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Expert Perspective on the Barriers and Enablers of Joint Effort and Technological Collaboration Among Malaysian Industrialized Building System (IBS) Housing Project Supply Chains

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ABSTRACT

Housing shortages has been a recurring dilemma for Malaysia and the domination of traditional methods have made it hard to deliver targets. With today's construction industry being more complex, specialized, and demanding, Industrialized Building System (IBS) has been promoted to help the sector deliver citizen's house demands. However, this initiative has been hampered by fragmentation issues causing IBS to be inefficient. Joint Effort and Technological Collaboration, which stems from Supply Chain Management (SCM) philosophy has been suggested as the way forward for the industry by capitalizing on the various tools available to improve coordination, integration, and information flow. However, many proven successes have not translated to higher adoption rate in Malaysia. Implementations are rather scarce. This paper therefore sheds light into the barriers and enablers of Joint Effort and Technological Collaboration uptake among Malaysian IBS housing project supply chains from the perspective of industry experts. Semi-structured interviews were undertaken on five (5) practitioners with a minimum of twenty (20) years' experience for a deep scrutiny on the matter and responses were analysed using content analysis. Finding indicated that the main barriers stemmed from commitment issues, indicating their hesitance towards committing to positive changes in practice, which hampers virtually any initiative. On the other hand, most significant enabler to Joint Effort and Technological Collaboration rooted on the willingness of industry players to transform themselves and adapt to new technologies and working culture. The outcome of this study not only contributes to the body of knowledge regarding collaborative initiatives in construction, but it is also expected to benefit the industry on identifying the stopping blocks and ways forward for better diffusion of these initiatives for future success.

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1. Introduction

Construction industry is the most important contributor for growth of Malaysian economy [1] as well as affecting the growth of other sectors [2]. Beyond that, it also has multiplier effect on job creations meaning that it creates job opportunities beyond the sector itself but also all along the multiple tiers of supply chains connected to construction jobs [3]. Therefore, it is vital that the industry operates in the most optimized manner to maximize its contributions to the Nation's economy. However, despite aiming to become a developed nation [4] with high-income status [5] by year 2020, Malaysian construction Industry has still been below-par [6], problematic [3] and plagued with delivery issues up until recent times (e.g., [7-11]).

This has led to problems in meeting the housing needs [12] which is very alarming considering the vast number of houses needed by year 2020 (see [13]) including affordable ones (see [14]). The Malaysian Construction Industry Development Board (CIDB) has promoted the use of Industrialized Building System (IBS) as means of boosting project deliveries. However, IBS, which has been proven superior over traditional methods (see [15-16]) has been plagued with fragmentation which limits its effectiveness. Fragmentation has been consistently linked with many of the industry's deficiencies (e.g., [17-21]) and under-performance (see [22-24]).

Interfaces of project parties has long been established as the uttermost crucial aspect of construction projects [25] and that virtuous team dynamic is vital to achieve competitiveness [26]. Ability to overcome fragmentations by improving collaboration has been linked with many benefits (i.e., [3]; [27-31]) and the potential of Joint Effort and Technological Collaboration to assist these efforts has been evident (see [3]; [26]) however, Malaysia seem to still be inept on adopting these initiatives thus, practices are still very scarce [3]. This scenario therefore calls for an approach to overcome fragmentation in Malaysian IBS housing project implementations to ensure proper delivery of the much-needed houses in time and meet the needs of people. Considering the multiple tiers of supply chain within a construction project; and that fragmentation impedes innovation [26] and leads to poor performance [3], an effort towards adopting Joint Effort and Technological Collaboration is more important than ever. The success of these efforts has been proven in few applications in the past (i.e., [32-37]) and initiatives has also emerged in form of tools proposed to facilitate its implementations ([34]; [36]; [38-39]). Nevertheless, the scarcity in implementation within Malaysia [3] highlights the need for further scrutiny on the reasons behind this as well as on ways to improve implementation rates. This is to enable the local IBS industry to also reap the full benefits of IBS.

This paper therefore aims to shed some light into the barriers of Joint Effort and Technological Collaboration among supply chains of Malaysian IBS housing projects as well as the enablers to overcome and improve the issues plaguing the industry. Utilizing responses via a series of expert interviews undertaken on industry experts, responses are extracted, analysed, and presented to provide a view on the problems and strategies that could be taken towards enhancing uptake of these initiatives among industry players.

2. Malaysian Construction Industry Scenario

Poor performance of construction industry has been a common scenario in Malaysia with issues ranging from delays, cost overrun, poor quality and many more. The local construction industry achievement has in the past been reported by the Malaysian Construction Industry Development Board to be below-par and contributing very poorly towards the GDP (see [40]). Nevertheless, this situation has yet to show proper signs of improvement with performance dilemma continue to plague the industry. Jatarona *et al.,* [8] reported that hundreds of sick projects were experienced in

year 2011 and 2013 which was during the Tenth Malaysia Plan; despite the plan targeting "Zero Delay" in their projects. On the other hand, statistics from the Malaysia Productivity Corporation [10] highlighted an obvious lack in construction labour productivity compared to other major economic sectors in Malaysia namely agriculture, manufacturing, and services. On top of that, their trend on labour productivity was also the only one showing a declining trend from year 2000 to 2015 when compared against few developed countries thus, a growth from 1.8% to 3.7% was targeted for the Eleventh Malaysia Plan (2016 to 2020) compared to the previous one (see [9]) to boost the industry productivity and performance.

The poor performing construction industry not only led to delivery issues but has also hampered the ability of the nation to fulfil its housing needs [12] which in most cases refers to the affordable housings to fulfil the needs of low-income groups that makes up a big portion of residence in the country. Yoke *et al.,* [13] estimated the need of five million new houses between 1995 to 2020 while according to Zill [14], the 2014 yearly report from the Malaysia National Bank showed a shortage of 960,000 affordable housing while their 2016 yearly report mentioned that the country will face a shortage of one million affordable housings by year 2020. Nevertheless, while it is quite impossible to deliver these expectations satisfactory within time via conventional methods [41], it is still one of the most dominant methods preferred by industry players in Malaysia [2] thus, limiting the industry performance and delivery.

Realizing the need boost performances, the Malaysian Construction Industry Board (CIDB) has promoted IBS as the way forward [42], an initiative that first landed in Malaysia since 1960 and has been linked to many advantages over traditional methods (see [16]). Nevertheless, despite the ability of IBS to boost delivery rates and quality, the nation has yet to full reap the benefits of this revolutionary construction method. Traditional practices still dominate its implementation [41] with fragmentation issues still being evident [42] despite its existence being roughly six (6) decades now. This scenario has led to poor performance of the industry including inability to meet delivery targets such as housing needs.

3. Joint Effort and Technological Collaboration among Project Supply Chains

Effective coordination, management and collaboration is key to IBS success [2] and fragmentation has been mostly blamed for poor industry performances [19] which ties back to the traditional working system ([20]; [41]; [43-44]). This disjointed scenario has been connected to many problems of the industry (see [17-18]; [20]; [23]; [45-50]) thus, limiting ability of projects to achieve the best of improvement, innovation, time, cost, quality, productivity, and satisfaction ([22-24]). As a result, Joint Effort and Technological Collaboration initiatives have gained a lot of attention to deal with the increasingly complex and specialized skills and knowledge that are required in the construction industry. From the context of construction industry, Riazi *et al.,* [3] referred Joint Effort as "*a collaborative endeavour that aims to create an integrated project delivery by including elements of effective teamwork towards achieving a both short-term and long-term outcome that benefits all parties*" (p. 1098). Technological Collaboration on the other hand involves the use of various technological tools to enable the achievement of effective joint effort by improving aspects of coordination, integration, and sharing of information. Using technologies such as IT also enables better communication with customers all over the supply chain [51]. Joint Effort and Technological Collaboration tools represent as among the important elements in Supply Chain Management (SCM) and has the prospect to overcome the disjointed working environment of IBS projects (see [3]; [21]).

Actions forward has proceeded with the introduction of various tools to assist initiatives to overcome fragmentations using Joint Effort and Technological Collaboration. Among them are the

introduction of champion/driving personalities (see [30]) to encourage cooperation, brainstorming, and open communication [52]; "Relational Index" measurement (see [53]) to measure and improve team relationships; Framework Agreement for a long-term collaboration [37] and foster continuous improvement [36]; Building Information Modelling (BIM) which uses technological collaboration to assist coordination and collaboration in producing integrated project designs (see [54]), assist Facilities Management [55], and assist collaborative decision makings ([56]) to avoid errors and conflicts during project implementations; MyVirtual Home (MVH) which provides an ICT collaborative platform for supply chains to share their knowledge and come up with best decisions (see [57]). This 3D home design software uses technological hub to produce accurate designs thus, reducing error and rework during construction stage; Automated Construction Activity Tracking System (4D-ACT) is a technology platform that uses 4D models [58] to automate the tracking of construction activities and allow better detecting of changes that has happened between built elements and the original plans (see [59]) so that timely actions can be taken to reduce errors and delays; and the Relationally Integrated Value Networks (RIVANS) software that was introduced by Kumaraswamy *et al.,* [60] to allow for engagement of variety project supply chains, allowing value to stream throughout the system and foster long-term collaborations.

The potential of Joint Effort and Technological Collaboration to overcome fragmentations has been clear (see [3]; [26]) and their benefits have been proven (i.e., [32-37]). In fact, the fast growing of technology has made their adoption easier than ever; since no formal education is generally required for one to master technology (see [61]). However, while Malaysia is struggling to meet their citizen's housing needs; initiatives towards overcoming the disjointed working environment in IBS housing projects is still far from adequate [3] and that Technological Collaboration implementations still requires lots of improvement. This scenario calls for a scrutiny on the reasons behind this as well as on ways to improve implementation rates. To improve project delivery and success, it is vital for Malaysia to adopt best practices in the industry which as of now steers towards improved collaboration, relationship, and teamwork.

4. Methodology

Towards deriving the findings of this study, a semi-structured interview was conducted on five (5) experts of the Malaysian construction industry with a minimum of twenty (20) years of experience, averaging at 24.60 years. The characteristics of interviewees are highly justifiable as experts of the industry considering that an expert opinion study by Ismail *et al.,* [62] only interviewed five (5) people with a minimum of ten (10) years' experience. Approaching vastly experienced group of practitioners enhances the validity of findings especially when combined with interviewees from different backgrounds which covers different perspective on the subject matter. Interview results were then analysed using content analysis to come about the findings of this study.

5. Data Analysis

This section presents the outcome obtained via the five (5) expert interviews that were performed. Table 1 summarizes the expert profiles and their perception on the extent of "Joint Effort" uptake while Table 2 summarizes their responses on the barriers and enabler of Joint Effort and Technological Collaboration initiative in Malaysian IBS housing projects.

Table 1
Expert profiles and their perception on joint effort and technological collaboration uptake

Questions/ Responses	Position	Nature of Organization	Years of Experience	Extent of Joint Effort and Technological Collaboration Initiative in Malaysian	
				Construction Industry	IBS Housing Projects
R1	Director	Consultant	24	Average	Low
R2	CEO	PMC/ Developer	30	High	High
R3	Senior Project Manager	Developer	29	Low	Average
R4	Quantity Surveyor	Interior Design	20	Average	Average
R5	Site Supervisor	Construction	20	Average	Average

With reference to Table 1, it is evident that all interviewees are vastly experienced, ranging from twenty (20) to thirty (30) years of practice in construction industry. Most of them also hold senior and/or top managerial posts in their organization - 1 Director, 1 CEO and 1 Senior Project Manager. On top of that, the organizations involved in the interview varies in nature therefore increasing the validity of responses. In term of their views and experience on the extent of Joint Effort and Technological Collaboration activities within the construction industry as well as in IBS housing projects was rather average with only one person stating that they are at high extent for both type of projects.

At a glance on Table 2, it is evident that there is generally more barrier than enablers for implementation of Joint Effort and Technological Collaboration initiatives in Malaysian IBS Housing projects. After considering those with similarities in meaning and combining them together, a total of seventeen (17) barriers as well as eight (8) enablers were identified. The barriers were: - (1) Increase in construction cost; (2) Poor level of trust among stakeholders; (3) Poor working relationships; (4) Unwilling to get out of comfort zone; (5) Poor selection of workable IBS system to make it an IBS program; (6) Inconsistent understanding on the IBS term; (7) Hard to convince stakeholders to commit on a workable scheme; (8) Conflicting objectives between stakeholders; (9) Conflict of interest; (10) Lack of need for Joint Effort in smaller scale projects; (11) Lack of partnership between companies of different scale; (12) Lack of funding; (13) Lack of communication between project parties; (14) Government policies; (15) Lack of expertise; (16) Lack of experience and; (17) Financial risks. On the other hand, the enablers were: - (1) Improved government policies; (2) Improve scale of profit for companies; (3) Self-education by stakeholders; (4) Being updated with new innovations; (5) Having an open and progressive mindset; (6) Improving understandings; (7) Improving financial stability and (8) Involving experienced / expert parties.

Table 2
Expert responses on the barriers and enablers to joint effort and technological collaboration uptake in Malaysian IBS housing projects

	Barriers	Enablers
R1	1) Increases construction cost	1) Change in government policy
R2	1) Poor level of trust between stakeholders 2) Poor working relationship 3) Unwilling to get out of comfort zone 4) Conflicting objectives between stakeholders 5) Parties having different understandings about the IBS term 6) Hard to achieve economy of scale (balance between cost and benefit) 7) Hard to convince various stakeholders to commit to a workable scheme 8) Poor selection of workable IBS system to make it an IBS program.	1) Self-education 2) Being informed with recent industry innovations 3) Having an open mindset 4) Having a progressive mindset
R3	1) Conflict of interest 2) Different in policies between companies 3) Small scale projects do not trigger the need for a Joint Effort initiative 4) Lack of partnership between companies of different scale (commonly big companies only choose to partner with ones with the same or higher scale thus, smaller companies are often left out)	1) Better initiative by the government (e.g., tax reduction) 2) Mass construction / big contracts to give companies economic of scale thus, encouraging uptake of modern initiatives (e.g., Joint Effort and Technological Collaboration)
R4	1) Lack of funding 2) Lack of communication between parties 3) Government policies 4) Lack of experience 5) Financial risks	1) Improve scale of profit 2) Improve cultural understanding 3) Improve financial stability
R5	1) Lack of expertise 2) Lack of communication among consultants 3) Lack of trust	1) Have an IBS expert available. 2) Improve mutual understanding 3) Having experienced partners

**R1 to R5 refers to Respondent 1 to 5*

6. Discussion

In overall, numerous barriers and enabler to the uptake of Joint Effort and Technological Collaboration initiatives were obtained via interviews that were undertaken on the Malaysian Construction Industry experts. However, while the list seems quite long, these barriers and enablers were found to stem from several latent aspects.

Based on Table 2, seventeen (17) out of twenty-one (21) barriers mentioned by the interviewees were found rooted to five main issues namely financial, trust, commitment, communication, and expertise. Despite mentioned in different manner, many of them indirectly had quite a similar pattern and themes thus, they were grouped under a root issue. From the research findings, the most significant barriers rooted to Commitment issues (**R2** [4], **R2** [7], **R3** [1], **R3** [2], and **R3** [4]) followed by Financial issues (**R1** [1], **R2** [6], **R4** [1] and **R4** [5]). Third highest was Trust issues (**R2** [1], **R2** [2] and **R5** [3]) while the other three root issues shared two (2) barriers each - Communication issues (**R4** [2] and **R5** [2]) and Expertise issues (**R4** [4] and **R5** [1]). This comes as no surprise since team spirit of all

parties has been regarded as a vital component of any team-oriented task [3]. When parties are committed to a set of goals in project, it would influence the entire team's behaviour [63] thus, increasing the effectiveness of the supply chains [64-65]. Getting the highest level of commitment among project team is vital towards enhancing collaboration of all parties as it would encourage them to willingly work together towards delivering the project at its best. Collaboration has been regarded as an important driver for Supply Chain Management [66] as well as for achieving a triumphant relationship [30] thus, a lack of this element surely hampers the success of any collaborative initiative (i.e., Joint Effort and Technological Collaboration). As a result, chances for continuous improvement to happen is also hampered which according to Samuel and Kubeyinje [67], continuous improvement is vital for business sustainability and achieving the most optimum performance. An improved performance consequently enhances project quality and value which according to Seng *et al.,* [68], these aspects have started to become the focal point for most customers when doing investments.

On the other hand, withe reference to Table 2, twelve (12) out of thirteen (13) enablers that were mentioned by interviewees also showed many similar themes which led to them being segregated into five (5) root aspects as well namely government policy & initiatives, expertise improvement, self-transformation, fiscal incentives, and improved understanding. The most important enabler of all were rooted to Self-Transformation (**R2** [1], **R2** [2], **R2** [3] and **R2** [4]) while the other eight (8) enablers were all stemmed on the rest of root enablers which are - Government Policy & Initiative (**R1** [1] and **R3** [1]), Expertise Improvement (**R5** [1] and **R5** [3[), Fiscal Incentives (**R3** [2] and **R4** [1]) and Improved Understanding (**R4** [2] and **R5** [2]). The significant importance of self-transformation also comes as no surprise since it is the first step required to shift towards a new way of working. Only by agreeing to get out of the comfort zone then any new initiative could succeed because it requires one to entirely change not only their way of working but also thinking, approach and transparency. Competitive surroundings and primacies change from time to time [69] however, the Malaysia practice is still very much rooted on old mind-set (see [41-42]; [70]) and even Construction Industry Master Plan 2006 to 2015 also lacked innovative approaches [71] despite aiming to achieve a World Class construction industry by 2015. Hence, a "change" in practice, mentality, and thinking is very much needed by the Malaysian construction industry [26] towards transforming their way of working towards a more revolutionized approach which among them includes the joint initiatives.

7. Conclusion

The need to meet housing needs among Malaysians are at critical stage with severe shortages. To make matters worse are the lack of affordable housings that are vital to enable lower- and middle-income groups to be able to own a home that are within their means. To tackle the situation, the Construction Industry Development Board (CIDB) has promoted the use of Industrialized Building System (IBS), a construction method that has been proven to not only be more efficient, but it also allows for faster construction, consistent in quality and enables achievement of economic of scale when used with mass-developments. The qualities and achievements via IBS have been seen worldwide and has in fact been very evident during the recent COVID-19 pandemic period whereby many facilities were able to be built in significantly less time to meet the urgent need of people and patients. However, success in IBS requires input of various parties in a project setup to make it a success which is a major problem within the Malaysian industry scenario. The disjointed nature of working among project entities has led inability to fully reap the benefits of IBS thus, efficacy has been rather limited, and targets are not able to be met (i.e., housing needs). Joint Effort and Technological Collaboration which stems from the Supply Chain Management (SCM) philosophy encourages the total opposite of fragmented working environment. It has the potential to improve

the current situation however, Malaysia's implementation is very much at an infancy stage. This paper therefore sheds light into the barriers as well as enablers of Joint Effort and Technological Collaboration in Malaysian IBS housing projects with the aim to identify the stopping blocks as well as initiatives that could be taken to encourage more integrated working environment. Five (5) experts of the industry, with a minimum of twenty (20) years of experience were interviewed as means of getting a broader perspective. It was found that the main barriers stemmed from commitment issues, indicating that the current industry players are rather hesitant to commit themselves to a newer way of working. Without full commitment of all parties, no endeavour could attain success since commitment influences the people's behaviour which is vital to encourage collaboration. On the other hand, the most important enabler for Joint Effort and Technological Collaboration rooted to self-transformation. This comes as no surprise considering that the Malaysian practices has pretty much been based on conventional approaches thereby indicating the lack of willingness to transform their way and approach to working. Even some government transformation initiatives have been short of modern approaches (i.e., CIMP 2006 to 2015) hence, the local industry has been suggested to change their practice, mentality and thinking towards a more revolutionized approach.

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