INDICATORS FOR HERITAGE BUILDINGS SUSTAINABILITY

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Summary

Heritage buildings preservation has become a major concern in our society. In the past, hundreds of heritage buildings were demolished due to high cost of adapting for new uses. The preservation of old historic buildings is in fact crucial as it not only represents our cultural identity and continuity, but also creates environmental benefits. Many of researches in the past emphasized the importance of environmental assessment methods to improve the environmental performance and building quality. Yet, for gauging heritage sustainability, the environmental assessment methods alone are insufficient. The social and economic aspects also play a role in heritage preservation. The heritage sustainability should thus embrace three pillars of sustainability, namely environmental, social and economic. This study attempts to develop a set of sustainability indicators for heritage buildings assessment. Fundamentally, sustainability indicators have emerged in the sectors like agro-ecosystems, bio-energy systems, corporate systems and urban sustainability. However, its evolution in the heritage sector has been relatively slow. Heritage needs its own tailor-made indicators. Based on the concept of sustainability, a multi-criteria assessment method and a set of indicators are developed to determine the level of sustainability of heritage buildings. A heritage building in Hong Kong will be selected as our case study to test the indicators. The outcomes will serve as a useful tool for policy making and assist government bodies in assessing the performance of heritage buildings with regard to the embedded objectives of building sustainability.

Keywords: Sustainability indicators, heritage buildings, a multi-criteria assessment method, building sustainability

1 Introduction

Heritage, an inheritance from the past, is an important component in our mature society. The call to protect and preserve our natural and cultural heritage for the benefit of present and future generations was expressed in the international treaty by UNESCO in 1972. In fact, hundreds of heritage buildings have been demolished due to high cost of adapting for new uses [1]. The old historic buildings are important cultural and economic resources as a witness of represent our continuity. It also has resource value as the use of material resource can be reduced, contributing to energy and material savings. The conservation of

built heritage is thus placed shoulder-to-shoulder with sustainability, as both would be most benefit from working in harmony [2]. This inspires the interest in the link between heritage and sustainability, which was emerged in the mid-1990. Heritage sector needs its own tailor-made sustainability indicators [3]. Yet, its evolution has been relatively slow. Thus, this study attempts to develop a set of indicators to assess the level of sustainability of heritage buildings.

2 Environmental assessment methods

A huge amount of building stock constructed in the past and remained in use for decades initiates the focus of building environmental assessment methods shift from new construction to refurbishment project [4]. Environmental Impact Assessment (EIA) and Life Cycle Assessment (LCA) are two basic methodological frameworks, in which 'building' falls somewhere in between the two [4]. BREEAM in the UK and LEED in the US are among the most popular building environmental rating schemes. Despite their significant contributions to the knowledge of building-related environmental issues, solely emphasizing on environmental performance alone is inadequate for the context of sustainability [5]. The environmental, social and economic dimensions are equally important to frame sustainability.

3 Sustainability indicators

Sustainability Indicators (SIs) have been used for examining the performance of environmental, social, economic and urban planning for more than 40 years [6]. The SIs developed in the past included Dashboard of Sustainability (DS), Ecological Footprint (EF) and Environmental Sustainability Index (ESI). Despite various indicators assembled, the challenge of Agenda 21 to develop sustainability indicators has been far from satisfactory since none of indicator sets has been widely implemented [7]. Stubbs [3] developed indicators for measuring the sustainability in historic environment. Yet, this methodology has not been generally implemented. Further efforts are needed for the development of heritage sustainability indicators to meet the sustainable development challenges [3].

4 Development of sustainability indicators for heritage buildings

The environmental impact and technical aspects of built heritage have been extensively discussed. In fact, the impact of heritage to local community and the consideration of funding for maintenance should be considered for its sustainability. Adapting the framework of Stubbs [3], our study develops a set of indicators, called Heritage Sustainability Index (HSI), consisting of environmental, social and economic dimensions. The *generic* area of Stubbs is excluded in our framework as it should be applied to the urban heritage rather than to individual building. A total of 18 indicators were selected to assess the level of heritage buildings sustainability (See **Fig.1**). The site inspection, interview with the building management and questionnaire surveys with workers, visitors and local inhabitants will be carried out to obtain the rating for each indicator.

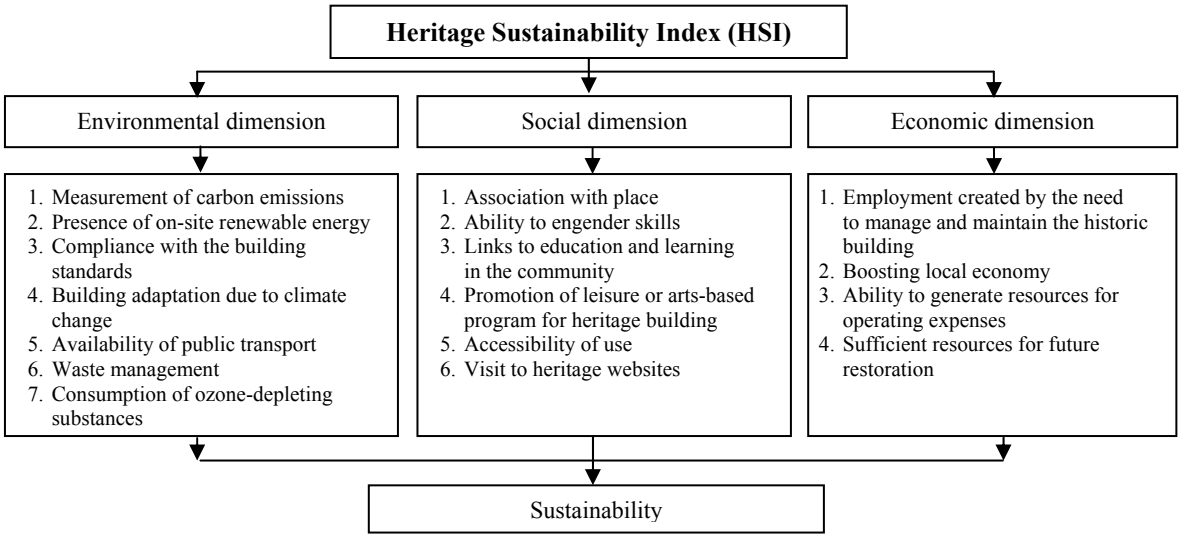

Fig. 1 *Framework of Heritage Sustainability Index (HSI) for heritage buildings*

4.1 Environmental dimension

The energy consumed and waste produced by a building brings negative impact to the environment. The energy usage for older buildings may be higher for maintaining the humidity to avoid the building decay. An indicator is needed to ensure that the building is environmentally sound. Eight indicators are developed to measure the environmental sustainability (See **Fig. 1**). The carbon emissions generated by a heritage building is mainly due to the electricity usage. The presence of environmental friendly devices and the building capability to adapt to climate change may result in less energy consumption. The availability of public transport, such as mass transit train and bus, will bring less traffic, contributing to less consumption of natural resources and air pollution. The compliance with the building standards helps to ensure the health and safety of the occupants [8].

4.2 Social dimension

Heritage sustainability should also include the social aspect, such as social security and equity, labor market relations, etc. [9]. Six indicators are built to gauge the social sustainability (See **Fig. 1**). The importance of heritage building to a sense of place needs to be examined [3]. Its demolition could lead to a feeling of loss to local inhabitants, in particular. Its existence provides knowledge to present and future generations about the past. Heritage building maintenance could develop skills for local people. For social sustainability, everyone should have a fair access to the buildings, physically or virtually.

4.3 Economic dimension

Conflict between heritage conservation and economic development has been extensively debated due to different concern among different parties. To be sustainable, the heritage building should be growth-oriented and economically sound [9]. Four indicators are developed to assess the economic sustainability (See **Fig.1**). The economically sustainable heritage building can create the employment opportunities and boost local economy. It can also generate income for the operating expenses and future restoration.

5 Conclusions

This paper has developed a set of indicators for the sustainable assessment of heritage buildings, embracing three pillars of sustainability. It will be applied in our case study, which is under ongoing research. A heritage building in Hong Kong will be selected as a case study to test the framework. Each indicator will be rated during the site inspection, interview and questionnaire surveys. To arrive at a single index, the HSI will be weighted by using Delphi method or Analytic Hierarchy Process (AHP). The index will demonstrate the level of sustainability of a heritage building. The results will serve as a constructive tool for the stakeholders of built heritage.

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