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Implementation challenges to the adaptive reuse of heritage buildings: Towards the goals of sustainable, low carbon cities

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A B S T R A C T

It is well acknowledged that low carbon emissions is one of the key factors contributing to sustainable urban development and effectively tackling climate change. Adaptive reuse of buildings is a form of sustainable urban regeneration, as it extends the building's life and avoids demolition waste, encourages reuses of the embodied energy and also provides significant social and economic benefits to the society. Thus, it embraces the different dimensions of sustainability. However, the debates over which sustainability factors are key, and how to address them all in practice, remain unresolved. This study begins with an intensive literature review of the factors that contribute to the goal of sustainable development in the conservation of built heritage. This is followed by in-depth interviews with practitioners who have participated in adaptive reuse projects in Hong Kong. These interviews confirm the reliability of the shortlisted sustainability factors. More importantly, this paper examines the challenges in incorporating a sustainability framework into adaptive reuse projects. The authors stress that the framework for achieving sustainable, low carbon adaptive reuse should be viewed more holistically, integrating social, economic, environmental, urban and political policies.

Introduction

The reality of climate change has prompted to the urgency in the reduction of carbon emissions and the planning of low carbon cities. The construction of new buildings consumes significant amounts of raw materials and energy, and generates high carbon emissions. Buildings are responsible for more than 40% of global energy use, and produce one third of global greenhouse gas emissions (UNEP, 2009). Construction and building account for approximately 136 million tonnes of waste annually, nearly half of which is from demolition (HUD, 2003). Greenhouse gas emissions (GGE) in Hong Kong are nearing 50 million tonnes per annum and rising (http://www.epd.gov.hk/). Given the above figures, the building sector also has great potential for significantly reducing carbon emissions.

Buildings are concentrated in urban areas, which should therefore be the focus of efforts to reduce building related carbon emissions. In particular, historic buildings constitute a significant portion of the entire building stock all over the world and it is not possible to preserve them all intact. In the UK, only an additional 1.5% is added to the existing building stock each year, and there are approximately 372,000 listed building entries (English Heritage, 2010). New South Wales in Australia has 20,000 listed buildings (NSW Heritage Office, 2010), China has 67,750 county, state and municipal level listed heritage places (Chan, 2004), and Hong Kong has 94 declared monuments and 1444 proposed graded historic buildings (Antiquities Monument Office, 2011).

Adaptive reuse bypasses the wasteful process of demolition and reconstruction. This environmental benefit, combined with the energy savings, carbon emissions reduction, and the social and economic advantages of recycling a valued heritage building, make reuse an essential component of sustainable development (Department of the Environment and Heritage, 2004). Current research is advocating on incorporating green environmental design into the adaptive reuse of buildings (Getty Conservation Institute, 2011; Langston, 2010). Although there can be little doubt that incorporating environmental design into the adaptive reuse of historic buildings is one way to achieve low carbon emissions, addressing only the environmental sustainability is not sufficient. All the other sustainability domains also significantly contribute to the extent to which heritage buildings are sustainable.

In that context, this study attempts to identify a list of underlying factors, which contribute to the concept of sustainable development in the context of heritage conservation. This study defines sustainability as consisting of four components—the social, economic, environmental, and political–institutional (Chan & Yung, 2004; O'Connor, 2006; Shen, Ochoa, Shah, & Zhang, 2011; UN Habitat, 2004;

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Valentin & Spangenberg, 2000). It then further evaluates the challenges in implementing these factors in practice. In-depth face-to-face interviews were conducted with participants in adaptive reuse of historic building projects in Hong Kong. Hong Kong is chosen as a city as it produces a significant proportion of GGE compared to other cities around the world. Land is scarce and so demolition has often been preferred to refurbishment or renovation, irrespective of the consequences to the environment. Thus, this study provides valuable insights on the ways in which the adaptive reuse of heritage buildings can make positive contributions to sustainability in cities worldwide.

Literature review

Low carbon cities and urban development

It is well understood that carbon emissions reduction is one of the most crucial strategies to mitigate the adverse impact of climate change. There is also a growing concern in the planning regime to incorporate the reduction of carbon emission in urban development. There are three broad approaches for reducing carbon emissions including substitution or mitigation of carbon energy sources, technology innovation, and adaptation or behaviour change (Crane & Landis, 2010).

The Kyoto Protocol, signed in 2005, requires the developed nations to reduce GHG emissions to 5.2% below the 1990 level, between 2008 and 2012. It is often suggested that planning of low carbon city needs to consider the following major issues: cost and energy effectiveness and efficiencies of new built and existing buildings, resource management (recycle planning), and develop Low Carbon and renewable technology planning and incorporation and developing and designing a corporate social responsibility agenda (Energy City Frederikshavn, 2006). In this context, the reuse of existing buildings to suit the needs of the present and future generations, while avoiding demolition and reconstruction is one of the most sustainable form of urban development.

Low carbon cities and sustainability

The concept of low carbon cities is closely linked to sustainable development and is arguably one of the most critical sustainability challenges facing the world in recent decades. Reduction of carbon emissions is important, as they are also part of the sustainable development concept. The Brundtland Commission provided the often quoted definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Since the adoption of Local Agenda 21 strategies after 1992, the term has extended from the environmental sphere to economic, social and even cultural spheres. The concept of sustainable development is often characterized by issues such as the proper use of resources to guarantee generational equity, protection of the natural environment, minimal use of non-renewable resources, economic vitality and diversity, community self-reliance, individual wellbeing, and satisfaction of basic human needs (Choguill, 1996; Hardoy, Mitlin, & Satterthwaite, 1992).

In recent research, it also postulates a fourth component of sustainability, the political-institution sphere (O'Connor, 2006; Valentin & Spangenberg, 2000). It often refers to the institutions of the society which guide the human interaction and the governance of rules (Valentin & Spangenberg, 2000). The political sphere acts as the regulating agent which balances the tradeoffs and resolves the conflicts between the other spheres of sustainability. Whitehead (2003) stresses the importance of local political governance in constructing strategies of sustainable urban development. It is argued that the interferences of all the four spheres become the fundamentals to achieve the goal of sustainable cities (O'Connor, 2006). In the field of heritage conservation, Kocabas (2006) argued that an evaluation of the impact of urban conservation should access outcomes against a combination of physical, social and economic objectives. However, the challenges still largely remain in translating these principles into operation.

Adaptive reuse of built heritage in enhancing sustainability and low carbon cities

Built heritage that through adaptive reuse has a new function for some socially useful purpose, appears to be the most effective approach for a self-financing and sustainable form of conservation (Balaras, Dascalaki, & Kontoyiannidis, 2004; Brand, 1994; Bromley, Tallon, & Thomas, 2005; Kurul, 2007; Pickard, 1996; Steinberg, 1996). In particular, extending the life of an existing building through reuse can lower material, transport and energy consumption and pollution and thus make a significant contribution to low carbon reduction and sustainability (Bullen, 2007; Van der Voordt, 2004; Velthuis & Spennemann, 2007). In addition, the concept of 'green' adaptive reuse of heritage buildings is an effective strategy, it does not only extend the life's cycle of the buildings, reduce its carbon emissions and improve cost efficiency, but also conserve significant heritage values (Langston, 2010). Thus, adaptive reuse strategies for heritage buildings provide economic, environmental and social benefits. This is consistent with the goal of sustainable development.

Adaptive reuse is broadly defined as "any building work and intervention to change its capacity, function or performance to adjust, reuse or upgrade a building to suit new conditions or requirements (Douglas, 2006). Previous studies have stated the factors which may make a building suitable or unsuitable for adaptation (Bullen & Love, 2010; Langston & Shen, 2007; Langston, Wong, Hui, & Shen, 2008; Watson, 2009; Wilkinson, James, & Reed, 2009). However, the adaptive reuse of historic buildings is more complicated than the reuse of ordinary buildings. The adaptive reuse of a historic building should have minimal impact on the heritage significance of the building and its setting, and add a contemporary layer that provides value for the future (DEH, 2004). The significance and integrity of important historic assets can be threatened by poorly designed adaptations and mitigation responses. Thus, the new use should be a *compatible use* (ICOMOS, 1999) in which interference with the fabric is minimized. The new use should also ensure the *appropriateness* of potential uses in the light of the assessment of significance, and take into account the medium and long-term financial (and cultural) viability of the site. Balancing cultural significance and economic viability is one of the major challenges in the reuse of historic buildings (Murtagh, 2006). Although it is commonly believed that it is cheaper to convert old buildings to new uses than to demolish and rebuild (Ball, 1999; Department of Environment and Heritage, 2004; Douglas, 2002; Pearce, 2004), there is still some debate on whether the costs of reusing buildings are in fact lower than the costs of demolition and reconstruction (Douglas, 2006; Hall, 1998; Kohler & Yang, 2007).

The international charters and organisations stress the conservation of the culturally significant fabric of a heritage place as a criterion for achieving successful adaptive reuse projects (NSW Department of Planning and RAIA, 2008). However, the role of the adaptive reuse of historic buildings in enhancing sustainable development still lacks a comprehensive theoretical framework.

Low carbon goals and sustainable development in Hong Kong

Since the mid-1990s, the Hong Kong government has acknowledged the importance of sustainable development and is