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The dialectics of sustainable building

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ABSTRACT

Dialectics exist between economic development, environmental protection and social needs during the urbanization process. However, such dialectics have seldom been explored at the building level. Dialectics of sustainable building (SB) denote the interdependence among the elements of the complex socio-technical SB systems. This paper aims to examine the dialectics of SB drawing on the dialectical systems theory. The research was carried out through case study with three real-life SB projects in China which has witnessed a rapid urbanization process and also set ambitious targets of promoting SB. Multi-faceted and interwoven dialectics of SB were observed in the concept, methodology and value dimensions. Systems thinking was found to help to recognize the dialectics. Strategies that could synergize or synthesize the elements of the dialectical systems of SB were effective for managing the dialectics. The SBs studied were considered to be complex socio-technical systems embedded in their social, political and geographic contexts, which led to varied articulations of the dialectics of SB. The findings contribute a contextual factor to the dialectical systems approach that solutions to delivering SBs need to be customised in order to best address the specific dialectics.

1. Introduction

It has been widely recognised that tensions exist between economic development, environmental protection and social needs during the urbanization process (e.g. Morrison-Saunders & Pope, 2013). However, such tensions or the dialectics of sustainable development have seldom been explored at the building level. Dialectics denote the interdependence among the elements of a system (Rosi & Mulej, 2006). Sustainable buildings (SB) are increasingly been regarded as complex socio-technical systems. Among the few fast-developing countries in the world in recent decades, China has witnessed a rapid urbanization process and a great number of construction projects. By 2011, the total floor area of the existing building stock in China had exceeded 44 billion m^2; the annual floor area added is approximately 2 billion m^2, accounting for 50% of the world's total. From 1980 to 2010, the jobs in the Chinese construction industry increased from 8.54 million to 35.97 million (CASS, 2011).

However, the urbanization process is a significant contributor to the carbon emission increase (Poumanyvong & Kaneko, 2010). The CO_2 emissions of the building stock in China have exceeded 50% of the national total (Qiu, 2005). To cope with the problems associated with the urbanization, the Chinese Government is promoting sustainable urbanization (Shen & Zhou, 2014) and prioritizing green buildings in the governmental agenda (Gou, Prasad, & Lau, 2013; Shi, Zuo, Huang, Huang, & Pullen, 2013). The Chinese Government has published the 'Evaluation Standard for Green Building' (ESGB) in 2006 (Ministry of Construction, 2006). The Government has also set a target to reduce carbon intensity by 17% and energy intensity by 16% over the period 2011–2015 (www.gov.cn). The Ministry of Finance and the Ministry of Housing and Urban-Rural Development (MOHURD, 2012) announced the 'Implementation Plan for Accelerating Green Building Development' that set the targets for new green building areas of 1 billion m^2 by 2015 and of at least 30% of new building areas by 2020. All these factors together shape and incentivise the building industry to seek effective solutions to delivering buildings towards sustainability.

To realize the unification of the environmental, social and economic (ESE) benefits as required in many green or sustainable building assessment schemes reflects the fundamental dialectics of the ESE triple bottom line of SB. For instance, the national standard ESGB of China (Ministry of Construction, 2006) requires that the evaluation of green buildings should fully consider the dialectics between energy saving, land saving, water saving, materials saving, environment protection, and building functional requirements during the complete lifecycle of the building. However, it remains

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unclear what dialectics exist and how they are perceived and managed. This knowledge gap hampers the delivery of buildings with the ESE triple bottom line addressed systemically. Therefore, this paper aims to explore the dialectics of SB by examining their nature and management in practice. The paper first proposes a dialectical systems approach that frames the dialectics of SB in the three dimensions of concept, methodology and value. The paper then examines the dialectics with three real-life SB projects in China. The results are cross-case compared and reflected in relation to the findings of previous research, before conclusions are drawn.

2. Sustainable buildings

Berardi (2011) argued that "the definitions of sustainable building often prove to be useless because they are unclear (p. 277)". Even the concept of sustainable development that underpins SB delivery is also criticized for its nature being complex, normative, subjective and ambiguous (Martens, 2006). The difficulties in defining sustainable building lie in its dependence on time, scale, domain and social uncertainties (Berardi, 2013). Nevertheless, one way of escaping from the dilemma is to begin from the opposite that of non-sustainable development (Martens, 2006), or doing less harm (Reed, 2007). In ISO 21929 (2011) sustainability impacts are categorized as: environmental; economic; and social aspects.

In accordance to the scope of the impact of buildings, Chwieduk (2003) presented a typology of: 1) energy-efficient buildings; 2) environmentally-friendly buildings; and 3) sustainable buildings. Energy-efficient buildings deal with only one element of environmentally-friendly buildings (i.e. green building) without consideration of other elements, such as water. Furthermore, green embodies part of being sustainable (Alwaer & Clements-Croome, 2010). The detailed difference between green building and sustainable building are shown in Table 1.

3. The dialectical systems approach for SB

Previous research has examined SB using systems approaches, which adopt the principle that systems can be described by their components and interrelationships within the systems. For instance, Edum-Fotwe and Price (2009) developed a specification for the ontological topography, which defines three broad categories: those which represent spatial scales, urban systems and development life cycles, and sustainability dimensions and their associated issues and sub-issues, such as stakeholders, impact, influences and polices associated with any entity. Alwaer and Clements-Croome (2010) regarded sustainable intelligent buildings as a complex system of three basic inter-related issues, i.e. people, products and processes, and the inter-relationships between them. Mukherjee and Muga (2010) proposed a framework that can be used to integrate reductionist approaches within a systems paradigm. Nevertheless, although these research attempts are helpful to gain insights into the complexity of the SB systems, they fail to explore how the dialectics are dealt with in practice.

There is an established body of knowledge of dialectical systems theory in the literature of systems theories. Its basis is the dialectical systems concept (Božičnik & Mulej, 2009). Rosi and Mulej (2006: 1168) defined a dialectical system as "a network/system of essential interdependent viewpoints of consideration". Instead of providing a practical tool, the theory tries to influence users' thinking and feeling (Zenko, Rosi, Mulej, Mlakar, & Mulej, 2012). Božičnik and Mulej (2009: 350) revealed that dialectical systems theory "enables humans to apply the law of requisite holism to their observation, perception, thinking, emotional and spiritual life, decision making, and action". The preference for the requisite holism is because it "provides a middle ground between the impossible total system (full, real holism) and the often dangerous one-viewpoint system (fictitious holism)" (Mulej et al., 2003: 77). Drawing on such body of knowledge, this present paper proposes a dialectical systems approach for examining the dialectics of SB. In this approach, it is posited that the requisite focus of SB dialectics should be linked to three interconnected dimensions of the concept, methodology and value of SB (Fig. 1).

- The dimension 'concept' refers to the ESE aspects of SB. Dialectics may exist between and within the ESE aspects and their sub-aspects.
- The dimension 'methodology' describes the boundary of the temporal and spatial aspects of the building. The temporal aspect can be described in two trajectories: (1) the material flow that ranges from the stage of material extraction to the end-of-life of the product; and (2) the work flow that starts from the stage of planning to demolition. The spatial aspect describes the location of the physical subject, which ranges from technology, component within the building, the building as a system, towards the broad context at the community, city and global levels.
- The dimension 'value' is concerned with the stakeholders and their networks, and their interfaces with the project delivery.

The dialectics may exist in any single dimensions and/or aspects, and/or in their integration. The interpretation of the dialectics will need to depend on the integration of the three dimensions (illustrated using 'Point A' in Fig. 1). The interpretation may draw on

Table 1
Major issues covered by 'green building' and 'sustainable building'.

Major issues of building performance	Green building	Sustainable building
Consumption of non-renewable resources	✓	✓
Water consumption	✓	✓
Materials consumption	✓	✓
Land use	✓	✓
Impacts on site ecology	✓	✓
Urban and planning issues	✓	✓
Greenhouse gas emissions	✓	✓
Solid waste and liquid effluents	✓	✓
Indoor well-being; air quality, lighting, acoustics	✓	✓
Longevity, adaptability, flexibility		✓
Operations and maintenance		✓
Facilities management		✓
Social issues (access, education, inclusion, cohesion)		✓
Economic considerations		✓
Cultural perception and inspiration		✓

Source: UNEP (2003), Berardi (2013).

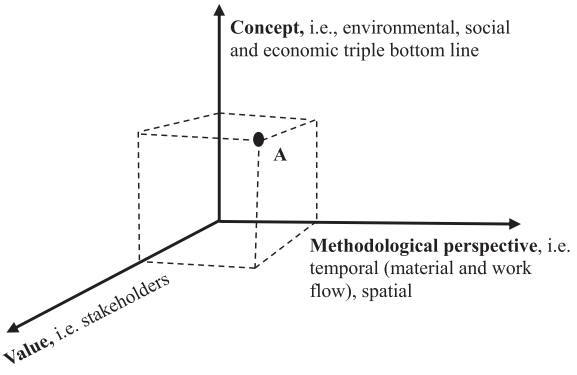

Fig. 1. A conceptual framework of examining dialectics of sustainable building.