Integrated Design Approach: A Mode towards Sustainability in Building Project

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**ABSTRACT**

Sustainability in building project is a relatively young and emerging discipline. There is at present no generally agreed on a set of methodologies recognized as standard practice. Integrated design process is regularly cited in literatures as an approach for achieving the holistic nature of a sustainable project. The project is only possible through implementation on integration since the early process of the design, as 70% of the decisions are made in the first 10% of this stage. This study attempts to explore an integrated design process that practiced for realizing sustainability in building project. For this, a case study approach has been employed. The selected case is a project named ‘Diamond building’ in Malaysia. Following, the main research question was formulated: How do Diamond building stakeholders apply an integrated design process in the project? The finding was that Diamond is compared to the literature review are very high when it comes to integrated design practices. This study shows that integrated design process is vital to be practiced throughout the development of a building project towards accomplishing sustainability performance of the project.

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**INTRODUCTION**

The purpose of this paper is to research and describe the situation of Diamond building project in practicing integrated design throughout the preconstruction stage of the project. A research question was formulated: How do Diamond project stakeholders apply an integrated design process in the project? The answer to this research question will be distracted out of a comparison with the literature review and the case study at Diamond project.

Over the last decade, there has been a frustration with the traditional approach of project planning and management in Malaysia that runs linearly and usually has minimal input from multidisciplinary profession throughout the conceptual and design process [1,2]. The selection of designers and the main contractors has been primarily based on the lowest tender price. Consequently, it was reported that, 50% of the failures in Malaysian construction industry can be attributed to design faults, while 40% are due to construction faults and 10% are because of material faults [1]. Malaysian clients and consumers of the construction industry place on emphasis on costs, often at the expense of quality.

Diamond building project is a new effort of Malaysian building industry to venture a new paradigm of building development called sustainable building project. The nature of complexity and holistic approach of the project made the project stakeholders explores solution to achieve sustainability target that will align the planning, design and delivery process among multiple stakeholders including owners, architects, engineers and others, to ensure buildings function and integrated wholes rather than a series of independent components. The solution is known as integrated design approach. Through this approach, the project stakeholders are expected to commit and collaborate throughout the process since the early conceptual and development stages to address project goals, needs and potential barriers in order to optimize the whole construction project [3,4,5]. This multidisciplinary integrated design approach can be a very effective tool to understand the clients’ needs and requirements, evaluate and correct design flaws, determine proper sustainable material usage and installation, and foster communication among all of the stakeholders. Bringing all of the team members together as early as
possible since the conceptual and design stage allows the project team to take a whole building approach towards achievement of a sustainable building at lower costs [4,5,6]. It is also allows the project team to create a highly effective analysis of the project and to leverage synergies between various building functions and site characteristics.

The requirements for an integrated design and the process, the sustainability requirements of the project, the cost, benefits and the performance target of a sustainable building project must be documented and communicated to expand the market for a sustainable development [5,8]. Integrated design process in this sense implies using a collaborative teams of stakeholders to collectively consider various aspects of sustainability and whole building designs and synergies and tradeoffs between them over the life cycle of the project [3,7]. A whole-systems analysis that treats the building as a system and takes into account the interactions and synergies between the different components should be done when possible [4,5,6]. The outcome would be an optimized building that provides a healthy productive environment and generates value to owner.

Stakeholder engagement is a core element of any sustainable development plan. A project is more likely to be successful especially in the long term, by taking into consideration the expectations of the stakeholders and endeavors to meet their needs [7]. A truly sustainable development should recognize all the stakeholders in decision making as they have rights, whether or not they are enshrined in legislation. The design that developed through the sustainability concerns should consider the user’s community needs and fit for purpose. The fact is, buildings which are loved are more likely to be maintained and in turn, to be sustainable [8,9]. The team should works with prospective occupants or end user to establish their requirements and interiors spaces, adjacencies and other programming requirements [6]. This can be achieved by involving at least a representative of the end user during the process.

A common challenge in conventional construction projects is a lack of effective communication among various technical experts who tend to use their own tools, protocol, and industry standards for making decisions and tracking information. This situation makes it difficult to manage changes, mitigate risks, and contain costs with a holistic view of the project. This inhibits the project from taking advantage of system optimization, which can save time and money. Therefore, communicating with stakeholders since early the conceptual and design stages of the project development assures that key groups understand and support the project’s sustainability goals [10]. Successful charrettes often result in stakeholders feeling included and listened to, even if they do not agree with every aspect of the end product [3,4]

This paper will make an attempt to looks at the way how the integrated design process was delivered in achieving sustainability performance in Diamond building project.

Research Methodology:

Interviews with project team members were used to identify the integrated design process that has been practiced throughout the conceptual and design stages and its impact towards sustainability performance of the project. The respondents of this research are the project stakeholders, who have been directly involved, especially during the conceptual and design stages of Diamond building project. Inputs from them are useful to understand the integrated design factors that have been practiced throughout the process. Due to some limitations, only five project stakeholders were managed to be interviewed consisting of the owner (O1), energy consultant (E1), local authority (L1), contractor (C1) and energy manager (M1). To support the interview results, the data for this study were also obtained through reviews of the relevant project documents.

RESULTS AND DISCUSSION

Diamond building is the first green building in Malaysia certified with both Green Mark Singapore Platinum rating and Malaysia Green Building Index Platinum rating. The client requested the building to be delivered as a sustainable building. The Diamond building was planned and designed to achieve the results of energy index of 55 kWh/m²/year which is on the way forward for energy efficiency in buildings, equally important is to integrate the essence of our culture, urban character in its surroundings, and celebrate them through designs and ideas of sustainability in order to attain the delicate balance of modern comfort with environmental responsibilities [O1,E1,C1,M1]. These goals were established from the beginning of the project.

The building project offered an opportunity to explore an integrated design process in delivering a sustainable building design [O1,E1].

The Diamond project design strategy was encapsulated through four main aspects, namely energy efficiency, water efficiency, indoor environmental quality and outdoor environmental quality. The holistic approach for the building envelope, atrium design, mechanical and electrical systems, day lighting system, landscaping and material selection enables the design of an environmentally sustainable building. As the building incorporates a combination of new concepts and ideas for a sustainable building, the rest two sustainability aspects which are social and economic aspects were also integrated to get the optimum stakeholders’ satisfaction results. An integrated design approach was implemented in which the energy efficient
and green targets were decided since the beginning of the conceptual and design stages of the building project. The integrated design process that has been practiced throughout the conceptual and design stages of the project is summarized by the authors as illustrated in Figure 1.

![Fig. 1: Integrated Design Process in Diamond Building Project.](image)

The project gathered together a multidisciplinary design team including the architects, engineers, energy consultants, contractors and other related project key stakeholders. At the start of the project, the consulting team went on a series of study trips, which included trips to Singapore in 2005 to study their experience on sustainable buildings. Frequent meetings and charrettes between the project team members, working design sessions and increase communication was the primary management strategy for the integrated process [O1,E1,C1].

A wide range of modelling and simulation techniques early in the conceptual with follow up detailed studies in design development have been done to realize the integrated design project. Computer simulation of the ‘diamond’ form of the building was conducted to ensure that the daylight and energy performance is achieved for the building. Detailed daylight simulation to ensure adequately distributed daylight and hourly energy simulation of the building to ensure reduced energy use were also conducted (O1, E1). The team members worked closely each other to achieve the green design guidelines, energy efficiency requirements and to achieve the design that enables to satisfy the end users. To sum up, Diamond is compared to the literature review are very high when it comes to integrated design practices. To date, the stakeholders assessed the sustainability performances of Diamond project during conceptual and design, construction, and operation and maintenance stages to be at an ‘excellent’ level (O1,E1,L1,C1,M1). The stakeholders perceived that the integrated design process exerted a very positive influence on the overall performances of the project.

Summary:

This paper offered an ideal set of factors for practicing an integrated design process in sustainable building project. The fact was revealed by the Diamond project which has successfully practiced this approach. It was easier to bring a new concept of sustainable building project on the early project stage by involving a collaborative team of various disciplines to collectively consider various aspects of sustainability, the synergies and compromise them over the life cycle of a project. The result of this study provide an indication that the integration approach throughout the conceptual and design stages of building projects are not specific to sustainable buildings and is indeed vital for the all types of building.

REFERENCES