

LEED BD + C and Sustainable Development



Sustainable Buildings and the LEED BD + C Certification

Cláudia de Assunção,
Micheli Kowalczyk Machado and
Estevão Brasil Ruas Vernalha
Núcleo de Estudos em Sustentabilidade e
Cultura – NESC/CEPE, Centro Universitário
UNIFAAT, Atibaia, São Paulo, Brazil

Definition

The adverse effects resulting from environmental problems and increased public environmental awareness have fostered the development of creative solutions to reduce the environmental impacts of construction. In this context, several assessment tools are being developed worldwide to provide an effective framework for measuring the construction process environmental performance (Amasuomo et al. 2017). Among them, the Leadership in Energy and Environmental Design (LEED) certification, in particular its certification for new buildings and major reforms: LEED BD + C, which can be used as an instrument to promote sustainability considering the role of construction in this process.

Introduction

Nowadays, there is a growing emphasis on the importance of preserving the environment, in order to influence the nature protection and make rational use of natural resources. The considerations presented in this study show how the use of environmental certifications for buildings has been growing in Brazil and how they contribute to minimize the environmental impacts caused by construction activities, in particular the construction of new buildings and major remodelings.

Environmental certifications such as Leadership in Energy and Environmental Design (LEED), in particular its certification for new buildings and major reforms: LEED BD + C, are used to define criteria and scores in order to categorize works on a scale of sustainable construction assessment. Thus, it can be said that the use of environmental certification tools results in construction activities which are less and less impacting on the environment, in order to contribute to the reduction of waste emissions, to the reduction of the exploitation of nonrenewable natural raw materials, and to social inclusion.

In Brazil, civil construction is growing more, and as a consequence, there is an increase in waste generation, informality in activities, and degradation to the environment. In this context, it is crucial to define sustainable practices for the sector and to disseminate building assessment tools, highlighting the growing discussion about the

rational use of the resources available in nature (Afonso et al. 2014).

Dissemination and extension of sustainable practices related to sustainable construction and LEED DB + C certification are related to the training of professionals who can work in this area. Thus, it should be noted that higher education institutions (HEIs) play a fundamental role in this process. According to Casagrande and Deeke (2009), to serve as an example for society, the concern of HEIs with sustainability must reflect in their physical infrastructure, administration, pedagogical line, and research and extension projects.

Kraemer (2004, p.8) strengthens this vision, mentioning that:

Challenge of sustainable development sees university as a specially equipped agent to lead the way, because its mission is to teach and train future decision-makers or citizens who are better able to make decisions; because it is rich and extensive its experience in interdisciplinary research; and because its fundamental nature as the motor of knowledge gives the university an essential role in a world whose borders dissolve every day.

In this sense, this entry presents the results of a research project entitled “Sustainable Construction: a Study in the Bragantina Region - SP,” developed at UNIFAAT University Center, located in the city of Atibaia, São Paulo, Brazil. In this HEI, there is a research center called CEPE – Center for Studies, Research and Extension – whose main objective is to foster research activities of the institution’s teachers and students, as well as to accompany and support extension activities involving students, teachers, and the community. Its mission is defined as the feasibility and coordination of research, academic extension, and socio-environmental responsibility of UNIFAAT.

This research is linked to the Nucleus for Sustainability and Culture Studies, belonging to CEPE, and aims to investigate the role of LEED certification for sustainability, with emphasis on LEED BD + C, using as an example the situation of Brazil and the state of São regarding this type of certification. In this way, we seek to collaborate

with the extension of the teaching-learning process and higher education student formation.

Sustainability and LEED BD + C Certification

The discussion about sustainable development has already come a long time, since in its various dimensions, the theme has been approached under different aspects and connotations (Amato Neto 2011). In this sense, it is worth highlighting one of the historical milestones related to this theme, the Brundtland Report, published in 1987 by the World Commission on Environment and Development (WCED), which defined sustainable development as “the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (CMMAD 1991, p. 46).

In general terms, the definition of sustainable development is based on the pursuit for conscious use of natural resources, in order to preserve the environment and prevent social inequalities (Borges 2008). Although this concept has assumed a prominent role in society in the last decades, many analyses and discussions have developed around its contradictions. It aims to conserve the environment for the survival of humanity under a preventive vision, but does not maintain a clear position regarding the capitalist development model based on high consumption standards, which determine the relationship between human being and nature nowadays (Machado 2009).

For Leff (2006, p.86), this capitalist model is based on an economic rationality characterized by “the misfit between the forms and rhythms of extraction, exploitation and transformation of natural resources and ecological conditions for their conservation, regeneration and sustainable use.”

In this context, it is observed that the search for sustainable development faces great challenges, among them, the difficult convergence of the economic growth, overcome of poverty, and attention to environmental limits. The concept of sustainable development has fueled many proposals that point to new market tools as a solution to combine

production and the capacity to support natural resources. However, it is necessary to consider whether these mechanisms are capable of reorienting the logic of the consumer society, effectively contributing to the conservation of the environment (Scotto et al. 2007).

Borges (2008, p.440) draws attention to the popularization of the sustainable development concept. For the author, “Trivialize the expression sustainable development is the most effective way to prevent the growth of this proposal and its capacity for real change.” Keeping distance from inadequate examples regarding the pursuit for sustainability is a fundamental role of the social actors involved in this proposal of vital change to the planet. In this perspective, the critical thinking and content evaluation must always be more important than well-designed labels (Borges 2008).

In the face of the development and historical improvement of issues related to the sustainable development concept, in 2015, the new Agenda 2030 was published, listing the goals for transforming the planet from sustainability. There are 17 objectives and 169 goals. Agenda 2030 creation was based on the principles of the Charter of the United Nations and on the International Declaration of Human Rights, international human rights treaties, the Millennium Declaration, and the 2005 World Summit Outcome document. From a very ambitious point of view, the UN demands integrated solutions between the nations and between the great conferences and summits to dedicate actions toward the objectives (United Nations 2015).

In order to reach sustainable development, according to Agenda 2030, it is crucial that the Global Partnership addresses the three spheres, social, economic, and environmental, in an integrated and balanced way to achieve the objectives set (United Nations 2015).

John (2008) reinforces this view by mentioning that the development of humanity over the last 250 years has resulted in the worsening of negative impacts on the planet. Considering also that about 45% of the population is poor and that more than 1 billion people live in extreme poverty resulting from poor income distribution and

voracious consumption habits, the great challenge of sustainable development is to meet balance between the three sustainability aspects: environmental protection, social justice, and economic viability.

Among the commitments of Agenda 2030 is the preservation of the planet. As the devastation of natural resources and degradation to the environment are challenges to sustainable development, attention must be paid to the minimization of negative shocks on the environment. Once the objectives of Agenda 2030 are the protection, recovery, and promotion of the sustainable use of terrestrial ecosystems, sustainable construction plays a fundamental role in achieving these objectives. If on the one hand it is an activity that generates great environmental impacts, if it is worked from a sustainable perspective, it can provide alternatives that enable the environmental conservation and guarantee the quality of life for the populations.

Civil construction makes great use of natural resources, and over the years, with the increase in population and economic development, there is a consequent increase in the demand for built-up areas. According to Afonso et al. (2014), civil construction is today one of the most important sectors of the Brazilian economy, and its growth brings with it a whole chain of companies linked to the production of inputs and services. Consequently, its macrosector is responsible for a great consumption of materials, emission of gases, and use of energy and water.

Once it is impossible to exclude impacts to the environment through construction, by the exploitation of natural resources, generation of waste, segregation of the most needy classes, and influence on climate change, among others, there is a need to explore, discuss, and reflect on related issues in order to expand knowledge that minimizes such impacts.

Since construction activities are responsible for the greatest impact on the environment, investments have been intensified in the last decades in order to find alternatives that indicate practices that minimize the environmental degradation that the sector provides, from new buildings to renovations and demolitions. In several countries,

public policy applications encourage studies applied to develop actions to reduce the use of nonrenewable resources, energy savings, and reduction of construction waste (Silva et al. 2003).

A technical solution for assessing environmental impacts is to use tools to diagnose, compare, and monitor changes in the environment over time in order to clarify and parameterize the information regarding the consequences of civil construction to the environment (Silva 2007).

According to Agopyan and John (2011), in the long run, the generation of waste in construction is 2 to 5 times higher than the products consumed. To contribute to the achievement of the goals set by Agenda 2030 for sustainable development, certifications such as Leadership in Energy and Environmental Design (LEED), which is an international system of environmental certification and guidance for buildings, are applied with the objective of protecting the planet from degradation and contributing to dematerialization (build using less materials) of the buildings.

According to Motta and Aguilar (2009), when analyzing sustainable development, considering the concern with environmental quality, historically it is possible to observe that the environmental problem is not recent and that the growth of consumption has implied in a greater exploitation of natural resources. Associating sustainability to the built environment, it is verified that the consumption of energy in the construction industry is responsible for more than 50% of the use of the planet's energy sources. For John (2008), in relation to resources extracted from nature, it is stated that about 40% to 75% are used in civil construction.

Since resources are limited and many of the impacts negatively affect the quality of life of all living beings, in search of improvements in the quality of life of society, there are currently studies that expand the options that enable sustainable constructions that meet the requirements proposed in standards, laws, and certifications in the construction area.

The improvement of civil constructions is closely linked to human development. Thus, conservation of the environment through sustainable construction is extremely important, not only for

the present society but also for future generations. In this context, sustainable constructions can reduce the impacts caused to the environment, generate social and economic benefits, and enable the rapprochement of the human being with nature (Afonso et al. 2014).

Soares et al. (2006, p.97) mention that:

The construction industry has a significant impact on a nation's economy. Therefore, small changes in the different phases of the construction process can promote, besides important changes in the environmental efficiency and reduction of the operational expenses of a work, greater incentive to investments in the sector. In this market of increasing competitiveness and submitted to control instruments (legislation and standards) and continuous improvement, the choice of building materials represents an important field of environmentally responsible engineering.

Industrialization has caused accelerated economic development. As a consequence, the actions of destruction to the environment were accentuated. From the 1990s, in Europe, methodologies for the environmental evaluation of buildings were developed, and, considering local characteristics, parameters were elaborated to analyze the life cycle of buildings. These parameters were used for the orientation of the designers, for possible interventions in the construction and foundation for certification requirements (Silva et al. 2003).

These parameters are fundamental in view of the impossibility of constructing environments without impacts. Thus, there are some challenges to be faced: to search for more knowledge and to develop methods and tools to help reduce many of these impacts, as well as to enhance social and economic benefits (John 2008).

For Motta and Aguilar (2009, p. 99), "In construction, sustainability is being inserted as a requirement for an environmental or green certification tool, such as LEED or AQUA. Green certifications play an important role in changing construction practices and are directly related to management aspects of the project."

According to Silva et al. (2003), in Europe, each country has methods of evaluating buildings, in addition to the United States, Canada, Australia, Japan, and Hong Kong, in which evaluation tools can be divided into two categories:

(a) market-oriented methods with simpler structures, such as LEED certifications, and (b) evaluation methods aimed at scientific research, such as the Green Building Challenge (GBC).

Among the various tools that help to monitor environmental actions, LEED certification is expanding its reach, with application in more than 160 countries. Environmental certification tools such as LEED help to verify the use of each practice and are directly related to project management, contributing to strategic planning for a more sustainable construction (Motta and Aguiar 2009).

LEED certification started its activities in 1996, and its pilot version was released in early 1999 in order to define concepts of practices for environmentally responsible construction. In the 2000s, a new LEED 2.0 version was released with updates to a method that consists of a list of prerequisites to reduce the negative impacts of construction on nature (Silva et al. 2003).

LEED is a certification system that aims to disseminate sustainable practices in construction and minimize the environmental impacts of the sector. It includes the following types: LEED BD + C, new construction and major renovations; LEED ID + C, commercial offices and retail stores; LEED O + M, existing enterprises; and LEED ND, neighborhoods and LEED for homes (USBC 2017).

In each typology, eight areas are considered for analysis and classification within the certification. They are location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation, and regional credit priority. Each analysis provides a score, which through the fulfillment of the prerequisites of each area accumulates credits that will indicate the qualification for certification, being the minimum score 40 points and maximum 110 points. It has four levels: certified, silver, gold, and platinum (Fig. 1). For projects and construction of new buildings, LEED BD + C proposes sustainable building practices in order to achieve harmony between natural and built environments (GBC Brasil 2018).

According to Silva et al. (2003), LEED evaluations consider the construction practices of each country, city, and state, aligning the methodology with local cultural traditions.

As announced by GBC Brasil (2018), the LEED BD + C certification, as well as new construction and large reforms, embraces other sectors such as schools, core and shell development, retail stores, warehouses and distribution centers, data centers, hospitality, and healthcare.

The use of the tool has been growing around the world and expanding the history of certified buildings, which results in a data collection that helps in simplifying the information according to each region of each country. The continuous use of the evaluations incorporates the database, creating references that help in the creation of goals applicable to positive practices to the sustainable construction (Silva 2007).

According to data from GBC Brasil (2018), every day about 158,000 square meters is certified in the world. In this ranking, Brazil is among the five with the highest number of projects registered and certified. This characteristic shows that the country is in a growing process of awareness regarding sustainable constructions.

In the country, the green building certification began to be promoted in 2007, when the Brazilian Sustainable Construction Council (CBCS) was created. In order to start the activities for the acquisition of LEED seals in the country, the Green Building Council Brazil (GBCB) (Agopyan and John 2011) was set up.

The projects that used the tool have already shown results. According to GBC Brasil, certification contributes to reductions in water and energy consumption, reduction in CO₂ emissions, and generation of waste (Fig. 2) (GBC Brasil 2018).

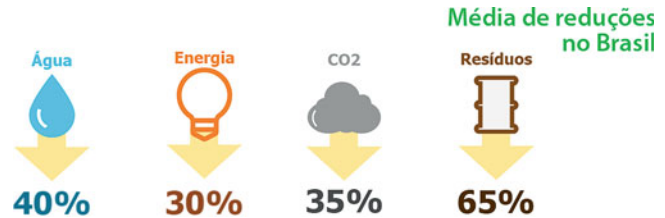
According to a survey on LEED certifications, the practice of sustainable construction generates benefits such as the improvement of housing quality, minimization of environmental impacts, rational use of natural resources, reduction of operational costs, as well as social inclusion and incentive to environmental awareness. After verifying the data of the most used environmental certifications in Brazil, it shows that from 2004



LEED BD + C and Sustainable Development, Fig. 1 Rating levels of LEED. (Source: Reproduced from GBC Brasil 2018)

LEED BD + C and Sustainable Development,

Fig. 2 Average reductions in Brazil from the LEED certification. (Reproduced from: GBC Brasil 2018)



to 2016, 1106 LEED certifications were registered and more than 50% of the certifications are from São Paulo State in which 666 registered until 2017 (GBC Brasil 2018).

According to records released by GBC Brasil (2018), LEED certifications in Brazil are increasing. Specifically related to LEED BD + C certification, there are a growing number of registrations and certifications, mainly for commercial projects. São Paulo is the state with the highest number of both registrations and LEED certifications.

In view of the above, it should be noted that certifications play an important role in the rise of sustainability, by creating parameters aiming at the lowest possible impact of construction activities on the environment (Costa and Moraes 2013) in order to comply with the requirements of the certification used.

The search for more sustainable and environmentally efficient buildings is a reality in Brazil. The motivations for this option can vary from the aim to comply with current environmental legislation to the pursuit for a better positioning in the real estate market and attend the demands of increasingly conscious consumers. The fact is that civil constructions have sought to adapt to this new scenario. “Regardless of the reason, this recent posture has provided a reduction of the environmental impacts that this sector has

historically caused to the environment” (Afonso et al. 2014, p.7).

Camargo et al. (2015) mention that one of the greatest challenges of civil construction is the search for balance in the three pillars of sustainability, which should result in a reduction in environmental impact, corporate social responsibility, and improvements in climatic conditions.

In this sense, Afonso et al. (2014) emphasize that among the benefits guaranteed by sustainable construction, the sustainability pillars are highlighted, guaranteeing savings for owners, investors, and occupants, minimizing environmental and social impacts, and avoiding major construction problems, expropriations, and the need to expand urban infrastructure. Thus, specific environmental certifications for this sector have added even more and have been important tools to the entrepreneur and to society.

As quoted by John (2008), two proceedings can be applied in this context: the dematerialization of the economy and construction and the substitution of natural raw materials for waste, as long as it does not create and/or amplify other negative impacts on nature. According to Coelho (2010), for elaborating sustainable housing projects, it is very important to evaluate the bioclimatic and geographical conditions about the place in which the dwelling will be inserted. In order for the results to be involved in permeable, wooded,

low-cost areas, with water and energy efficiency, it is important to apply techniques to help achieve these results, culminating in better-quality built environments.

In addition to these issues, it should be pointed out that, according to John (2008), in Brazil, the social class division is also marked by the quality of built environments and the poorest inhabit poor-quality buildings. For society's sustainability, the challenge is to increase the built environment, with improvements for the poorest, with the least possible impact. However, to amplify the built environment, there are consequences such as destruction of forests and exploitation of non-renewable resources. The author also emphasizes that in order to overcome the challenge of building with the least possible impact, technologies and means must be created in order to significantly reduce environmental impacts and return social and economic benefits. In the question of the reduction of social and economic inequality, in Brazil, there is still a lot to be done; the sustainability agenda, in the evaluation of buildings, should consider this reality in the country (Silva et al. 2003).

In the world perspective, even with economic growth and development, about 45% of the population is poor. Considering this scenario, it is part of sustainable development to aim to meet social demands (John 2010).

In this context, LEED BD + C certification can and must contribute to social issues, given that current environmental problems are the result of human interaction with the space in which they live, and in this way, the search for sustainability must overcome perspectives which consider only the natural environment.

Final Considerations

Although the economic development of recent years has boosted life quality and expectancy of the population, it also increased the production of consumer goods, which resulted in a strong exploitation of natural resources. Today society

is facing an environmental crisis, with shortage of potable water, desertification of previously forested areas, social inequality, and much precariousness in the conditions of preservation of the environment.

Although the advances in environmental technologies and certifications have intensified, as exemplified by the case of the of São Paulo State mentioned in this study, the scope of techniques that help in the improvement of the built environment is still insufficient considering the great extension of Brazil and also that there is little application of these techniques to popular housing.

Above all, there are so many impacts to the environment through civil construction, such as exploitation of natural resources, deforestation of forested areas, excessive use of water, air pollution, water pollution, and large generation of waste and illegal waste discards, besides poor quality of built-up areas, especially where poor people live; studies on the use of tools that minimize such impacts are expanding, but there is still much to invest in knowledge and reflection on the subject to achieve continuous improvement.

With environmental education, from awareness to responsibility for cultivating a more sustainable environment, and innovative technology applications for improvements to the built-up areas, it will be possible to incorporate more and more environmental responsibility through quality management practices in construction activities.

In Brazil, the use of the LEED BD + C certification demonstrates its importance in reconciling with the objectives of Agenda 2030, which provide parameters for estimating the environmental impacts of civil construction, as well as setting goals and guidelines for the development of new studies in this area.

The increase in the use of environmental certifications in Brazil contributes to minimizing the environmental impacts generated by construction, especially proving the benefits of using sustainable construction proposals. The dissemination and interest in the theme are being established in

the country and stimulating practices that integrate the day-to-day activities, contributing to the preservation and improvement of the quality of the natural and built environment.

Higher education institutions are key elements in this process, insofar as they are responsible, among other factors, for training professionals and citizens committed to the quest for sustainability. Development of research involving teachers and students, as presented in this entry, enables the production and dissemination of knowledge, such as those related to sustainable construction and LEED certification. In this case, it also encourages the use of new technologies that can contribute to a more balanced interaction between humans and the environment.

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