

DIMENSIONS OF SUSTAINABLE CONSTRUCTION: THE PERSPECTIVES OF CONSTRUCTION STAKEHOLDERS

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ABSTRACT

The recent trend of sustainable development in the Hong Kong construction industry has drawn construction organisations' attention to sustainability issues. However, the fragmented nature of construction industry has led to divergence in stakeholders' understanding of sustainable construction, in addition to the traditionally debatable concepts of sustainable development. This paper explores and examines how different stakeholders perceive and treat sustainable construction. Twenty two interviews were carried out with stakeholders from various backgrounds including architects, engineers, surveyors, contractors, developers, facilities managers, environmentalists, suppliers, and sustainability consultants. The results show that there is still a disagreement on embracing the economic and social pillars in sustainable construction, whilst the environmental pillar is acknowledged by the majority. In addition to the triple bottom line, sustainable construction is also linked to culture and health and safety. Interestingly, this study found that construction stakeholders perceive sustainable construction as an ideal situation in which it is very hard to attain zero carbon and complete sustainability in real life development. In view of the absence of a clear definition and direction in applying sustainable construction, a gap can form in sustainable practices when incompatible goals are set by various parties due to their different interests. As a result, more effort should be made by providing a platform for the diverse interest groups of construction stakeholders to share ideas, communicate and distribute sustainability information.

Keywords: Dimensions; Stakeholder; Sustainable Construction.

1. INTRODUCTION

Global issues such as climate change, exponential population growth, and finite natural resources have caused people to pay more attention to sustainable development. The wave of sustainable development has also brought a revolutionary movement to the construction industry and community. To remain competitive in the market, leading construction organisations react to the sustainability phenomenon by integrating sustainability practices into operations and projects. However, construction stakeholders face challenges to implement sustainability in practice due to the lack of a common definition and principle of sustainable construction.

This paper will recall the ongoing debate about the meaning and dimensions of sustainable construction from literature. Hence, it conceptualises the interpretation of sustainable construction from the viewpoint of various construction stakeholders to examine how well has sustainable construction been captured by stakeholders in the industry.

2. UNDERSTANDING SUSTAINABILITY FROM THE LITERATURE / THEORY

Despite the high popularity of the sustainable development, there is no standardized definition for sustainability or sustainable related terms to date. The interpretation of sustainability concept is still open and a number of new thoughts and ideas have evolved over time. Oxford Advanced Learners' Dictionary defined "sustainable" as one "involving the use of natural products and energy in a way that does not harm the environment" or one that "can continue or be continued for a long time". In the Brundtland

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Report, World Commission on Environment and Development (WCED) (1987) proposed sustainability as “the ability to meet the present needs without compromising the ability to meet the needs of future generations”. The interpretation of WCED has been widely accepted by recognising the interfaces of environmental, economic and social development in the commitment of sustainable development. Balancing the eternal trade off between people, planet and profit is proposed to be the central concept of sustainable development in order to maximise the absolute value of an undertaking (Beheiry *et al.*, 2006; Opoku and Ahmed, 2013; Talbot and Venkarataman, 2011). Apart from the balance, Said *et al.* (2008) and Talbot and Venkarataman (2011) also suggested sustainability as a long term exercise carried out by various parties for attaining a sustainable condition within the parameters of social, environmental, and economic cornerstones.

3. SUSTAINABILITY AND THE CONSTRUCTION INDUSTRY

Although sustainability practices are evolving in the construction industry, it seems that the philosophy of sustainability cannot give practical guidance to construction players attempting to integrate it into their businesses or operations. Sustainability is an overarching concept which can impact and be impacted by every aspect of development. Development implies changes and it often involves the transformation of natural resources into desired outputs. Construction is one of the industries that undergoes massive transformation to introduce changes and development to the people, society and country. As highlighted by Du Plessis (2007), placing the terms of “sustainability” and “construction” together would further magnify the interpretive dilemma since these two terms are both highly complex ideas.

Viewing the broad coverage of sustainability, it deems that sustainable construction (SC) should address wider concerns on the comprehensive construction cycle from material extraction, planning, design, implementation, deconstruction and management of resultant waste, instead of a site activity or a particular stage of the project life cycle (Goh and Rowlinson, 2013). As indicated by Hill and Bowen (1997), sustainable construction was initially proposed to describe the responsibility and role of the construction industry in achieving sustainability, where the construction industry is deemed to include civil engineering and building construction. Kibert (2007) advanced his definition proposed in a 1994 conference by defining sustainable construction as “how the construction industry together with its product, the ‘built environment’ can contribute to the sustainability of the earth including its human and non-human inhabitants”. In the meantime, Said *et al.* (2008) proposed to adhere the definition of sustainable development to the principles of sustainable construction by protecting the environment and enabling all people to improve their life through the pursuit of economic and social objectives. Du Plesis (2007) emphasised the use of a broad interpretation of construction as a cradle to grave process embracing environmental protection, value addition to the quality of life, and both technological and non-technical aspects of social and economic sustainability.

Hill and Bowen (1997) divided the principles of sustainable construction into four pillars, i.e. social, economic, biophysical and technical aspects, while Conseil International de Batiment (CIB) (cited Kibert 2008) articulated seven principles to ideally inform decision making of sustainable construction: 1) reduce resource consumption; 2) reuse resources; 3) use recyclable resources; 4) protect nature; 5) eliminate toxins; 6) apply life cycle costing; and 7) focus on quality. At the same time, Fellow and Liu (2008) suggested that four systems as sustainability indicators, i.e. economic, socio-economic, socio-environmental and legal systems. Pearce (2006) also employed a different approach - economist’s approach to define sustainability in construction by measuring human well-being through assets.

Literature review implies that the interpretation of sustainable construction is still contentious and continues evolving. By and large, sustainable construction shall cover three key elements of sustainability in its concept and application, i.e. environment, economy and society. Although there is a growing body of literature and standards recognising the triple bottom line, construction stakeholders with varied interests may still hold different viewpoints in regard to sustainable construction.

Since the understanding of sustainable construction held by stakeholders at all levels of project delivery is key to its successful implementation, a lack of common understanding among construction stakeholders could impede the development towards the goal of sustainable construction. Therefore, it is important to examine what sustainable construction meant to stakeholders.

4. METHOD

This study used a qualitative approach to explore and examine the dimensions of sustainable construction. In-depth interviews were employed to obtain detailed information from various construction stakeholders who are engaged actively in sustainability practices during the delivery of construction projects. Unlike surveys, the approach of interview is more exploratory and open-ended in nature. Interviewees were asked about their understanding and perception about sustainable construction. Under the structure of interview, both interviewees' responses and feelings towards sustainable construction were also observed and examined. With participant permission, the interviews were recorded and the interview data were transcribed and coded in accordance to thematic analysis.

The interview participants were selected through purposeful sampling to ensure that the interviewees offer information-rich cases at interview. All interviewees were required to have direct exposure to sustainable construction projects or practices. A broad spectrum of professions and background, ranging from developers to academics, architects, engineers, surveyors, contractors, planners, supplier and facilities manager, were embraced in the sampling to avoid overlooking any interests of the related parties and also to ensure the comprehensiveness of the subject being studied.

Table 1 shows the profile of the interviewees. The interviewees possess with an average 22.5 years of working experience in the construction related field. All interviewees hold either executive position or managerial position in their organisations. They have played significant roles in either decision making or the implementation of sustainable construction in their respective organisations.

Table 1: Profile of Interviewees

No	Code	Experience (Years)	Job Position
1	C01	35	Engineering and Risk Manager
2	C02	>35	Chief Quantity Surveyor, Corporate Legal Consultant
3	A03	18.5	Chairman of HK Chapter of China Green Building Council
4	E01	>22	Project Director
5	D01	40	Director in Architectural Services
6	C03	12	Design Manager
7	C04	15	Design Manager
8	U01	>30	Director of Planning and Design
9	E02	8	Sustainability Officer
10	E03	16	Director in Building & Technology Division
11	D02	25	Assistant director
12	C05	37	Chief Sustainable Development Manager
13	E04	>25	Executive Director
14	R01	20	Associate Director & Director of Sustainable Development
15	E05	12	Director
16	S01	45	Director of project advisory
17	I01	9	Co-founder and Creative director
18	E06	7	Director of Sustainability
19	C06	26	Director
20	M01	> 20	Regional Head of Real Estate & Site Development
21	S02	31	Director
22	E07	28	Executive Director and Regional Manager

5. FINDINGS AND DISCUSSION

All the interviewees have a common understanding of the inclusion of the environmental pillar in their definitions of sustainable construction (SC). As reflected by interviewees, sustainability is always viewed relating to carbon footprint, pollution, green resources, material use, resources efficiency, energy consumption, water use and waste management.

A03 stressed four major savings in SC: material, water, energy and land resources while E03 proposed six factors in applying sustainable construction i.e. sustainable materials, ultimate energy use, water consumption, waste management, access to public transport, and life cycle cost. E02 argued that SC should contain the least environmental impact or pollution, minimum carbon emission, prolonged life cycle, renewable resources, less energy and material use, durable material, and recyclable and reusable materials. The interviewees highly acknowledge the environmental pillar since the focus of sustainable construction practices is mainly directed at environmental sustainability (Smitt and Pitt, 2011).

Regarding the economic pillar of sustainability, most interviewees share a common interest to embrace life cycle cost in the practice of SC. People should avoid from narrowing their focus to the cost incurred from a particular project stage; they should instead consider true cost, which involves the cost commencing from the supply, taking-off and bringing in to the site, until the disposal of materials. E01 supports the view and holds that life cycle costing is critical in improving sustainable performance; cost effectiveness and payback period should be often given a high priority in the pursuit of sustainability. She felt some sustainable features such as windmills often have low cost effectiveness due to their high initial cost and maintenance cost, considering their limited benefits generated. The inclusion of life cycle cost in SC practice is supported by E03 and D02 too. Rather than mere construction cost, E03 and D02 opined that SC should examine the whole life cycle cost of buildings, whereas life cycle entails the whole processes of design, construction, operation, demolition and maybe even the reuse of the buildings. E03 also asserted that “*achieving life cycle can drive the occurrence of other sustainable factors which can help to drive more sustainability into the buildings, while the emphasis on short term gains will always lead to wrong decisions*”. As reflected by E03, operation cost is typically 80% of the total building life cycle cost, and if a building can be operated at lower cost, it can produce lower energy consumption, better water usage and lower waste outputs.

Meanwhile, the integration of the social pillar in SC does not gain much support from the interviewees, although some acknowledge the significance of social concerns in developing sustainability in construction. E02, for instance, embraces indoor environment quality, flexibility in building use, occupants’ comfort and intelligent systems in the principles of SC. As an urban planner, U01 advocates placing a great emphasis on the development of urban landscape, culture, and human interaction in SC. He feels that current construction has induced a low town bearing and imposed lesser connectivity between people and the place. Therefore, more attention should be placed on the natural setting, cultural landscape and community in an effort to attain sustainability. A balance between culture and community identity also needs to be stressed. R02 indicated that adding value to the entire community and neighbourhood development is part of SC.

The embracement of economic and social development in SC is sometimes arguable. According to E04, it would be somewhat broad to include them, particularly the inclusion of social development depends very much on the types of site involved (e.g. heritage preservation site). As a policy maker, E09 also opined that SC should only deal with environmental perspective, although a project can also contribute to regional neighbourhood. In her views, the contribution of construction to economy is not on a macro scale with long term impacts to the overall industry development. From the perspective of C03, cost is a separated exercise in sustainable project operation, whereas the emphasis on sustainability tripod depends on the adopted procurement. Similarly, E07 also excludes social and economic development in the consideration of SC. The empirical findings concur with Abidin (2010), which also found that sustainable construction is viewed as a form of environmental protection and seldom to be related to social well-being and economic factors. The historical tendency to focus on environmental sustainability has over aligned sustainable development with green movement and alienated business executives (Beheiry *et al.*, 2006)

Meanwhile, health and safety are perceived as an important concept of SC. Rather than triple bottom line, C06 has employed a unique approach for sustainability by incorporating safety and health in SC to form a quadruple bottom line. As highlighted by E04, a better work environment and rest areas are often provided to labourers in order to achieve zero accident on site, since Labour Department in Hong Kong will suspend the work at site if any accident happens. F01 also supports the inclusion of safety by acknowledging the importance of safety towards sustainability.

Striking the balance between the three pillars is another emphasis placed by the interviewees in their pursuits of sustainability. The balance to achieve SC is another focus given by the interviewees in picturing SC. As revealed by D01, it is critical to strike a balance between cost, people and environment in a sensible way in implementing SC. The value of sustainable development would lose if the project fails to achieve one of the three pillars. Construction practices should examine the entire issues of people, cost and technology in the path towards sustainability. Exploring life cycle costing is important to determine the worthwhileness of sustainable efforts as it is impossible to introduce sustainable features which are unacceptable by the people, as stated by D01. Concurrently, A03 believes that three pillars of sustainable development have not been developed equally in construction, whereby environmental development receives comparatively less emphasis than the other two aspects in the past. He opined that more effort is currently invested in environmental improvement in order to retrieve the balance of SC.

To uphold the long term development, stakeholders also consider sustainable construction as an integrated and total approach that covers the entire life cycle - from cradle to grave. D02 regards SD as a total concept by covering all areas of property life cycles from design, construction, maintenance, renovation to demolition. Interviewee R01 also advocated SC as an integrated construction practice based on a closed-loop system of thought, which tracks the supply chain of materials sources from the extraction, production to waste generation and moves back to the production cycle. The integrated system promotes a close link and full cooperation between project parties such as developers, designers, contractors and facilities managers. Supporting to the idea of a closed loop system, E05 also felt that “*SC is to create building structure with resources and spaces available to (attain) a self-sufficient manner*”. The self-sufficient manner refers to not only energy and water conservation but also the economic sufficiency.

Interestingly, the findings suggest that sustainable development in construction could be an ideal situation and maybe very hard to have zero carbon, or a complete sustainability in the construction development. The interviewees expressed the following comments for achieving sustainable construction:

“It is impossible to achieve zero waste with current technology and methods [C05]”

“Sustainable interior design is ideal and cannot 100% achievable [I01]”.

“Self-sufficient is however an ideal situation and it is very difficult to achieve. Instead, we should strive to get as close as possible to this ideal situation in all aspects [E05]”.

Apart from the traditional triple bottom line, this study found that culture is another important issue for developing sustainable construction. The interviewees highlighted the importance of changing people’s mindset to work towards sustainable development. As expressed by E03, although smart engineering solutions have been designed for the clients, end users and/or operators still need to know how to use them in their designed way. He shared his experiences, whereby the operators switched the building devices to automatic off, and did the operation manually, which is the way they are used to it. The case has proven how critical of the understanding and commitment of the end users and/or operators to successfully shift the whole construction society towards sustainable development. It is thus necessary to improve the knowledge and commitments of not only construction parties but also all involved interested stakeholders in the construction industry for attaining SC. The finding is consistent with the work by Ball (2002) which argues cultural sustainability to be one of the most important un-addressed issues.

C04 believed that the sustainable development trend will only be changed totally when private developers are willing to pursue sustainability and build good quality buildings without any enforcement of government policy. It is essential to pursue sustainability from a genuine heart but not from either the desire to secure advantage over other firms in the market or the desire to comply the legislation requirements. Meanwhile, interviewees also asserted that people should change their lifestyles by

mapping their real needs to any decisions they made. Even though a smallest development, it would also lead to negative impacts on the environment, human and the planet by changing the original identity and ecology system surrounding of a place. As a result, Fellow and Liu (2008) suggested that only a real convergence value shift, supported by strong and enforced legislation to get to grips with the divergence in value judgement of various systems in completing sustainable development framework.

In the absence of a clear definition, concepts, principles and directions in applying sustainable construction, stakeholders tends to make SC suit their particular needs and fit their professions, in which they would be more familiar in their field of practice (Chong *et al.*, 2009). A gap would be formed in sustainable practices when incompatible goals are set by various parties due to their different interests. To achieve the wholesome sustainability in construction, the crossover and integration of knowledge between different fields is essential (Chong *et al.*, 2009).

6. CONCLUSION

A right context of knowledge and mindset about sustainable development is still questionable, particularly in light of the arguable definitions and principles of sustainable construction. There appears to be a need for construction stakeholders to acquire the right context of sustainability knowledge. The three fundamentals of sustainability should always be encompassed into the implementation framework by the construction stakeholders. Even if social and economic developments are sometimes taken into the considerations, it seems that sustainable construction is firmly entrenched within the environmental movement only. To avoid the knowledge gap of sustainable construction from continually expanding, a common definition and framework should be established to smoothen the transition towards sustainable construction. More effort could be done by providing a platform to the diverse interest groups of construction stakeholders to share ideas, communicate and distribute information to work towards a common goal in their sustainable construction practices.

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