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Leadership in Energy and Environmental Design (LEED) and its impact on building operational expenditures

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Abstract

Ever-changing needs in the built environment create new incentives for enhancements in the process of building design. Increasing prices of building operations and utilities have a profound impact on the conceptual design and implementation of sustainable architecture. Green building certifications have been initially implemented as a tool for creating more sustainable buildings. However, the real impact of green certification systems on building operations remains unclear. This article focuses mainly on water and energy consumption assessment of LEED certified buildings and to what degree certification systems achieve cost savings in building operations when implemented during the design and construction process. The method of estimating these effects is based on hard costs and soft costs linked not only to the certification cost itself but also on the economic impact of the construction costs designated for achieving the required certification level. Furthermore, the building projects investigated, have been selected according to a specific paradigm in order to include buildings with a different type of operation. Each selected building has been holistically differentiated and assessed according to its performance in the following categories: water usage and energy efficiency. The aim of this paper is to objectively assess buildings that were certified under the LEED certification system and to determine the financial effectiveness of the invested resources in the construction process in relation to the operational and environmental benefits. Moreover, the research is focused on determining the operational costs at a point in time. Because of this, a relevant discount factor has been determined and applied for the life cycle assessment of each researched project. The outcome of this paper is an objective assessment of six LEED certified buildings based on water and energy consumption compared to a reference buildings.

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1. Introduction

The building industry is continuously facing economical, technological and social challenges. The recent financial crisis caused changes in overall perception of building projects' design and construction. Almost every stakeholder within the construction process is seeking to make savings and reduce costs. Building contractors are being forced to reduce their bidding cost in order to maintain their competitiveness, whereas project owners are experiencing difficulties in renting their assets to tenants who are looking for buildings with low operational costs and rent.

However, the financial crisis is not just the only reason for inevitable changes in the traditional conception of property development (Yudelson, 2008). Other strong incentives for enhancing the process of building construction are linked with the operational costs such as utilities, cleaning, security and rent. The scarcity of natural resources is placing pressure on the cost of both utilities and construction. Furthermore, it can be predicted that there will not be any decrease to the cost of utilities in the near future (Zuo & Zhao, 2014). Buildings must become more energy independent and resilient in the surrounding environment, which is very sensitive to political, environmental or economical impulses (Macek, 2011). Building users are often more interested in the overall performance of the building and increasingly are asking questions such as; "How much do I have to pay for utilities? How effective will my employees be while working inside? How long will the building retain its value?"

There is strong pressure on the implementation of sustainable development or the development of green buildings within the built environment. However, there is no official definition of what constitutes a "green building". EPA (Suh, Tomar, Leighton & Kneifel, 2014) defines green building as: *"a practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building"*. The term "green building" places emphasis on creating sustainable buildings and does not give a concrete construction description (Tywoniak, 2012).

In order to more clearly measure and emphasize building performance in terms of sustainability and green building techniques it is necessary to investigate not only materials and energy performance, but also location, indoor environment quality, management process or innovation enhanced by the development process.

Complex assessment tools and certification systems are focusing on measuring buildings from different points of view in order to provide information about a buildings' performance in terms of their location, energy efficiency, usage of potable water, used materials and the quality of the indoor environment. A third party, who is delegated for supervising the assessment process, verifies the final measurements.

2. Certification Systems

Certification systems have become more popular for complex building assessment and promoting aspects of sustainability and green building all over the world. This article focuses on assessing six real buildings using the same certification system, in this case, LEED (Leadership in Energy and Environmental Design). Nevertheless, it is vital to also mention other main players within the green certification business (Cole & Valdebenito, 2013). Those are:

- BREEAM (Building Research Establishment Environmental Assessment Method). Founded in the United Kingdoms. Used mostly in Europe.
- DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen). Founded in Deutschland.
- LEED was founded in the United States and it has spread over the whole world.

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