Integration and Coordination

All the respondents were explained that traditional procurement method was non-collaboration and integration between construction players in the construction process and it lead to conflict and had an impact on the quality of the design procedure and design outcome. Hence, Industrialised Building System [IBS] was a pre-planning and design system. Besides that, this system need a lot of pre-preparation in the design stage. Thus, all the IBS components should check clearly and perfectly before constructing. However, most of the problem arise was design problems in initial stage. Furthermore, Industrialised Building System [IBS] design work would be done by consultant team. After the design have been produce by consultant, main contractor would take the design drawing to IBS manufacturer in order to produce the IBS components. Therefore, main contractor play an important role should coordinate the work on site to ensure the quality of works was fulfil the client's requirement. Besides that, main contractor also should coordinate with IBS installer. In short, all respondents were claimed that traditional procurement method was lack of sense identity, introduce a confrontational culture, lack of integration and feedback loops between design and construction process.

4.1.4. Knowledge and Understanding

Most of the private consultant team and client were lack of knowledge and concept in the Industrialised Building System [IBS] implementation due to they were not experienced in term of the knowledge and skill in the IBS design as specified by company E. For instance, architect's drawing was not match with structural engineer's drawing. Hence, it would affect the mechanical and electrical engineer came over their service. As the result, main contractor need to redesign the design and drawing for the mismatch components and incorporated to solve the M&E service on site during construction stage. Besides that, most of the respondents were commented that the consultant team only indicated IBS components in drawing without any detail drawing provided to main contractor in order to carry out the works. In contrast, half of the respondents were meet-up some of the private consultant and client were experienced in this system. The consultant team were design the detail drawing for IBS system. Hence, this could reduce down the redesign works been carried out by main contractor.

4.1.5. Role and Responsibility

Adopting traditional procurement method in Industrialised Building System [IBS] process where consultant team should be completed their design. After awarded the tender to particular main contractor. Main contractor would submit all the architect and structural engineer's drawing to IBS specialist. Then, IBS specialist would produce their shop drawing according to the design. If there was a discrepancies design, IBS specialist would be proposed a new design or shop drawing to consultant team in order to get approval. Consequently, contractor would take their role and responsibility to raise out query to consultant. As stated by respondent's company C, he claimed that some of the consultant would not play their important role and responsibility to re-check the drawing discrepancy and review the new design that proposed by IBS manufacturer. Most of the IBS components were designed by the structural engineer, if there was any new design proposed by IBS specialist need to endorse by the structural engineer. However, the procedure to get the endorsement from structural engineer was a long process. In short, all the respondents stated that lack of role and responsibility by consultant team would impact the construction process.

4.1.6. Risk Liability

Risk liability between structural engineer would be transfer to main contractor. This is because consultant team would assume that main contractor check all the specification in the drawing. If there was a discrepancy, main contractor should raise out query. Without any query raise out by main contractor when design was not constructability, the risk liability would be transferred to main contractor. Besides that, any new design counter proposed by main contractor, they should bear the risk if the new design has not been get endorsement from consultant. However, most of consultant would delay approval their new design. This is because once the new design get the approval and endorsement by consultant. The most affected to take the risk liability was the structural engineer.

4.1.7. Communication and Information

The consultant should have a better communication and information to give to the contractor to carry out the works. Most of the respondents were explained that problems such as inaccurate design information, refuse to adopt others member perspective, inaccurate data, late updating related information and late submission to the local authority. All these would cause an indirectly impact to quality of IBS project delivery. Besides that, one of the respondent from company B was claimed that IBS manufacturer was not sharing of information and share their technology while visiting their factory.

4.1.8. Attitude and Relationship Matters

Half of the respondents were claimed that client and consultant have a bad attitude such as self-pride, arrogance, no respect and lack of understanding and cooperation with main contractor. For

instance, they refuse change their design in order to secure their professionalism even though the design was not suitable on site fabricated. Besides that, most of the private consultant and client were refused to adopt the new construction method likes Industrialised Building System [IBS]. They were satisfied with the conventional construction method that involved a cheaper construction cost compare to Industrialised Building System [IBS] construction.

4.2. To Identify the Innovative Procurement Suitable for Industrialised Building System [IBS] Implementation

Most of the contractors have been faced out the challenges on current procurement for Industrialised Building System [IBS] implementation. In order to overcome the challenges faced by them, an innovative procurement should be introduced such as Separation of IBS Procurement from Main Contract, Partnering and Integrated Project Delivery [IPD] in the Malaysian construction industry.

First and foremost, Separation of IBS Procurement from Main Contract could address the major challenges that contractor needed a higher initial capital in order to obtain IBS components from IBS manufacturer. Therefore, it could overcome financial matters among IBS main contractor in Malaysian construction industry due to payments would be direct paid from the project owners or clients to the IBS specialist. Hence, this could reduce the cost of contractors whereas it could increase the demand certainly from IBS manufacturer. Besides that, it would create a good competitiveness among the IBS manufacturer. However, this type of procurement has disadvantages to main contractors. This is because main contractor could not mark-up the potential price in order to gain more profit in the project. Besides, half of the respondents were claimed that main contractor could only gain 3%-5% of profit and attendance from the IBS construction works.

Secondly, partnering was one of good innovative procurement system that involved an agreement among the parties in order to achieve mutual objective, problem resolution and continuous improvement. Partnering was incorporated all the construction parties from design till construction stage that comprising of life cycle oriented performance and cost certainty. Therefore, it could solve the challenges lack of early involvement in traditional procurement method. All construction players were integration and coordination together from design stage till construction stage in order overcome the obstacles arise. Nevertheless, one of the benefit of partnering itself was risk and profit share among each other's. Most of the respondents were claimed that risk and profit share among each other's was not applicable in Malaysia construction industry. This is because there was a lot of unforeseen risk and obstacles could not be forecast early as most of the construction players were lack of vast experienced in this system.

Last but not least, Integrated Project Delivery [IPD] was a business structure for design, implement and transmit the building by incorporated, integrated and productive team of project construction players such as client, architect, engineer, main contractor, manufacturer, supplier and others. Integrated Project Delivery is a new concept of project delivery method introduced in the industry. It is being adopted widely in other developed countries for integration among project team members throughout the project duration in order to deliver a more effective and better understanding project. The statement above indicated that Integrated Project Delivery [IPD] was a business structure for design, implement and transmit the building by incorporated, integrated and productive team of project construction players such as client, architect, engineer, main contractor, manufacturer, supplier and others. Therefore, all construction parties were incorporated with Building Information Modelling [BIM] software to carry out the work from design stage till completion stage. As respondents R2 defined that Integrated Project Delivery was a Design and Build procurement that integrated with BIM. For instance, architect change design in initial stage. All the parties could be easily amended the work or measurement in the BIM software. Hence, this kind of procurement could overcome the design problems due to main contractor was involved in the initial stage. Besides that, BIM software was one of the important tools to assist the construction parties to manage all the unforeseen obstacles between design stage and construction stage. Moreover, construction players who lack of knowledge and understanding in Industrialised Building System, this procurement could help them to share knowledge and advance innovative ideas to be incorporated into Industrialised Building System.

Therefore, all construction parties were incorporated with Building Information Modelling [BIM] software to carry out the work from design stage till completion stage. Hence, this kind of procurement could overcome the design problems due to main contractor was involved in the initial stage. Besides that, BIM software was one of the important tools to assist the construction parties to manage all the unforeseen obstacles between design stage and construction stage. Moreover, construction players who lack of knowledge and understanding in Industrialised Building System, this procurement could help them to share knowledge and advance innovative ideas to be incorporated into Industrialised Building System. Nonetheless, half of the respondents were claimed that Integrated Project Delivery [IPD] was suitable for large scale and complex project types. Furthermore, BIM software need a large amount of capital to invest such as training, license software, workshop and others. Hence, main contractor shall prepare a huge amount of money to invest this software.

Overall, Partnering and Integrated Project Delivery were rated the highest innovative procurement suitable for IBS implementation among the respondents. This is because both procurement was a relationship based procurement method that could overcome the challenges on lack of early involvement, lack of integration and coordination between design and construction stage, lack of knowledge and understanding of consultant team. However, Respondent 3 was not familiar with the Partnering and Integrated Project Delivery [IPD] procurement in the construction industry. Besides, respondent 1 and 3 were agreed with Separation of IBS Procurement from Main Contract was suitable for IBS projects. However, most of the respondents were commented this procurement could not suitable being used for IBS projects due to they only gain 3-5% of profit and attendance.

5. Conclusion

In conclusion, the major challenges faced by contractors are financial matters, lack of early involvement, lack of integration and coordination. For financial matters, the main contractor should have a strong financial background or cash flow in order to make payments to specialist or manufacturer in the initial stage to order IBS components. Lack of early involvement from contractors impact the contractors by having to rework the design. IBS system is different with conventional construction method; it needs integration and collaboration between design and construction to be carried out in a sequential manner. In order to overcome major challenges faced by contractors, an innovative procurement such as Separation of Industrialised Building System [IBS] Procurement from Main Contract, Partnering and Integrated Project Delivery [IPD] shall be introduced, where the project delivery involves contractors from the early stages until completion.

Since the study only focuses on identifying challenges in current procurement and innovative procurement suitable for IBS implementation, it is recommended that further studies be carried out on challenges of current procurement system faced by manufacturers or specialists.

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