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Developing post occupancy evaluation sustainability assessment framework for retrofitting commercial office buildings: A proposal

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Abstract

Developing a new assessment tool in the area of sustainable development requires a strategic methodology for a cohesive and logical framework incorporating relevant theory and practical experience. This study is aimed to provide a Post Occupancy Evaluation (POE) sustainability assessment framework for retrofitting commercial office buildings in Malaysia. The design of sampling selects GBI certified office buildings and a non GBI certified commercial building, to obtain the building performance score then, conducting interviews with professionals to obtain feedback on environmental performance and determine the occupants’ satisfaction level in certified GBI commercial office buildings and conventional, through questionnaire distribution.

Keywords: Commercial buildings, Facilities management, Indicators, Post occupancy evaluation, Sustainability

1. Introduction

Sustainability indicators and composite index are gaining a lot of importance and increasingly recognized.
As a powerful tool for policy making and public communication in providing information on buildings and corporate performance in fields such as environment, economic, social, or technological improvement. Existing buildings and to this extend, commercial buildings have an important role to play in addressing the sustainability issue for any meaningful development. By conceptualizing phenomena and highlighting trends, sustainability indicators simplify, quantify, analyze and communicate the complex and complicated information (Kumar et al., 2012).

Research in the area of ‘green building’ focused on the assessment of environmental and (to some extent) health-related attributes of buildings. The further development towards the ‘sustainable building’ approach led to the inclusion of economic and social aspects that resulted in a substantially widened scope of assessment criteria. Concerning ‘sustainable buildings’, the description of functional building performance is therefore a precondition for safeguarding the comparability of building concepts, and for validating the fulfillment of building users’ needs (Lutzkendorf and Lorenz, 2006). Consequently, this can be achieved by merging both approaches and by the development of an overall system for the description and assessment of a building’s characteristics and attributes, hence this research focus on integrating the POE concept as a means of feedback for retrofitting process for the fulfillment of building user’s need towards performance-based sustainability.

2. Problem Statement

The Malaysian building industry has over the years been developing and working towards a more sustainable and green architecture. The issue of Sustainable Building Rating System in Malaysian building industry is still new. Even though Green Building Index has been developed, but the application has been mostly to the new building. There has been no study done on the application of SBRS to existing building yet. Thus, Knowledge and understanding on how the Sustainable Building Rating System (SBRS) can increase their building performance and prolong the building life span among the actors in Malaysian building industry are very low. Hashim (2011) reveals that one of the major barriers holding back the development of sustainable building in Southeast Asia is the lack of awareness of sustainability issues in related to the profession.

The survey conducted by Jaafar et al (2007) also reveals that the Malaysian building industry players have ‘little’ knowledge on sustainable building assessment, rating and labelling system. Due to this, many office buildings in Malaysia lay claim for sustainability. The building maintenance and operation cost increase drastically every year. The building condition deteriorates and this situation will lead to the loss of rental income by the owner. Tenant of an office building will go for a better building environment for their companies’ good reputation. Even though the capital investment for sustainable building is very high, but the long term of operation and maintenance cost is very low, hence POE is required if achievement is to be made in any successful commercial upgrade in order to satisfy the need of occupants.

3. Literature Review

Sustainability assessment has been developed conceptually and through practice. Pope et al. (2004) conceptually reviewed several approaches of sustainability assessment such as environmental impact assessment (EIA), strategic environmental assessment (SEA), objectives-led SEA, EIA-based integrated assessment, objectives-led integrated assessment, and assessment for sustainability which relied on principles-based criteria. In sustainability assessment, the triple bottom line approach, covering
environmental, economic and social dimensions, is a starting point (Pope et al., 2004). Sustainability assessment focuses on the prospects for lasting net gains and the acceptability of associated trade-offs with generic trade-off rules (Pope et al., 2004; Winfield et al., 2010).

Sustainable renewal/retrofit of buildings uses the building data and case studies as well as the identification of sustainable features for Building retrofit (Mohseni et al., 2012; Edirisinghe et al., 2011). This research will adopt the model developed by (Ruwini et al; 2012), in their study of the Sustainable renewal/retrofit of public building project as shown in Figure1, modified to suit the context of this study. This model takes sustainability indices into consideration in order to determine various environmental, social, economic and functional factors as emphasized by (Kalutara, et al., 2011), when assessing sustainable retrofit options and technologies for buildings. In addition to that, the model also takes associated risk into account in assessing various sustainability features. Once the retrofit case study is identified the project estimates the quantifiable sustainability criteria and indices such as Heating, Ventilation, and Air Conditioning systems (HVAC), Indoor Environment Quality (IEQ), energy and water prior to retrofit. Upon implementation of the retrofit, a building monitoring system is used to validate the pre-estimates through the post-retrofit real measurements of the above criteria and indices.

Fig 1. Conceptual model of POE Sustainability Assessment/retrofits of commercial buildings
(Adapted from Ruwini et al; 2012)

Regarding existing buildings, it is desirable to assess occupants’ satisfaction through POE (Lutzkendorf and Lorenz, 2006). The indicator ‘occupant satisfaction’ represents a key performance
indicator that may replace some other partial indicators. This indicator reveals a very close relationship between the social aspects of sustainable development (in terms of health, comfort and well-being) and economic or financial considerations. Therefore, there is a close correlation between occupant satisfaction and occupant productivity (Heerwagen et al., 2004; Kampschroer and Heerwagen, 2005). Hence, occupant satisfaction has an impact on the risk of losing the tenants, on the cash flow generated by the building and thus on the building’s market value. Furthermore, aspects of occupational health and safety feed into the ‘labor practice’ and ‘decent work’ criteria, which are applicable within the framework of the Global Reporting Guidelines (Lutzkendorf and Lorenz, 2006).

Currently, several environmental methodologies and methods for evaluating environmental performance of buildings are being developed. In a global scale it is worth mentioning SB (Sustainable Building) Tool, formerly known as GB Tool (Green Building Tool), which is an international project coordinated from Canada, LEED (Leadership in Energy and Environmental Design) a method developed in the USA with a worldwide application and CASBEE (Comprehensive Assessment System for Building Environmental Efficiency), a method developed in Japan. In Europe, some of the most frequently used include BREEAM (Building Research Establish Environmental Assessment Method) in the UK and it is worth mentioning the HQE (High Environmental Quality) developed in France during the last decade and the VERDE method developed recently in Spain (Sinou, 2006).

4. Methodology

Both, qualitative and quantitative methods will be used as a research method to achieve the objectives of this study and to answer research questions, table 1 below depict the research strategy

Table 1: Research Strategy

<table>
<thead>
<tr>
<th>Objective</th>
<th>Type of Data required</th>
<th>Data collection Approach</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>To critically examine the relevant criteria for assessing sustainability of existing office buildings.</td>
<td>Green Building system strategies. Environmental, social and economic Sustainability indicators.</td>
<td>Literature Review Interview with experts (Qualitative)</td>
<td>Content analysis</td>
</tr>
<tr>
<td>To evaluate the occupants' perception of sustainability in both GBI certified office building and conventional commercial office building.</td>
<td>Environmental, Social and Economic indicators</td>
<td>Quantitative data (Questionnaire)</td>
<td>Factor analysis</td>
</tr>
<tr>
<td>To determine the variability of the occupants' perception in the two buildings</td>
<td>Indicators</td>
<td>Quantitative data (Questionnaire)</td>
<td>Principal Component Analysis</td>
</tr>
<tr>
<td>To develop a POE sustainability assessment framework for retrofitting commercial buildings.</td>
<td>Categories of assessment indicators and their weighting coefficient</td>
<td>Quantitative and Qualitative data</td>
<td>AHP</td>
</tr>
</tbody>
</table>
4. Conclusion

To achieve sustainability objectives in buildings, a coherent strategy and action plan is needed to address occupants expectations and needs in existing buildings. This highly fragmented and important issue must be aligned for action in a timely manner or objectives will be at risk. The creation and adoption of a Post occupancy evaluation sustainability assessment framework that incorporates occupants, such as the one described and demonstrated here, with escalating mandatory performance levels would help to drive improvement in existing commercial building stock. Such an approach would be used to rate existing commercial buildings, galvanize stakeholders around a common framework, and provide long-term visibility in the marketplace. A retrofit-rating scheme must be integrated with existing building regulations, planning mechanisms, incentive programs, and assessment requirements such as energy performance certificates. Third-party assessment and achievement of minimum requirements should be mandated at key trigger points, such as sale, lease, extension, major renovation or conversion. Because there is not enough empirical information regarding the value of buildings, this study was centered on development strategies and expectations. Given the properties of the qualitative and quantitative research, it must be acknowledged that the results of this research will be more clarifying than conclusive and imply paths for future research studies regarding sustainability.

5. Acknowledgement

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6. References


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