INTEGRATED PROJECT DELIVERY FRAMEWORK FOR SUSTAINABLE CAMPUS DEVELOPMENT: A QUALITATIVE STUDY ON JPP UUM

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ABSTRACT. At present, the frameworks to improve construction design team integration have seldom included the solution for sustainability challenges within design for buildings. This challenge is even greater in achieving sustainability in campus universities such as UUM, where high volume of users and activities has made it more imperative to promote green buildings that reduce energy and water consumption while having a minimal carbon footprint. Therefore, in response to that challenge this paper investigates how the delivery team, responsible for the design and construction of a project, can be integrated to work together more efficiently and effectively. The process will involve a comprehensive review of secondary sources of data, including reports, principles, tools and guidelines that particularly relate to the best practice of team integration such as Design and Build, Concurrent Engineering (CE), Partnering, and Integrated Project Delivery (IPD). The review of these practices will contribute to the development of a conceptual guideline/framework for improving campus sustainability, particularly in the early stage (planning and design) of UUM construction projects, which will be validated through qualitative methods in an on-going research project. The outcome or result of this research will meet and support the requirement of construction, maintenance, and operation process for 'JPP UUM' towards sustainable building/campus in the future.

Keywords: integrated project delivery, sustainability, campus university

INTRODUCTION

The traditional construction process has been widely criticized for its fragmented approach to project delivery and its failure to form effective teams, which involves players that are disconnected from each other and work in isolation resulting in inefficiencies. Non-collaboration and coordination 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 (Nawi et al, 2011a). 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, poor performance and others problems that related to maintenance and operation issue (Latham, 1994; Egan, 1998; Nawi et al, 2011b)**.** These existing issues have added more barriers in achieving sustainable development and design practice in many aspects of the nation's growth, where campus development is not excluded. In response to these issues which stemmed from the lack of coordination among construction parties, many industry-led

reports (Latham, 1994; Boum, 2001) have all called on the industry to change from its traditional modus operandi and perform better through increased team integration. However, there is a lack of specific guidelines on how to achieve successful integrated design team delivery from current research propagating the many benefits of team integration in the construction industry. Although there are some frameworks addressing project team integration through relationship contracting, collaborative working and integrated procurement methods; the impact of these initiatives to the sustainable building/ design is still limited. This is because of the confusion and partial understanding that exists between current construction industry stakeholders either in terms of imprecise working processes or lack of framework, model or guidelines that can be practically applied. In view of these issues, this paper is framed with the following objectives; (1) to highlight the rationale of existing tools and principles that involves early participation of all stakeholders from the very initial onset of construction projects and, (2) to report preliminary findings on the current practices for campus design and development, and sustainability awareness of the Department of Maintenance and Development, UUM (henceforth JPP UUM). The following sections shall highlight the various methods found in literature concerning collaborative working, relational contracting and integrated procurement.

Design and Build

At the turn of the millennia, the Malaysian construction industry has undergone a wave of change, in which projects are of higher complexity and warrants for greater emphasize in management techniques and engineering skills. The traditional method was deemed to be no longer the relevant approach to suit the needs of such projects. Public Works Department (PWD) has started introducing the Design and Build approach as a response to this situation. Generally, the Design and Build procurements are structured in one of two ways (Ng and Yusof, 2006); where the clients employ a dedicated Design and Build organization with its own in house design team, or the clients engage a general building contractor who employs external design consultant members of the contractor's team for the duration of the project. There is however evidence (Adnan et al, 2008) indicating some significant risks related to this procurement approach, for example; time overrun, cost overrun, delay caused by the owner or the government, overlapping of roles, difficulty in adhering/following instructions, lack in employer brief, conflict of interest and variation to changes in the design criteria. Therefore, to achieve the full benefits of Design and Build, the construction practitioners involved will need to mitigate these risks effectively in a timely manner.

Concurrent Engineering

In a construction context, concurrent engineering (CE) is defined as an attempt to optimise the design of the project and its construction process to achieve reduced lead times and improved quality and cost by the integration of design, fabrication, construction and erection activities and by maximising concurrency and collaboration in working practices (Evbuomwan and Anumba, 1998). According to (Mohamad, 1999), the teamwork concept based upon CE principles is normally referred to as the Cross Functional Team (CFT). The formation of the team is crucial for effective implementation of CE. The term CFT in construction refers to a group of people who apply different skills, with a high degree of interdependence, to ensure the effective delivery of a common organisational objective The implementation of concurrent engineering has been guided by the following characteristics; co-location of project team, cross-functional team (CFT) adoption of improved coordination processes, the integration of design and manufacturing activities, maximising parallelism in working practices, collaboration in working practices, consideration of downstream requirement during the design development stage, and the establishment of customer requirements and specifications.

Partnering

Partnering can be defined as a set of strategic actions which embody the mutual objectives of a number of firms, which are achieved by cooperative decision making aimed at using feedback to continuously improve joint performance (Bennett and Jayes, 1998). This is mainly due to the fact that it has described partnering as an intentional act to achieve certain objectives, and also because it incorporates the use of feedback to improve the performance of the parties involved. The term strategic refers to a certain time expectations, which in this case it refers to the long term relations between parties who are prepared to work together over long periods of time. Partnering is assisted by the presence of enablers within the partnering relationship. According to Nifa and Ahmed (2010) there are 8 commonly cited partnering enablers within current literatures. These enablers are cooperation and collaboration, commitment, communication, tools, policies, procurement, trust and culture. The common forms of partnering applied are Public Private Partnership (PPP) or Public Finance Initiative (PFI). However, in the Malaysian construction industry, PFI is understood as a subset of PPP (Rusmani, 2010), and is gaining popularity due to the industry's realization of the existence of adverse relationships and opportunistic behaviour; thus now moving towards relationship-based approach to project delivery and mutual trust working environment (Yong and Mustaffa, 2012).

Integrated Project Delivery

Integrated Project Delivery (IPD) is defined as a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all project participants to optimise the results, increase value to the owner, reduce waste, and maximise efficiency through all phases of design, fabrication and construction (AIA, 2007). The main advantage of IPD is that this process is designed to produce shorter delivery times as compared other project delivery system such as the design and build (Kibert, 2013). Furthermore, the principles of IPD can be applied to a variety of contractual arrangements for highly effective collaboration among the owner, the prime designer and the prime constructor, commencing at initial design stage and continuing through to project handover (Anderson, 2010). In addition to being highly collaborative and seeking input from project team members at the outset of the project, many reports (AIA, 2007; California Council, 2007) suggested that IPD should be operated together with Building Information Modelling (BIM). According to the reports, this integration process allows members of projects to leverage Building Information Modelling (BIM) by creating a virtual design of every element of a construction project's process through enhancing communication between parties in the architectural, engineering, and construction industries (Shourangiz et al, 2011).

METHODOLOGY

This paper reports the initial work related to recently completed research investigating the current approach of design practice in UUM construction projects. A review of integrated practices in project delivery is conducted through literature review, as well as identifying the most appropriate method for the Department of Development and Maintenance (JPP UUM) in inculcating sustainability within design and campus development. The research also reviews the current practice of maintenance and management of work that will be gathered from JPP UUM through 2 phases within the data collection stage.

IPD AND SUSTAINABILITY

Integrated project delivery (IPD) has been positively linked with sustainability in design and construction. This emerging project delivery method takes advantage of several other relatively new ideas such as lean construction, BIM, integrated process and procurements, and other technologies that provide the potential for better collaboration on construction projects (Kibert, 2013). With this in mind, it is suggested that IPD can be effective in campus universities such as Universiti Utara Malaysia (UUM) to introduce sustainable design in campus development and maintenance practice minimizes the impact to the environment. At any given time, there are approximately a total of 1.2 - 1.5 million students in higher education institutes, which include the public and private universities, colleagues and polytechnics in Malaysia (Mat et al, 2009). In UUM itself, the population contributes to around 2.5% of total students, whereas all the students are living on campus; it provides accommodation for a number of figure 30 thousand students. If we include the academic staffs, researchers, administrative personnel and others, UUM consumption of energy and materials can be assumed to be almost comparable to small commercial cities. Accordingly, sustainability in campus calls the university to promote green buildings that can reduce energy and water consumptions while having a minimal carbon footprint. The target of the energy-efficient green buildings is to have better lighting, temperature control, improved ventilation and indoor air quality which contributes to healthy environments by reducing the dangerous air-pollutants that cause respiratory disease in campus buildings (Mat et al, 2009). However, (Kibert, 2013) had highlighted that many of the key aspects of IPD are compatible with green building certification systems such as Leadership in Energy and Environmental Design (LEED) and Green Globes in the US. Building on this proposition of IPD's compatibility with sustainable construction, the findings from this research will provide a significant contribution to knowledge by identifying which green building certification in Malaysia that is compatible with the IPD method to be adapted with the framework. Furthermore, campus sustainability initiatives often encounter many barriers most of which are linked to the low priority of environmental issues on the campus agenda and are compounded by a lack of coordination among stakeholders involved during the design and construction stage towards sustainable practices. This is where IPD concept will be useful, where adapted into the proposed framework, shall necessitate the involvement of all stakeholders UUM in developing a potentially sustainable campus.

JPP UUM AWARENESS IN SUSTAINABILITY PRACTICES

A number of pilot interviews with four JPP officers from different job functions (civil engineering, architecture, quantity surveyor and M&E engineering) were conducted in exploring the current practices of JPP in campus design and development, as well as their awareness towards sustainability practices. Preliminary findings, although were not conclusive, were indicative of the current understanding of JPP in promoting green and sustainability efforts in the design. As part of a public HEI, JPP is subjected to certain procedures in dealing with campus development which varies according to the value of the project. In projects exceeding a certain amount of sum; decisions on design and implementation lies with the federal appointed external parties (Public Works Department etc.). However JPP's awareness in sustainability practices is exemplified in the current on-going 'UUM Welcome Centre' which design incorporates certain green and energy efficient building characteristics, as well as the formulation of an action blueprint which includes green elements in campus maintenance and improvement of facilities. As for the methods of project delivery, it was determined that most of the officers were unsure of project delivery methods other than Design and Build. However, they are well aware of the many challenges and problems brought upon by the implementation of Design and Build, and were open to the idea of IPD in executing potentially sustainable and green efforts for campus development. The following stage of research will take into

consideration the findings from the pilot data collection and secondary data, which will both inform the development of a proposed framework for JPP UUM in sustainable design and campus development. This proposed framework will then be validated in an industrial workshop that includes other stakeholders relevant to the context of the research.

CONCLUSION

The strategy for implementing sustainable design for campus development requires a holistic understanding of the project delivery process in the context of UUM itself. Although initial findings from secondary and pilot data indicates that IPD is the most compatible delivery method which will merge the requirements of green building certification systems, the proposed IPD framework should take into consideration the specific attributes of UUM through the perspectives of all stakeholders, as well as evaluating its suitability as a method to be practiced by JPP itself. It is hoped with the forthcoming stages in the research; the proposed framework could be improved and validated for application in HEI in moving towards a sustainable campus.

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REFERENCES

Adnan, H., Rahmat, M.N., Mazali, N.F.N. & Jusoff, K. (2008). Risk management assessment for partnering projects in the Malaysian construction industry. *Journal of Politics and Law*, 1(1), pp 76-81.

Anderson, R. (2010). An Introduction to the IPD Workflow for Vectorworks BIM Users, Nemetschek, Vectorworks.

Bennett, J. & Jayes, S. (1998). *The Seven Pillars of Partnering*. Reading Construction Forum, Reading.

Bourn, J. (2001). *Modernising Construction (HC87 Session 2000-2001)*. London: National Audit Office.

California Council (2007). Integrated Project Delivery: A Working Definition. Available at: http://www.ipd-ca.net/images/Integrated%20Project%20Delivery%20Definition.pdf [Accessed: 3 February 2011].

Egan, J., (1998). Rethinking construction. *Report of the construction task force on the scope for improving the quality and efficiency of UK construction industry*. Department of the Environment, Transport and the Regions, London.

Evbuomwan, N.F.O., & Anumba, C.J. (1998). An integrated framework for concurrent life-cycle design and construction, *Advances in Engineering Software*, 29(7-9).

Hamid, S. H. A., Takim, R., & Nawawi, A. H. (2011). An Integrated Value Management (IVM) for Construction Projects in Malaysia. *IEEE Symposium on Business, Engineering and Industrial Applications*, 421–425.

Integrated Project Delivery (IPD): A Guide (2007). California Council, National, The American Institute of Architects, version 1.

Kibert, C.J. (2013). *Sustainable Construction: Green Building Design and Delivery*. John Wiley and Sons: New Jersey.

Latham, M. (1994). Constructing the Team. *Final report on the joint review of procurement and contractual agreements in the UK construction industry*. HMSO, London.

Mat, S., Sopian, K., Mokhtar, M., Ali, B., Hashim, H.S., Rashid, A.K.A., Zain, M.F.M., & Abdullah, N.G. (2009). Managing Sustainable Campus in Malaysia - Organizational Approach and Measures. *European Journal of Social Sciences*, 8(2), pp201-214.

Mohamad, I. M. (1999). The Application of Concurrent Engineering Philosophy to the Construction Industry. *PhD Thesis*, Loughborough University.

Nawi, M.N.M., Lee, A. & Nor, K.M. (2011). Barriers to the implementation of Industrialiased Building System (IBS) in Malaysia. *The Built and Human Environment Review: online journal*, 4, University of Salford, United Kingdom.

Nawi, M.N.M., Lee, A., Kamar, K.A.M. & Hamid, Z.A. (2011). A Critical Literature Review on The Concept of Team Integration in Industrialised Building System (IBS). *Malaysia Construction Research Journal (MCRJ)*, 9(2), 1-18.

Ng, W.S. & Yusof, A.M. (2006). The success factors of design and build procurement method: A literature visit. *Procs 6th Asia-Pasific Structural Engineering and Construction Conference (ASPEC 2006)*, 5-6th September 2006, Kuala Lumpur, Malaysia.

Nifa, F.A.A. & Ahmed, V. (2010). Effective partnering in construction – A critical literature review. *Proceedings of 4th International Conference on Built Environment in Developing Countries*, 1st - 2nd December 2010, Penang, Malaysia. pp 95-106.

Rusmani, N. (2010). Public Private Partnership in New Zealand and Malaysia. *Unpublished Master thesis*, Victoria University of Wellington, New Zealand.

Shriberg, M.P. (2002). Sustainability in US Higher Education: Organizational Factors Influencing Campus Environmental Performance and Leadership. *PhD Thesis*, University of Michigan.

Shourangiz, E., Mohamad, M.I., Hassanabadi, M.S., Banihashemi, S.S.., Bakhtiari, M., Torabi, M. (2011) Flexibility of BIM towards Design Change, *2nd International Conference on Construction and Project Management, IPEDR vol.15 (2011) © (2011) IACSIT Press, Singapore.*

Yong, C.Y. & Mustaffa, N.E. (2012) Analysis of factors critical to construction project success in Malaysia. *Engineering, Construction and Architectural Management*, 19(5), pp 543-556.