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Sustainability analysis of housing developments through the Brazilian environmental rating system Selo Casa Azul

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ABSTRACT

The building sector has a significant environmental impact and environmental rating systems could to indicate some guidelines for achieving sustainable developments. There are several systems, but the certifications in general are adjusted to peculiar conditions of developer country. The Brazilian bank Caixa Econômica Federal created and is responsible to assign the Selo Casa Azul ("Blue House Seal"). This certification apparently is the most applicable to Brazilian conditions. However, there are few studies about the procedures for analysis of housing projects. The aim of this study is to analyse the adequacy of typical housing developments with respect to Selo Casa Azul criteria by verifying existing facilities and considering the limitations of real projects. This research analyses 13 developments certified by the bank and seven new projects in Caxias do Sul, a city in southern Brazil. As a result, we found that the Selo Casa Azul constitutes a viable tool, demonstrating the relative ease of application. We verify that some criteria were not present in any of these projects and that alignment with Selo's criteria depends on a company's strategy, no matter the economic standard of its buildings. Lastly, we observe that most actions needed to reach unsatisfied criteria may be solved in the design stage, and these modifications do not require large investments. This study aims to contribute to the discussion about sustainable construction in Brazil.

1. Introduction

The construction industry has significant importance in the global economy. However, it is characterised as one of the activities that generates large environmental impacts (Du Plessis, 2002; European Comission, 2013; Kibert, 2016). There are several challenges for reaching sustainability in this sector, but it is essential to adopt a new attitude in the industry. In this context, the social, economic, and environmental performance of buildings can be supported by analysis through environmental certifications, which can guide design options, even if the goal may not be the certification itself. So, certification systems and environmental assessment can help reduce the impacts of the construction sector (John & Prado, 2010; Reed, Bilos, Wilkinson, & Schulte, 2009).

A certification is granted from an evaluation system that analyses the degree of sustainability according to specific criteria. The certification model depends on each country and its needs. A general advantage of the evaluation tools is to provide guidance to entrepreneurs, designers, and builders in the design and the production of sustainable buildings. USA, Canada, some Asians and Europeans countries have created certification of buildings, based on own criteria and performance indicators that evaluate, among others, energy consumption and environmental impact. These systems are designed to encourage the market demand for higher levels of environmental performance. They are based on systemic environmental assessment looking for the applicability of the systems worldwide. Apart from those elements, there are large influences of environmental character problems of each region in the use of these systems. Contextual circumstances that resulted in the creation of these systems vary, as well as the intended application, from tools to support design to post-occupancy evaluation tools. The majority of systems are best suited to the evaluation of new buildings or projects, working on the potential performance plan. There are some systems aimed at the use stage or to refurbished buildings. Environmental certification can follow several models, depending on each country and its needs. The main international processes of environmental certification are BEPAC (Canada), BREEAM (UK), CASBEE (Japan), GBL (China), Green Star (Australia), HQE (France), HK-BEAM plus (Hong Kong), ITACA (Italy), and LEED

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(USA) (Asdrubali, Baldinelli, Bianchi, & Sambuco, 2015; Chen, Yang, & Lu, 2015; Horvat & Fazio, 2005; Li, Ng, & Skitmore, 2017; Reed et al., 2009; Silva, 2003; USGBC, 2013; Ye, Cheng, Wang, Lin, & Ren, 2013).

However, these systems typically are adjusted to peculiar conditions of developer country and not always allows an adequate evaluation in other places. Indeed, some authors indicate the need to adjust to the conditions of each country (Alyami, Rezgui, & Kwan, 2013; Gou & Lau, 2014; Horvat & Fazio, 2005; Li and Nan, 2014; Reed et al., 2009; Silva, 2015).

Reed et al. (2009) highlight the differences among some rating systems, such as the LEED method, which is awarded to those ranked at the top of the BREEAM certification when applied to UK buildings. These authors maintain that direct comparisons should not be made because each certification adopts different approaches, considering the characteristics of each country.

In Brazil, the environmental certifications LEED, BREEAM, Aqua, Procel Edifica, and Selo Casa Azul are available (Asdrubali et al., 2015; John & Prado, 2010; Reed et al., 2009; Silva, 2003, 2007). LEED is a very known and largely used system around the world, and the same occurs on Brazil. In 2007, it was created the Green Building Council Brazil (GBCBrasil), whose objective was to be a reference in the evaluation and certification of sustainable buildings in Brazil, through regionalization of LEED assessment tools. The adaptations process was relatively successful, remaining some problems (Grünberg, Medeiros, & Tavares, 2014; Magnani, 2011; Silva, 2015). In recent years, the Brazilian state bank Caixa Econômica Federal has promoted a new environmental rating system, the Selo Casa Azul ("Blue House Seal"), which apparently is most applicable to Brazilian conditions (John & Prado, 2010). However, there are a few studies about the procedures for analysis of housing projects. The aim of this study is to analyse the adequacy of housing developments with respect to Selo Casa Azul criteria by verifying existing facilities and considering the limitations of real projects.

1.1. Some certifications available around the world

Some studies about sustainable construction in view of local conditions were developed in developing countries, such is Brazil. Ali and Al Nsairat (2009) studied Jordanian reality, investigating international green building assessment tools such as LEED, CASBEE, BREEAM, and GBTool. They propose a new assessment items respecting the local conditions of Jordan and discussed them with 60 stakeholders, most of them were experts on sustainable development. After selecting the assessment items, they were weighted. The outcome of the research was a suggested green building assessment tool (SABA Green Building Rating System), a computer based program that suits the Jordanian context in terms of environmental, social, and economical perspectives.

Azhar, Carlton, Olsen, and Ahmad (2011), indicates the most important decisions regarding a building's sustainable features are made during the design and preconstruction stages. To them, LEED is the most widely adopted sustainable building rating system in the United States. For projects pursuing LEED certification, designers must conduct in-depth sustainability analyses based on a building's form, materials, context, and mechanical–electrical–plumbing (MEP) systems. Since Building Information Modelling (BIM) allows for multidisciplinary information to be overlapped within one model, it creates an opportunity to conduct these analyses accurately and efficiently as compared to the traditional methods. The results of this study indicate that documentation supporting LEED credits may be directly or indirectly prepared using the results of BIM-based sustainability analyses software. This process could streamline the LEED certification process and save substantial time and resources which would otherwise be required using traditional methods.

Bendewald and Zhai (2013) argue the evaluation of sustainability of a building needs an objective assessment. They presented a computational model measuring carbon embodied in the building to obtain that kind of evaluation. They used the amount of carbon stored on the building site in its native state, land use change, carbon emissions in construction and operation. After this view, a building is sustainable if carbon emissions are completely offset in life cycle.

Gou, Prasad, and Lau (2013) studied user perception and satisfaction about sustainable buildings, evaluating green buildings in China. They suggest that green building users presents some degree of forgiveness in the relationship with their buildings. In other words, users are more tolerant in their judgment about the green characteristics.

After Zuo and Zhao (2014), some common themes are the definition and scope of green building; quantification of benefits of green buildings compared to conventional buildings; and various approaches to achieve green buildings. They found that the existing studies played predominately focus on the environmental aspect of green building. Other dimensions of sustainability of green building, especially the social sustainability is largely overlooked. Future research opportunities were identified such as effects of climatic conditions on the effectiveness of green building assessment tools, validation of real performance of green buildings, unique demands of specific population, and future proofing.

Darko and Chan (2016) review some green building papers, in the period of 1990–2015. They found that during the studied period, researchers from developed economies such as the US, Hong Kong, the UK, Singapore, Italy, and Australia, contributed most of green building research. Developing countries, such as China, Egypt, and Colombia also made good efforts of research. Research topics covered tend to focus on project delivery and developments, certifications, energy performance, and advanced technologies.

After the studies presented, one can observe that LEED is known and used around the world. However, there are some criticisms about LEED, besides the need to adjust to local conditions. After Zimmerman and Kibert (2007), LEED is a too general assessment tool which could be used to evaluate very different buildings, including small to large residential or office buildings, with few influence of economic, social or and climatic conditions of actual site in the final evaluation. Those authors recognise that some specific conditions were added in new versions, such as LEED Healthcare and LEED Retail, but even so they think LEED under evaluate specific local conditions. In other view, Chance (2012) argues that LEED creates new costs to candidate buildings and there is small incentive to improve building performance.

1.2. Selo Casa Azul

According to Silva (2007), the majority of certification schemes emphasise the environmental dimension of sustainability, and to particular conditions of developer country. Social and economic aspects, however, also constitute important factors, especially in developing countries such as Brazil. To consider those conditions, a new seal was created in Brazil, promoted by federal bank Caixa Econômica Federal. This bank is the main institution for financing social housing in the country as well as promoting the implementation of social practices. The certification is the Selo Casa Azul (SCA - Blue House Seal), which is awarded by Caixa only to projects financed by itself. The manual and a general explanation of SCA was presented in John and Prado (2010).

The method of the Selo Casa Azul consists of verifying the fulfilment of 53 criteria, categorised into mandatory and free