

# The Application of Procurement Systems in IBS Housing Project

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**Abstract**— Traditional procurement system has been critique due to inefficiency dealing with innovation and industry development. As the industry developed, modern and alternative procurement systems has been introduced such as Design and Built and Management fees. Malaysian National Housing Policy 2012 has focused on the implementation of industrialized building system (IBS) to transform the housing industry by improving its quality, more economical, speed to construct and less dependency on foreign labors. The success of these development will highly be depending on procurement system management. This paper explores the type of procurement system currently been used in the industry, the procurement system management and issues arise from the practice. The findings revealed that under the two most popular systems that are Traditional and Design and Built; there are no differences in terms of appointment of IBS Manufacturer where the IBS Manufacturer will be appointed late under the Main Contractor. Thus, it is hypothesized that the issues arise due to the practice of these 2 procurement system are almost similar which does not comprehend the need to cater innovation in the industry.

**Keywords**— *industrialized building system (IBS), payment, construction industry, procurement*

## 1. Introduction

Procurement system in construction is defined as a process to organize and coordinate the related parties in the project, especially on defining their contractual relationship. It includes the contract responsibility, the duties that every party has, their rights, liabilities and roles towards the project [1]. Procurement for construction project is only temporary where it is used during the construction process and dissolves when the project is completed [2]. Research by Hall et al., (2000) revealed that in order for a construction project to be completed, it must be governed by a suitable

procurement system that can be used to control and manage the process and activities involved. For example, to construct a building project, this requires the related materials, technology, services, and many other resources [27]. To procure all these materials and services will need negotiations with many suppliers, service providers, building professionals and consultants [3]. Therefore, in broad-spectrum, construction procurement can be referred as the project guidelines that determine the responsibility of the parties involved, including their contractual obligations and the activities to assist the client in obtaining competent construction services to complete their desired projects [4].

Due to the increasing project demands and the changing construction nature, several types of construction procurement were developed to fulfil these new requirements [5]. The aim of this development is also to provide better procurement that effective and efficient in satisfying the clients' needs. In the early construction era, Traditional construction procurement system was developed to organize the tradesman such as carpenter, masonry, craftsman, builder etc. and dealing with materials suppliers. However, as clients' needs has changed and construction has developed, alternatives construction procurement were introduced such as Design and Build, Management Contracting and Construction Management [6]. These new construction procurements are aim to fulfil and adapt the project with the new construction environment. The differences between each procurement are mostly on the contractual relationship, roles and liabilities among parties involved and the procurement strategy towards achieving the project priority such as speed to construct, fast track construction, price certainty, level of clients' interference, single point responsibility etc [2].

In Malaysia, the housing sector is also one type of major projects that contribute a lot to construction activities. Therefore, the housing sector should also

implement IBS, so that this sector can also be transformed from using inefficient construction method into using modern and advance construction method. To achieve IBS transformation, the housing Developers and Contractors are the most important key players for Malaysian IBS programs to be successful. According to Abd Rahman & Omar, (2006) before the year 2003, the CIDB levy for local residential projects was at 0.25% [7]. However, after the enforcement of the Economic Stimulus Package in 2003, the levy was reduced to 0.125%, to encourage more Developers to build housing projects to meet the demand. So, to increase IBS adoption in housing projects, the government had offered incentives to the housing Developers. If their housing projects adopt IBS and achieve IBS score 50% or more, they will be exempted from paying the CIDB levy.

In 1990s, IBS has evolved more into using precast concrete system in high rise residential building projects and high end housing projects. Started from 1981 to 1993, the Perbadanan Kemajuan Negeri Selangor (PKNS), a Selangor state government development agency had adopted precast concrete system made by Praton Haus International Company from Germany to construct high rise low cost residential projects and high cost bungalow houses [8],[9]. After this successful project, the same system was used to develop new townships in Selangor state. Since then, PKNS had built more than 52,000 unit of houses using Praton Haus system [10]. For public housing projects that are successfully completed using IBS concept are government quarters in Putrajaya Precinct 17 and Precinct 9 (used IBS precast technologies by Taisei Corporation from Japan and later adopted by Setia Precast), PPR Sungai Besi, Sungai Bedaun, Labuan and Telipok, Sabah [11].

Many research have been made on IBS projects but their focus are mostly related to product and process implementation from the perspective of IBS Manufacturers and Contractors. The research areas that have been covered among others are the barriers and implementation of IBS adoption [12], critical success factors [13], supply chain [14-17] and IBS awareness and acceptance level among Contractors [9],[18]. However, there is lack of research on procurement aspect in IBS projects. Therefore, this paper will thus discuss the current procurement practices in IBS housing projects. It

will cover 3 questions: 1. What are the procurement system applied in IBS housing project? 2. How is the procurement system management conducted? 3. What are the issues concern? This paper will report a part of a larger studies on procurement issues that happen in Malaysian IBS housing projects. It will start with discussing various procurement system, research methodology, findings, discussion and conclusion.

## 2. The Importance Of Construction Procurement

Construction procurement is a major factor that contribute to project success [19] Procurement is not only about forming a contractual relationship, but it also include a detail set of relationship defining and limiting the parties' rights, roles, duties, liabilities and responsibility of each project [20]. Construction procurement is necessary for every project because it helps the clients in getting their project completed while satisfying the clients' needs and requirements [2]. Besides that, procurement also play significant roles in spreading good virtues and values towards achieving teamwork culture and trust among project members [21].

However, research by Love (2002) revealed that many construction professionals do not really understand the various functions of different construction procurement systems [22]. Due to this, they tend to use procurement that they familiar with, or procurement that gives most benefit to them without giving much attention whether that procurement will suit their project's characteristics or not. As a result, some projects face many challenges, because the procurement they use is not suitable or less effective. Abdul Rashid et al., (2006) agrees with this argument and added that many projects which apply unsuitable procurement have more chances to face difficulties, thus prone them to be delayed, increase in cost, conflicts among project members and contractual and payment disputes which later involve civil court cases [6].

Khalfan et al. (2005) argues that the Traditional procurement has become unsuitable when the nature of modern construction has changed and more building technology being applied [23]. For example, Traditional procurement which applied fragmentation based, is no longer suitable for

modern projects that want to combine or overlapped some of the activities, where two or three construction works can be conducted concurrently. According to (Masterman, 2003), the Traditional procurement is no longer effective because it requires more time to be completed as it follows strict sequence of construction process [1]. Besides, this procurement causing many disputes especially when many different parties involved. Due to this procurement practice separation of roles and duties, so when defects occur, each party will not admit his fault and start to point the blame to the others.

New integrated procurement known as Design & Build placed the main responsibility to the Main Contractor who will responsible for both to design and to construct the project, and they will also responsible from project start to finish. Therefore, the Main Contractor will bear the liability for the whole project and they must use their expertise and skill to organize the work, thus it is called as 'everything under one roof [21]. The acceptance was encouraging especially for projects that involved high cost, one off and unique design. However, this type of procurement also cannot solve some disputes especially when too many subcontractors or suppliers are involved [24]. It is difficult for a single party such as the Main Contractor, to organized the whole project involving many trades from project start until completion. The single Main Contractor will be exposed to mistakes or errors when dealing with too many subcontractors and suppliers. Then, newer construction procurement which is based on management was introduced as an alternative to the Traditional procurement and Design & Build procurement [1]. This new procurement apply management oriented process where the Main Contractor will no longer responsible to design and construct the project, instead their focus will be to manage, supervise and organise the trade contractors, subcontractors and suppliers to ensure their work are smoothly done. This procurement had received positive acceptance from construction industry. Many projects adopted this procurement because it allows new requirements to be implemented such as the clients can involve more greatly in the project, allows fast track construction as the detail design can be made after the trade contractors are appointed, the clients can choose either to appoint the trade contractors directly or

indirectly and more activities can be overlapped, thus allowing time saving.

### 3. Data Collection

The respondents consist of 7 different companies which divided according to their nature of business. They were Developers (registered with REHDA), G6 and G7 building contractors, Mechanical and Electrical Contractors and IBS Manufacturers (registered with CIDB), Architect Consultant (registered with PAM), Civil and Structural Consultant (registered with IEM) and QS Consultant (registered with BQSM). The data collection is gained through mixed method which combine the quantitative data (questionnaires) and qualitative data (interviews). Both methods are conducted sequentially which first through questionnaires, then followed with face to face semi-structured interviews. This step was also applied in previous research by [25],[26]. The questions are designed to know the respondents views on procurement management in IBS housing projects. Their answers are based on their experienced and knowledge from their current or previous involvement in IBS housing projects. Overall, from the total 199 questionnaires sent, only 118 or 59.3% were replied. The highest reply was received from the IBS manufacturers where 74.4% from total questionnaire sent to them were returned, followed with 62.9% (Developers), 57.7% (Main Contractors), 53.3% (Architect Consultant), 52.0% (QS Consultant), 46.7% (C&S Consultants) and 42.9% (M&E Contractor). Interviewees were selected from the respondents who joined the questionnaires survey. After screening, 12 respondents were chosen based on their wide experience in the research areas. To ensure the information gained through interviews are not missed, the interview sessions were recorded and transcribed. From all the interviewees, 4 are from IBS Manufacturers (M), 3 from Main Contractors (C), 2 from Developers (D) and 3 from Consultants (CO).

### 4. Research Findings

#### 4.1. Background of Respondents

The majority or 63% from total respondents have Bachelor Degree as their highest academic qualification, 19% possess Master Degree and 18% with Diploma. From total respondents, 23% of

them have registered and become member with their respective professional institution. In terms of work expertise, 32.2% were specialized in Quantity Surveying, followed with Architect 11.1%, Civil Engineering 9.3%, IBS Designers 11.0%, IBS Installer / IBS Site Engineers 8.5%, Operation Manager 7.6%, Construction Manager 5.9%, Mechanical and Electrical Engineers 5.1%, Site Supervisor 5.1% and lastly Project Manager 4.2%. In term of working experience, 40% of the respondent have between 11–19 years, 37% between 1-10 years and 23% have more than 20 years. For interviewees, most of the respondents or 83% have between 8-15 years while 17% have between 16-25 years of experience.

### 5. Types of IBS used in Housing Sector.

CIDB, Malaysia has classified the types of IBS into 8 and they are divided into two major groups which is precast and non-precast. In this research, respondents are required to state the types of IBS that they have used in their IBS housing projects. They can tick more than one answer. Table below shows the result on the types of IBS that respondents used in their housing projects.

**Table 1.** Types of IBS Method used by Respondents.

Types of IBS Method	Usage		Rank
	Frequency	Percentage	
<b>Precast Concrete</b>	97	82.2%	1
Precast Concrete Structural Frame			
Precast Wall System	88	74.6%	2
Precast Staircase	78	66.1%	3
<b>Non-Precast Concrete</b>			
Formwork System	44	37.3%	4
Blockwork System	38	32.2%	5
Metal Framing	16	13.6%	6
Timber	7	5.9%	8

Framing			
Innovative (other than above)	10	8.5%	7

From the above result, the types of IBS method that received highest used by respondents is precast concrete structural frame with 82.2% (1st rank), followed with precast wall system with 74.6% (2nd rank) and precast staircase with 66.1% (3rd rank). These top three of IBS method that received highest percentage by respondents are categorized under precast concrete. While the non-precast concrete received lower percentage of usage where formwork received 37.3% (4th rank), blockwork system with 32.2% (5th rank), metal framing with 13.6% (6th rank), innovative with 8.5% (7th rank) and lastly timber framing with 5.9% (8th rank). In overall, between the two major IBS methods which is precast and non-precast, most respondents have used the precast concrete, and very few of them have used the non-precast concrete. The gap between the usage of IBS precast and non-precast is so vast. The highest usage among non-precast IBS is only 37.3%, while the lowest usage among precast IBS is 66.1%. From this comparison between the highest among non-precast and the lowest among precast has shown that most IBS housing projects apply IBS with precast method, and only few of them apply the non-precast method.

According to C1, most Main Contractors and Developers apply precast method because this method is fast and take less labour to install compared to non-precast method. For example, the precast methods will use prefabricated IBS components that fully made in the factory, and they are sent to site just for installation. The installation will be conducted by few workers because the components are ready made products. However, for non-precast such as formwork system, blockwork system, metal framing and timber framing, these IBS methods need more workers at site during installation because they are not ready made products. Besides, the application of non-precast IBS methods will take longer time than precast methods. This is because the non-precast IBS only apply certain techniques which simplify the construction process, but they are not using totally prefabricated concept. As a result, the non-precast IBS methods cannot achieve the speed and less number of workers like the precast IBS methods.

This was agreed by D1, M1, M2, CO1 and CO2. CO2 added that the precast IBS method will still achieve highest usage in IBS housing projects because it gives more point for the Developers to achieve higher IBS score compare to non-precast. Besides, the government encourage housing Developers to apply precast IBS method because it gives more benefit, not just to simplify the construction process like non-precast could offer. Among the advantages of precast IBS is that it can allow the project to be more economical when construct with certain scale, the quality is guaranteed because the components are made under strict procedures in the factory and it is more environment friendly as it produce less waste compared to non-precast IBS.

This was agreed by CO3, M3, C2 and M4. According to M4, the precast IBS has become the first choice of many housing Developers because of government incentives and promotions for this type to be applied in housing projects. She revealed that many housing projects that applied precast IBS will continue to do the same for their next projects, while this do not happen for projects that apply non-precast. Most of housing projects that apply non-precast IBS, will move to precast, as this method is encouraged by the government and gives more benefits. As a consequence, the number of housing projects that move to apply precast is increasing. Base on the result and the respondents' feedbacks, it is obvious that the precast IBS method is more suitable for housing sectors as it gives a lot of benefits compared to non-precast. Besides, the encouragement from government to apply precast IBS makes many housing Developers and Main Contractors to give priority for this type, and less attention to use the non-precast. Due to most respondents apply precast IBS and very few of them apply non-precast, coupled with the precast benefits and government encouragement, this research will therefore only focus to housing projects that apply precast IBS, and not cover the non-precast. So, the discussion in this research will only relate to procurement for housing projects that apply precast IBS.

## 6. Types of Procurement used in IBS Housing Projects

There are four procurement routes that mostly used in Malaysian building construction. In this research, respondents are required to state the types

of procurement route that they have used in their IBS housing projects. They can tick more than one answer base on their own experience. Below is the result on procurement that respondents used in their IBS housing projects.

**Table 2.** Procurement Route Used in IBS Housing Projects

Procurement Route Used in IBS Housing Projects	Usage		Rank
	Frequency	Percentage	
Precast Concrete Design & Build system	98	83.1%	1
Traditional	90	76.3%	2
Construction Management	20	16.9%	3
Management Contracting	15	12.7%	4
Others	2	1.7%	5

The above result shows that the Design and Build is the highest procurement route used by respondents in their IBS housing projects with 83.1% (1st Rank). The second highest percentage of procurement route is Traditional with 76.3% (2nd Rank), while the third is Construction Management with 16.9% (3rd Rank), followed by Management Contracting with 12.7% (4th Rank) and lastly other procurement with 1.7% (5th Rank). According to D1, the most procurement route used by respondents in their IBS housing projects is Traditional and Design and Build because these two procurements are most familiar with Malaysian construction industry. Besides, the two procurements are lump sum basis, while the other procurements which are Construction Management and Management Contracting are fee basis. Most housing Developers prefer to choose procurement that apply lump sum basis, not the fee basis because through lump sum, they can determined the overall cost before the project start. They will not need to think on spending extra cost to complete the project except for some unavoidable circumstances.

This was agreed by M2, CO1, CO2, C2, and D2. D2 added that most housing Developers will make initial cost target for their housing projects, and will appoint the Main Contractors who can offer the cost that within the range. The housing

Developers who become the client for the project will let the Main Contractors to arrange the whole projects based on their discretion, as long as the project cost is not exceed the agreed amount. He explained;

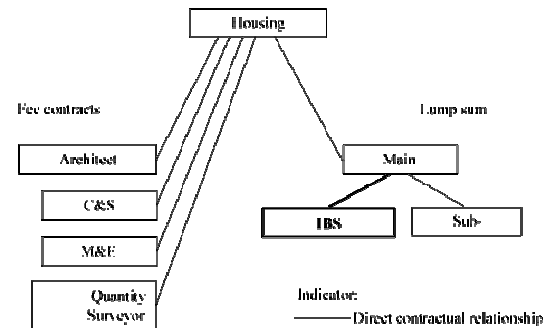
“Besides of the quality and time, the most important for the Developers is to ensure their housing projects can be completed within their targeted cost. So, they prefer to use procurements that apply lump sum basis because it allows them to have fixed price contract.”

According to M4, another reason why most housing Developers choose Traditional and Design & Build procurement in their IBS housing projects is because both procurements are suitable and not involving too many parties. The Developers can choose either Design & Build procurement which apply one single party that take the whole responsibilities to complete the project, or the Traditional procurement where the risk and responsibility is bear by different party in the project. Both procurements will not require the involvement of Construction Management Contractor who roles to oversee the project on behalf of client. Besides, in Traditional and Design & Build, the system are really well known to the parties who involve in IBS housing projects, and this will avoid dispute among them.

### 6.1. Traditional Procurement in IBS Housing Projects

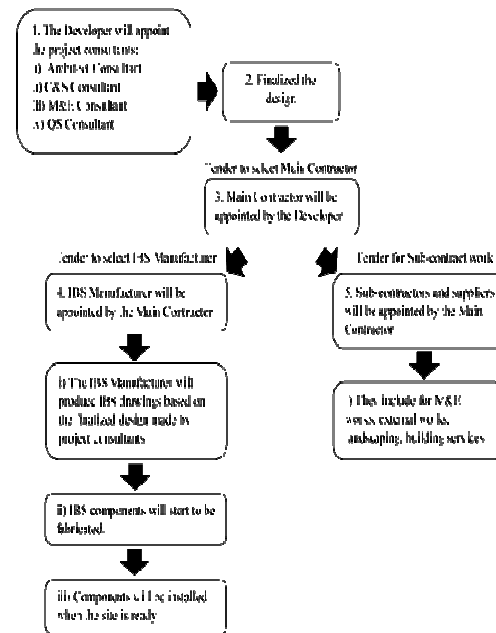
According to D1, in Traditional procurement, the parties in the project practice separation of work, where each of them focus to their own duty and not much integration among them throughout the project. This was agreed by M1, CO1, CO2 and C2. CO1 revealed that the fundamental for Traditional procurement is that the design and construction of the project is made by different team. So, the design must first be completed by the design team, then the Main Contractor will be appointed. In this research, all the research's respondents were using the outsource IBS Manufacturers because the Developers do not have their own IBS plant to produce the components. However, the appointment of the IBS Manufacturer is not made by the Developer, but they are appointed by the Main Contractor. The Developer will not intervene on the appointment of the IBS manufacturer and sub-contractors, as this is solely

under the Main Contractor's discretion. Figure 1 below shows the organizational structure of Traditional procurement that being practice in IBS housing projects.



**Figure1.** Organizational structure for Traditional procurement in IBS housing

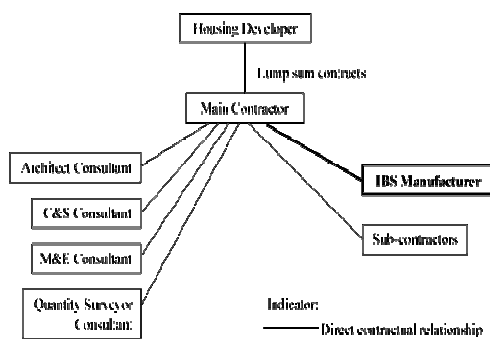
Base on the respondents' description, below is the flow chart showing the appointment process of the parties in IBS housing project that apply Traditional procurement. They include the design team, the Main Contractor, the IBS Manufacturer and Sub-contractors.



**Figure 2.** Appointment of IBS Manufacturer & Main Contractor under Traditional procurement.

### 6.2. Design & Build in IBS Housing Projects

For IBS housing projects that use Design & Build procurement, the Main Contractor will responsible for both, to design and to construct the whole project. So, the Main Contractor will implement integration of work among all parties in the project, or work as a team culture. This to ensure the whole project can perform well, and meet the proposal that the Main Contractor had submitted to the Developer. If any party fail to deliver his duty, the Main Contractor will be blamed because he is the sole entity who takes the whole risk for the whole project. Under this procurement, the Developer will appoint the Main Contractor on lump sum basis. If selected, only the Main Contractor will have contractual relationship with the Developer, while the other parties such as the Architect, C&S engineers, M&E engineers, QS, IBS Manufacturers, Sub-contractors and Suppliers will not have any contractual relationship with the Developer. In this research, all the research's respondents were using the outsource IBS Manufacturers because the Developers and the Main Contractors do not have their own IBS plant to produce the components. Figure below shows the organizational structure of Design & Build procurement that being practiced in IBS housing projects.



**Figure 3.** Contractual relationship under Design & Build in IBS housing projects.

Base on the respondents' description, below is the flow chart showing the appointment process of the parties involved in IBS housing projects that apply Design & Build procurement. They include the design team, the Main Contractor, the IBS Manufacturer and Sub-contractors.

## 7. Conclusion

Based on Traditional procurement, the design and construction work will be made in sequential and they are conducted by different parties. The design work will be completed by the design team before the Main Contractor is appointed into the projects. All the members in the design team are appointed early during design stage and they have direct contractual relationship with the client. After they have finished the design for the project, the Developer will appoint the Main Contractor who will responsible to select the IBS Manufacturer and other Sub-contractors. It is the Main Contractor discretion to appoint the IBS manufacturer that they think would be the best for the project. So, the IBS Manufacturer cannot join the design team because they were appointed late, which is in the middle of the project. Besides, they only have contractual relationship with the Main Contractor and they have no contractual relationship with other parties in the project.

Compared to Traditional procurement system, Design & Build procurement posed the main responsibility for the Main Contractor. The Main Contractor will responsible for the design and construction works. Despite the Main Contractor can appoint the IBS Manufacturer since early design stage, they do not do so due to several reasons. Due to this, the appointment of IBS Manufacturer in Design & Build procurement is no different with the Traditional procurement. This is because, under both procurements, the IBS Manufacturer is appointed after the design has been completed and they cannot join the design team during design stage. Besides, the IBS manufacturer has only single contract with the Main Contractor, and not having any contractual relationship with other parties.

Even the Design & Build procurement is considered to be a 'fast track' procurement because it allows some of the activities to be overlapped or combined. However, it does not apply strict sequential approach where each activity must follow the arrangement. For example, after the Main Contractor has been appointed, they will make detail design for the project while at the same time starts the initial construction works. Both the detail design and initial construction works can be made in the same time, thus can save the project time. Besides, the cost saving can also be achieved when the Main contractor applies the right approach that can simplify the method to construct,

use efficient management and optimizing the IBS adoption in the housing structure. However this said procurement has failed to overcome the involvement of IBS Manufacturer. Their appointment would also be rather late and the practice will be no difference compared to Traditional procurement.

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