Building and Environment 45 (2010) 2057–2067

Contents lists available at ScienceDirect

Building and Environment

journal homepage: www.elsevier.com/locate/buildenv

Measuring the influence of the greening design of the building environment on the urban real estate market in Taiwan

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ARTICLE INFO

Article history:
Received 4 December 2009
Received in revised form
3 February 2010
Accepted 15 February 2010

Keywords:
Sustainable development
Global warming
Greening design
Urban policy
Real estate market

ABSTRACT

To address the worsening problems of global warming and the urban heat island effect, ecological cities and building environment greening are being promoted in population-dense urban areas domestically and abroad. For example, the Japanese Ministry of Land, Infrastructure, Transport, and Tourism announced the CASBEE-HI (Heat Island) assessment system in 2008 as a response to worsening urban warming and urban heat island effects. The Ministry implemented "Building Space Greening Plans" in Tokyo, Osaka, and other cities, enforcing by law the effective reduction of urban temperatures and improving urban living environments and alleviating the threat of urban ecological disasters. Therefore, this study integrates Taiwan domestic and foreign building space greening design, derived greening benefits, implementation promotion methods, and greening design policies as measurement constructs to examine the mutual influence between different constructs and to analyze the degree of influence on the urban real estate market.

From the result, demonstrating that building space environment greening design does bring about positive benefits. In addition, the greening benefit was shown to have a positive impact on the urban real estate market. At the same time, greening promotion implementation method and urban policy standard both had a positive impact on the urban real estate market, demonstrating that government promotion of building environment greening design through urban design policy means is acceptable to the public.

1. Introduction

The study discussed previously [1] showed that sustainable building has a significant positive influence on housing purchase choices and that when sustainable building enjoys a positive appraisal response, housing purchase choices can be increased, thereby effectively increasing interior and exterior residential environment quality, reducing air conditioning use, properly implementing roofing insulation measures and roof greening and ensuring residential sanitation safety. These effects facilitate housing purchase choices. Raymond [2] also noted that the appraisal results or certification of "sustainable building performance" of overall building environments have gradually come to be viewed as the basis for project development, building award awards, as well as risk and real estate mortgage evaluations. One important message from the United Kingdom, Australia, and EU countries regarding standards for real estate evaluation is that they should be closely combined with currently implemented sustainable building assessment tools. This issue has become an internationally important one in real estate markets and in market transformation [3].

To address the worsening problems of global warming and the urban heat island effect, ecological cities and building environment greening are being promoted in population-dense urban areas domestically and abroad. For example, the Japanese Ministry of Land, Infrastructure, Transport, and Tourism announced the CASBEE-HI (Heat Island) [4] assessment system in 2008 as a response to worsening urban warming and urban heat island effects. The Ministry implemented "Building Space Greening Plans" in Tokyo, Osaka, and other cities, enforcing by law the effective reduction of urban temperatures and improving urban living environments and alleviating the threat of urban ecological disasters. The United States has formally incorporated rooftop greening into LEED assessment criteria. Relevant studies have demonstrated that appropriately increasing urban greening or reducing the proportion of artificial structures facilitates the alleviation of the urban heat island effect [5,6,7]. Studies have also demonstrated that plant greening provides the benefit of alleviating urban warming and the urban heat effect [8], providing

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doi:10.1016/j.buildenv.2010.02.013

tangible aid in reducing energy consumption as well as improving optimal energy use; such greening constitutes the optimal implementation in pursuing a sustainable ecological living environment [9,10]. In addition, "greening approaches" are the most inexpensive method of reducing temperatures [11].

The greening benefits resulting from space greening of building rooftops, walls, and bases can not only improve overall urban environmental quality, it can also improve the added value of buildings, e.g. increasing asset value, improving image and reputation, and increasing market competitive ability [3,12,13]. In the rapid increase of high-rise buildings in Taiwan, the development behaviors of builders favor the maximum usage benefits of bases; their contributions to environmental greening have been limited to minimum legal standards. Furthermore, the "Green Building Standard Promotion and Usage Operating Points" announced by the Building Research Institute of the Ministry of the Interior does not legally enforce the incorporation of privately-constructed buildings into the range of evaluation. Other relevant greening regulations and policies lack detailed specifications for the greening of the rooftops, walls, and base areas of building environment spaces.

Because Taiwan's building green design and urban real estate-related research are few, but this research hopes to obtain views on this topic of the general public, also worried that the general public do not to understand questionnaire question, therefore this text is to investigate the respondents with the basic specialized background of building, real estate, urban plan, and so on, then, the investigation object is not to emphasize specially the years of experience in green buildings. Therefore, the following objectives have been set for this study:

1. To integrate Taiwan domestic and foreign building space greening design, derived greening benefits, implementation promotion methods, and greening design policies as measurement constructs to analyze the mutual influence between different constructs.
2. To examine the influence of the building greening construct on urban real estate markets.
3. To determine the key variables/dimensions of urban real estate markets which are affected by the building greening construct, and provide domestic real estate-related industries and domestic cities with a reference for urban greening laws and policy promotion.

2. Literature examination

It can be seen from the studies discussed above that building space environment greening is an important component of sustainable building evaluations. Therefore, this paper organizes literature on greening-related evaluation content and Taiwan domestic and foreign greening standards and urban design for the benefit of sustainable building environment performance evaluation tools; this paper attempts to clarify the benefits produced by building space environment greening and its impact on the urban real estate market.

2.1. The impact of sustainable building and building space environment greening on the real estate market

As the climate experiences abnormal changes, international primary evaluation systems have also gradually begun to emphasize overall environmental climate regulation, creation of natural ecological environments, and the development of regional and urban evaluation tools. The warming caused by rapid development of large urban areas has led many countries to become aware of the importance and urgency of the greening of urban spaces, leading many countries to actively promote building greening policies.

Western countries were the first to begin developing and implementing greening. According to American and British studies, the asset value of a building can increase by 6–15% if it is covered by trees [13]; such green rooftop buildings as well as the social and environmental benefits they confer are greatly supported by the public [14]. Three-dimensional greening methods can also be used to alleviate the abnormal expansion and contraction caused by climate change, thereby reducing the need for roof repairs and roof replacements [13]; the implementation of rooftop greening can extend roof lifespans by approximately 20 years [15].

Table 1
Conmecting with building environmental green criteria of the main international assessment tools.

Assessment tool	Developer	Conmecting with building environmental green criteria
SBTool 2008 (Sustainable Building Assessment Tool)	iiSBE	• Urban Design and Site Development • Greenhouse Gas Emissions (Annual GHG emissions from all energy used for facility operations) • Other Atmospheric Emissions (Emissions of ozone-depleting substances during facility operations, Emissions of acidifying emissions during facility operations, Emissions leading to photo-oxidants during facility operations)
LEED-NC 2009 2nd 2008 (Leadership in Energy and Environment Design for New Construction)	U.S. Green Building Council (USGBC)	• Sustainable sites (Development Density, Development Footprint, Landscape & Exterior Design to Reduce Heat Islands)
LEED-EB 2009 (LEED for Existing Buildings: Operations & Maintenance)	U.S. Green Building Council (USGBC)	• Sustainable sites (High Development Density Building & Area, Heat Island Reduction)
CASBEE-NC 2008 (Comprehensive Assessment System for Building Environmental Efficiency for New Construction)	Housing Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)/Japan GreenBuild Council (JaGBC)/Japan Sustainable Building Consortium (JSBC)	• Preservation & Creation of Biotope Townscape & Landscape, Improvement of the Thermal Environment on Site • Consideration of Global Warming, Consideration of Local Environment (Heat Island Effect)
CASBEE-EB 2006 (CASBEE for Existing Building)	Housing Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)/Japan GreenBuild Council (JaGBC)/Japan Sustainable Building Consortium (JSBC)	• Consideration of Global Warming, Consideration of Local Environment (Heat Island Effect)
EEWH 2007 (Ecology, Energy Saving, Waste Reduction, Health)	Architecture & Building Research Institute, Ministry of the Interior, Taiwan	• Biodiversity; Greenery; Soil Water Content; Energy conservation; CO_2 Emission; Waste Reduction; Indoor Environment; Water Resource; Sewer and Garbage