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FRAGMENTATION ISSUE IN MALAYSIAN INDUSTRIALISED BUILDING SYSTEM (IBS) PROJECTS

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Abstract

As a developing country, Malaysian is currently driving for implementing a new or modern construction method, the Industrialised Building System (IBS), as an alternative towards enhancing construction performance. Currently, most of the IBS project developments in Malaysia are still conducted by using the traditional construction process approach. This traditional construction process has been widely criticised for its fragmented approach to project delivery and its failure to form effective teams thus created a number of issues such as reworks, time delay, rising costs, lack of communication and coordination, and wastages. This paper through literature review aims to highlight this fragmentation issue and clarify how far it affects the process of IBS implementation. Suggestions on how an integrated approach in design and construction in order to minimise the fragmentation gaps will be concluded.

Keywords: Industrialised building system (IBS), Fragmentation, Integrated team practice, Malaysia construction industry.

1. Introduction

It is predicted that between the years 1995 to 2020, Malaysia will need a total of 8,850,554 houses, including 4,964,560 units of new housing, to cater for the increase in population during this period [1]. The statistical data will be more crucial with the increase of immigration and natural disasters which will create

more demand for housing. However, only 1,382,917 units were constructed under the Sixth and Seventh Malaysia Plans. This means that another 3,581,643 units need to be built within the next twenty years to meet the targets, and not 600,000 - 800,000 units as planned under the 8th Malaysia Plan.

While the problem of housing grows more acute, Malaysia is struggling to meet its own housing needs, and is trying to do so through adopting new technology [2]. The conventional construction method, which is commonly being practiced, is high cost and unable to respond to this huge demand in a short time with standard quality [3-5]. Waleed et al. [6] stated that to achieve the Malaysian Plan target using current conventional building systems, it will require an excessive workforce, since on average, only one house is completed per year per worker (one house/year/worker). The rising cost of labour is an important factor in increasing the total cost of the house. As stated by Friedman and Cammalleri [7], the labour cost has increased to 30% of the construction cost as compared with 10% a few years ago.

2. IBS as an Alternative Solution

In an attempt to address these issues, the government, through its Construction Development Board (CIDB) Malaysia, actively promotes the adoption of a new or modern construction method system, entitled Industrialised Building System (IBS). Some researchers classify IBS as a process of total integration of subsystems, components and elements into one overall system which utilizes industrialized production, transportation, assembly and erection on site [8-10]. IBS was also identified as an industrialized production technique [11] and construction method [12] whose components are manufactured under control environment either at site or factory, transported, positioned and assembled into a structure with minimum additional site works [13, 14]. In this paper, IBS definition could be summarised as an innovative process of building construction using the concept of mass-production of industrialised systems, produced at the factory or onsite within controlled environment, that includes the logistic and assembly aspect under a proper planning and coordination design process towards enhancing the end users desired values. According to IEM [15], IBS has immense inherent advantages in term of productivity, indoor quality, durability and cost. Buildings constructed by this method also have a short construction time and standard quality [4].

Although, there were a lot of efforts and incentives by the Malaysian government to encourage the usage of Industrialised Building Systems (IBS) as an alternative to the conventional and labour intensive construction method, however it has not made headway. In an attempt to understand the poor diffusion of IBS, some researchers have investigated the barriers to effective IBS implementation in construction. Practically, most of the IBS project deliveries still apply the traditional approach. It is based on the fragmentation approach which was identified as one of the main barriers to adopting Industrialised Building System (IBS) in the Malaysian construction industry.

This paper gives focus on this issue, concerning ‘the traditional construction process’ which dominates the current Malaysian construction industry practice in organising and delivering IBS construction projects. Various issues pertaining to

'the traditional construction process' such as: its definition, process model, and its limitations will be explored. At the end of this paper, numerous tools and strategies developed to improve the traditional process and its applicability for IBS will be discussed.

3. Methodology

This paper is part of an on-going research on the fragmentation issue that affect the implementation of IBS in Malaysia. Multiple approaches have been employed in order to ensure that the data is gathered comprehensively and accurately. The approaches used include literature and workshops. A literature review, considered by many as part of research methodology, is essential in organising theoretical framework, developing a pertinent problem statement and research questions, and forming conjectures before formulating hypotheses to be tested. In this regard, Wisconsin [16] has aptly opined that a thorough literature review is a "critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles." This is precisely what this paper intends to present.

Through the literature review, the definition, concept, application, and related issues of fragmentation and Industrialised Building System (IBS) in the construction industry is examined and highlighted. All the data and information are gathered directly from libraries, books, articles and other printed materials sourced from international and national journals, proceeding and bulletin. This literature review is very important and helpful in the process of developing the theoretical sections of the actual research.

In addition, industry workshop was conducted in order to gather all the data that relates to the issue of fragmentation and finding solutions to solve the problem. The workshop is the most appropriate and effective way of obtaining information, insight, experience and knowledge of a large group of industry players in the shortest period of time. It produces data from the real-life situation and provides better details on the behaviour of the subject. In this research, the workshop was organized with the purpose to gather primary data and information directly from industry. The main objective of the workshop is to explore and discuss the issue of fragmentation in implementing IBS in the Malaysian construction projects. All the participants in the workshop are Malaysian IBS experts (i.e., manufacturers, designers, contractors and clients) that were previously or currently involve in IBS projects. There were several criteria that were used for the selection of the participants in this workshop. The participants must possess the required qualification, knowledge and skills relevant to the field such as having at least 5 years working experience involving several completed local IBS projects. Based on the selection criteria discussed above, 15 respondents were identified who agreed and subsequently attended the workshop.

4. Current Practice of Malaysian IBS Design Process

Previous studies [5, 10, 17, 18] highlighted that many IBS project developments in Malaysia are still based on the traditional design approach. The traditional approach means that all the design and construction process will be conducted in

a sequential manner throughout the project life cycle. Basically, this process starts with the client brief at the beginning of the project. During the briefing process, the client will brief the architect to design the building based on the traditional method of construction (i.e., reinforcement concrete and brick work system). The architect then will produce an architectural design by gathering and analysing the information and performing all the work necessary to design a project. For instance, the architect prepares a series of rough plans, known as schematics, to show the arrangement of rooms and building on the site.

In the next stage, all the detail of information and documentation will be given to the structural engineers in order to prepare and design for the structural elements. At the same time, this information also will be used by the Mechanical and Electrical (M&E) engineer in order to produce M&E specifications and drawings. After completing the structural and M&E design, the detail drawings and specifications will be passed to the quantity surveyor to estimate the costs and prepare the bill of quantities for the bidding and contracting process. During the main contractor selection process, the general practice is to base on the most appropriate submission with the lowest cost for construction. All the documents will then be passed to the awarded contractor to begin the construction work. The construction process however is unable to get started yet because of the existing design documents (i.e., drawings and specifications) that are still in form of the original or traditional method of construction. Therefore, the contractor needs to discuss either with the IBS manufacturer or consultant first in order to convert all the traditional construction drawings into IBS standard or specification. Finally the construction process can than begin. This traditional process is known as 'over the wall' syndrome and is shown in Fig. 1. The traditional construction process has been widely criticised for its fragmented approach to project delivery and its failure to form effective teams. The following section will discuss this issue/syndrome in more detail.

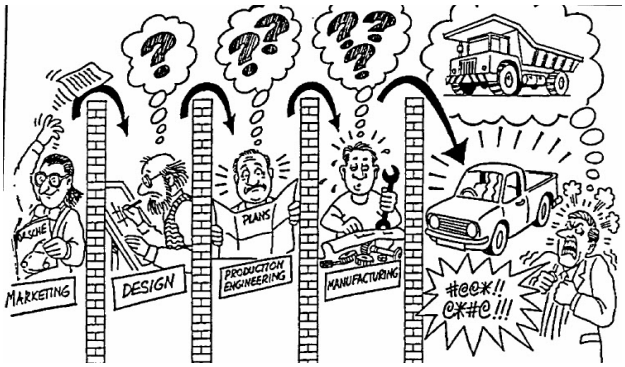

Fig. 1. Over the Wall Syndrome.

5. Fragmentation Issue

Previous researchers [19-21] revealed that this traditional approach generated many problems associated with fragmentation, such as isolation of professionals, lack of co-ordination between design and construction and as it is carried out in a sequential manner. Latham [22] highlighted that the traditional construction

process involves players that are disconnected from each other and work in isolation resulting in inefficiencies. Non-collaboration and co-ordination between the parties involved in construction also can lead to conflict and has a negative impact on the quality of the design process and design outcome [23].

On the other hand, Abadi [20] defined fragmentation as: "the division resulting from the increasing number of both professions and organisations involved in all processes of a building project. This has been caused by the growing demand for differentiation and specialisation as building projects increase in both size and complexity." Abadi [20] also explained that there are two main forms of fragmentation in the construction industry; internal fragmentation and external fragmentation. Internal fragmentation refers to the problem of integration and coordination between different alliance organisations (i.e., client, consultant, etc.) while external fragmentation refers to the involvement of non-alliance organisation (i.e., local authority, etc.) at different stages of the design process.

Fundamentally, fragmentation arises inherently in the traditional contract strategy (procurement) that is characterised by a lack of sense of identity, promoting a confrontational culture and a lack of feedback loops or co-ordination between the design and construction process [20, 21, 24]. Furthermore, the nature of the traditional construction process itself is conducted in a sequential manner and is constructed based on the approach by segregated professionals (lack of interaction between contractors and designers) during the design and construction phase. This scenario often results in inefficiencies during the construction phase such as increased project complexity, rework, increasing costs and longer construction duration [19]. This type of approach has labelled the construction industry as having a lack in continuity to form effective teams which resulted in inefficiency in the project delivery process [22, 24, 25].

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 [19, 21], poor performance [26] and client dissatisfaction of products delivery [21, 27]. 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. In addition, according to Evbuomwan and Anumba [19] this fragmented traditional approach also will create some related problems such as

- Fragmentation of different participants in most construction project leading to misconceptions and misunderstandings.
- The fragmentation of design, fabrication and construction data whereas data generated at one stage are not readily re-used downstream, leading to design clashes, omissions and errors.
- The occurrence of late and costly design changes and unnecessary liability claims, occurring as a result of the above.
- The lack of true life-cycle analysis of projects (including costing, maintenance, operating, etc.), leading to an inability to maintain a competitive edge in a changing marketplace.

- The lack of integration, co-ordination and collaboration between the various functional disciplines involved in the life-cycle-issues of the projects, leading to inefficiencies during construction phase.
- Inadequate capture, structuring, prioritization and implementation of client needs;
- Development of pseudo-optimal design solutions;
- Constructability, supportability and maintainability issue are considered late in the process;
- Characterisation of the design process with a rigid sequence of activity.

6. Approaches Towards Integrated Team Practice

Many industry-led reports [21, 22, 28, 29] 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 UKCG [30] and Egan [21], challenged the construction industry to create a fully integrated service capable of delivering predictable results to clients through processes and team integration.

Attempts at team integration in the construction industry have been largely focused on improving project procurement and the product delivery processes [31]. An integrated procurement approach gives clients a single point of contact for both design and construction besides creates an opportunity to implement constructability principles early during design stage of project [32]. In the constructability principle, it considers contractors' role early in the design stage thus results in a more constructible design and greater amount of cost savings, labor savings and less substance wastages [32, 33]. Furthermore, Russell et al. [34] highlighted that early involvement of construction knowledge and experience approach can reduce the likelihood of creating designs that cannot be efficiently built, thereby reducing design rework, improving project schedule, and establishing construction cost saving. For example, early involvement of contractor (ECI) has been selected as a contract delivery strategy towards integrated team and becoming more popular for a number of major construction projects especially in infrastructure [35].

On the other hand, the product delivery process has also been integrated to reduce the number of distinctive parties to a single all-inclusive party [36]. The several separate and phased processes involved have also been merged into a system capable of delivering the same product in a single process. Those related approaches to improve team integration have been highlighted by previous researchers through the concept of concurrent engineering [19, 37]; lean thinking [38]; 'using a boundary object' [39]; and integrated supply chain management [40, 41].

Based on the above studies, it shows that an integrated delivery team (refer to Fig. 2) is a highly effective to brings together various skills and knowledge, and removes the traditional barriers towards an effective and efficiency delivery of the project [36, 42]. As highlighted before, these strategies indirectly hinder the result in scheduling problems, delays and disputes during the construction process, and, hence, harm the overall project performance. Therefore, it can be summarized that efforts towards having an integrated team is an effective approach in order to overcome the

IBS constraints especially that relates to the fragmentation issue (traditional design and construction process) in the current Malaysian construction industry.

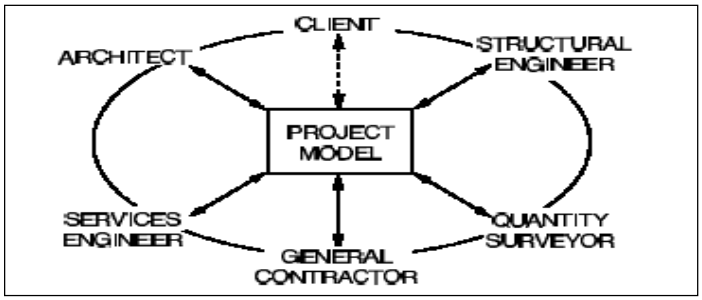

Fig. 2. An integrated Project Team Approach.

7. Conclusions

The result demonstrated that the nature of the Malaysian IBS construction process that is conducted in a sequential manner which is based on segregation of professionals during the design and construction phase has resulted in inefficiencies during the construction phase such as increased project complexity, rework, increasing costs and longer construction duration. 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.

Therefore, there is an urgent need for a paradigm shift within the IBS traditional approach. It is recommended that the IBS construction lifecycle process should involve the adoption of new business model, with the aim of integrating the functional disciplines at the early stages of project. The need for greater collaboration in the design project team delivery of projects is paramount towards more successful IBS implementation in the Malaysian construction industry. This paper concluded that improving relationships and communication process are important requirements especially by implementing an integrated approach in the design and construction, in order to minimise the fragmentation gap in the current Malaysian construction projects.

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