

Environmental Certification as an Incentive for Sustainable Civil Construction.

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Abstract. The current emphasis on sustainable development has given rise to an emerging paradigm in the field of civil engineering, known as "Sustainable Construction." This new approach to the design and construction of buildings primarily seeks to reduce the impacts associated with energy consumption, utilization of natural resources, waste generation, and other related factors. Moreover, this movement has sparked significant debates regarding methodologies for the conception, implementation, and operation of buildings. This study aims to explore and conceptualize sustainability from three fundamental perspectives: environmental, economic, and social. Furthermore, it emphasizes the relevance of environmental certifications, with special attention to the certification system known as LEED (Leadership in Energy and Environmental Design). LEED is an assessment tool that plays a crucial role in identifying, implementing, and evaluating sustainable practices in buildings, contributing to the promotion of ecologically responsible and socially beneficial constructions. A methodological approach focusing on a literature review relevant to the field of sustainable construction has been adopted. This approach involved a meticulous process of source identification and acquisition, encompassing scientific articles, literary works, technical reports, and other pertinent contributions through exploration of academic databases and digital library resources. Once a careful selection of sources was completed, the subsequent phase comprised a critical analysis of each of the identified articles and documents. During this phase, the prominent principles, findings, and trends related to the domain of sustainable construction were highlighted, recognizing environmental certification as a pivotal factor in encouraging stakeholders in the global construction industry.

Keywords. Sustainability, Leed Certification, Sustainable construction, Environmental certifications.

1. Introduction

The construction industry solidifies itself as a driving force of global development, playing a decisive role in shaping the contemporary socio-economic landscape. However, this demand intricately linked to growth also presents complex challenges, particularly concerning sustainability. As awareness of environmental impacts expands, there arises a vital need to adopt more responsible construction practices for the surrounding environment.

The coefficients of concern [1] assert that the realm of building construction consumes up to 75% of nature's extracted resources, exacerbated by the fact

that a significant portion of these resources is non-renewable. The same chain previously mentioned establishes itself as responsible for consuming 14% to 50% of the planet's extracted natural resources [2].

Given the environmental effects stemming from the inappropriate utilization of natural resources within the construction industry, the need for environmental management is gaining momentum. Such a measure proves to be a fundamental mechanism to mitigate the adverse consequences arising from this industrial sphere while encouraging the adoption of socially responsible practices. Furthermore, this approach aims to prioritize the health of workers and promote the

establishment of public policies aligned with these objectives [3].

The demand [4] for assessing sustainable constructions has spurred the development of methodologies aimed at evaluating the environmental performance of these buildings. These analytical frameworks, through the delineation of pre-established criteria and sub-criteria, confer a categorization upon construction projects. Moreover, these approaches provide substantial support to engineers, architects, and designers, enabling the conception of buildings aligned with sustainability principles.

That being said, this article's primary objective will be to define the concepts of sustainability related to construction, subsequently addressing the environmental certification known as the LEED Seal as an incentive for ecological management in the construction industry. Lastly, the importance of promoting such a theme for the development of the social, environmental, and economic aspects will be highlighted.

2. Methodology

To advance this study, a comprehensive literature review related to the topic of sustainable construction was chosen. The approach entailed a meticulous search for scientific articles, books, technical reports, and other relevant sources in academic databases and virtual libraries. Following the selection of sources, a critical reading and detailed analysis of each identified article and text were conducted. During this stage, the key concepts, findings, and emerging trends related to sustainable construction were highlighted, as well as the methods and tools used to assess its environmental impact and promote more responsible practices.

This literature review proved to be essential in establishing a solid theoretical foundation for the present study, enabling the contextualization of the current landscape of sustainable construction, understanding of the adopted approaches, and the identification of research gaps or opportunities.

3. Results

3.1 Definitions

In the year 1987, the World Commission on Environment and Development (UNCED) formulated the first definition of sustainable development in the Brundtland Report. In this document, the presented approach articulates sustainable development as a paradigm that aims for the fulfillment of current needs while not depleting the ability of future generations to meet their own demands.

In 1999, the International Council for Research and Innovation in Building and Construction (CIB) [5] introduced the Sectoral Agenda for Sustainable Construction (CIB Agenda 21 for Sustainable Construction) [6]. This initiative aligns closely with the guidelines advocated by the Brundtland Report [7], Agenda 21, the Habitat II Conference [8], and the Kyoto Protocol [9], with the objective of harmonizing construction practices with the sustainable principles outlined by these reference frameworks.

In the year 1994, John Elkington, one of the founders of the international non-governmental organization SustainAbility, formulated the widely recognized concept known as the "Triple Bottom Line" [10]. This concept delineates a balance between elements that are both socially desirable and economically viable while adhering to criteria of ecological sustainability.

Tab. 1 - Triple Bottom Line

Theme	Description
Social	Improve life quality.
Economic	Improve financial life.
Environmental	Improve the way of life..

Thus, there is a necessary triad [11] for achieving sustainable development, composed of:



Fig. 1 - Triple Bottom Line [12]

One of the notable achievements of sustainable development lies in its capacity as a comprehensive commitment among different stakeholder groups. These groups encompass those whose primary focus is on environmental and natural issues, advocates of economic progress, and those dedicated to improving human conditions [13].

3.2 Importance of environmental

certifications

When consensus emerged among researchers and governmental bodies regarding the effectiveness of performance classification through ratings, a crucial milestone was established. In this context, the fundamental importance of voluntary participation in performance assessment mechanisms stands out as a driving force capable of raising the standard of pre-existing environmental practices [14].

3.3 Leed Certification

The Leadership in Energy and Environmental Design (LEED) seal [15], conceived and refined by the United States Green Building Council (USGBC) [16] in 1998, stands as one of the internationally recognized certifications, encompassing approximately 160 nations. In accordance with Mahesh Ramanujam (2016), President and CEO of USGBC, LEED is part of a global initiative aimed at mitigating climate change [17]. In this context, LEED, alongside the ecologically conscious construction sector, establishes a path for transforming the market while simultaneously encouraging a rethinking of the approach involved in the planning, construction, maintenance, and operation of buildings, communities, and cities.

Regarding the certification, there is a ranking where it is possible to achieve four different types of certification (Figure 2), namely certified, silver, gold, or platinum, based on the score obtained by the building during the project evaluation and building analysis by experts. Nine factors are taken into account in the building evaluation (Figure 3), including integrative process, location and transportation, sustainable sites, energy and atmosphere, materials and resources, indoor environmental quality, water efficiency, regional priority credits, and innovation.

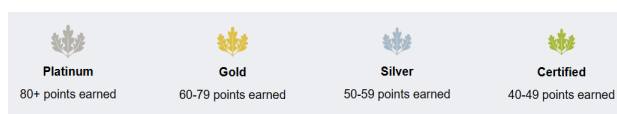


Fig. 2 - Certification levels - USGBC

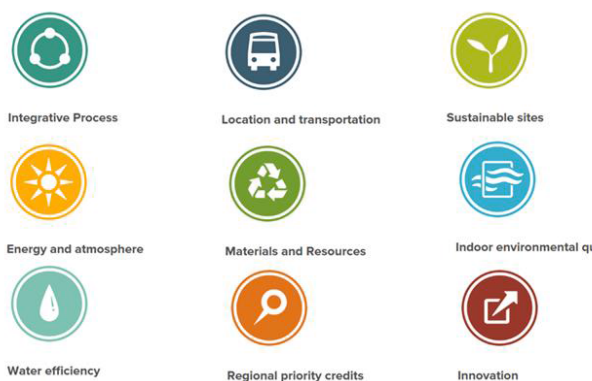


Fig. 3 - Evaluated categories - USGBC

Examining the relevance of the previously mentioned evaluation criteria, other entities have stood out, such as the Brazilian Association of Architecture Firms (AsBEA) [18] and the Brazilian Council for Sustainable Construction (CBCS) [19], as well as other relevant institutions, which propose a series of fundamental principles converging in the field of sustainable construction. Among these principles, the following are listed: the utilization of local natural conditions, minimal land use in conjunction with integration into the natural environment, implementation and analysis of the surroundings, the avoidance of impacts on the surroundings such as landscaping, temperature, heat concentration, and a sense of well-being, both internal and external environmental quality, sustainable management of the construction process, adaptation to the current and future needs of users, the use of raw materials contributing to eco-efficiency, reduced energy consumption, reduced water consumption, proper reuse and recycling of solid waste, the introduction of technological innovations whenever possible and viable, and finally, environmental education for those involved in the process.

A study published by the Hong Kong Polytechnic University, titled "A Guide for Minimizing Construction and Demolition Waste at the Design Stage" [20], provides a foundation for the importance of waste management in the design phase of construction projects. This study promotes concepts aimed at waste minimization that encompass not only the execution phase at the construction site but also the project's design phase. In this regard, the significance of project design in maximizing building durability is emphasized through the careful specification of appropriate materials and the minimization of input losses often associated with design deficiencies. Furthermore, it is highlighted that the selection of the appropriate construction method also plays a crucial role in waste reduction. Consequently, waste reduction implies a significant decrease in energy consumption, which was previously expended in the production of inputs and materials, contributing substantially to the promotion of more sustainable practices in the construction industry.

4. Conclusion

The construction industry, as a vital sector of the global economy, plays a prominent role on the international stage. Recent statistical data attest to its significant contribution to the Gross Domestic Product (GDP) of various countries, representing a substantial portion of global economic activity.

Furthermore, this sector is a significant job generator, promoting social inclusion and community development on a global scale. However, this economic significance has been accompanied by considerable neglect regarding environmental sustainability and the associated impact of construction. The sector faces considerable challenges, with a disproportionate consumption of non-renewable natural resources and significant waste production and greenhouse gas emissions. Such unsustainable practices not only threaten ecosystems and biodiversity but also compromise the ability of future generations to meet their own needs, as defined by the World Commission on Environment and Development in 1987 [21].

In this context, the need for a profound and comprehensive transformation in the global construction industry becomes relevant. The transition to more sustainable practices is not only morally necessary but also aligns with the environmental and economic imperatives of the 21st century. The adoption of more energy-efficient construction techniques, the reduction of material waste, the promotion of certified sustainable buildings, and the implementation of effective environmental management systems are critical measures that can minimize the negative impacts of construction on the environment. Additionally, this transition can drive innovation, create jobs, and contribute to a more resilient economy. The construction industry must therefore assume its global responsibility and actively work to integrate sustainability in all its facets, ensuring that its activities are compatible with an environmentally healthy and socially equitable future.

In light of the above, it is evident that environmental certifications focused on the construction industry fill a gap in incentivizing developers and builders in the field. The LEED certification, in turn, falls under the category of a "consensus-based, market-driven performance rating system designed to accelerate the development and implementation of environmentally responsible design and construction practices" [22].

In conclusion, the primary function of certification is to raise awareness among both the general community and companies operating in the sector, with the purpose of drawing attention to the imperative of adopting a sustainability-driven systemic approach throughout all phases of the construction cycle. Despite the potential increase in costs associated with sustainable construction practices compared to conventional construction, this approach encompasses significant medium and long-term benefits. These benefits are not limited

solely to building occupants but extend to the entire community.

Finally, the incorporation of environmental strategies can trigger competitive advantages in the business context. This adoption may initially imply an increase in initial costs; however, it offers the opportunity for a substantial reduction in associated operational costs, which, in turn, constitutes an effective way to enhance real estate assets' value and potentially add value to their sale transactions [23].

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