

# Sustainability criteria as a helping tool for developing architectural projects

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**ABSTRACT:** Sustainability criteria can be used by architects for developing more responsible projects in relation to environmental, social, cultural and economical factors. In this paper, global criteria, and international and national references for Brazil were considered. Among several sustainability criteria, the Agenda 21 for Brazil, the LEED® system and the GB Tool from GBC were analyzed and compared in order to identify the concepts that can influence the architects' way of developing their projects in Brazil.

**Keywords:** sustainability criteria, architectural project, Agenda 21, GBTool, LEED®

## 1. INTRODUCTION

Cities and architecture in general and specially the buildings have been one of the sources of the ecological degradation process on the last decades. Now the buildings with sustainable projects are seeing as having an important role in the recuperation and restoration of the environmental process, and with these architects are faced with new challenges needing to follow new guidelines and conditionings for their projects. Searching for guidelines to reach greater sustainability in architectural projects, the importance of the existing criteria of sustainable development in some world-wide accepted documents is seen, in the measure where these delineate the necessary bases for making initial decisions for the project. Some of the main current criteria of sustainability is given by Agenda 21(global and local), Agenda 21 for the sustainable construction – CIB [1], ISO 14000 [2], and, specifically for the architecture, environmental certification systems for buildings.

## 2. SUSTAINABILITY CRITERIA

This paper describes some results of a master degree research carried through in Florianópolis, Brazil, that aimed to answer the question about what can be considered sustainable for the constructions in Florianópolis, south of Brazil?". The concepts involved in sustainability criteria considered as important references such as Agenda 21, ISO 14000, the life cycle analysis concept, the environmental legislation of Brazil and the environmental certification systems for buildings were taken into account. From those were considered Agenda 21 from Brazil, the LEED® system [3] and the GB Tool [4] to establish a comparative degree of criteria presented in each one, with sights to the elaboration of direction lines for

projects in the city of Florianópolis, Brazil. The LEED® system and the GB Tool were chosen because in Brazil there is a lack of certification system, and those two are the ones that are most known in Latin America. The reference for local sustainability was found through the study of the Agenda 21 of the city [5], and the local information was corroborated through interviews with local architects. In this way documents such as Agenda 21 can give global and local concepts of sustainability in social, economical and environmental level.

### 2.1 Agenda 21: National sustainable criteria

Agenda 21 is "a program of action based on a 40 chapters document that constitutes the boldest and including attempts already carried through to promote, in planetary scale, a new standard of development, conciliating methods of environmental protection, social justice and economic efficiency" [6]. Amongst the 40 chapters that constitute global Agenda 21, some of them can be identified as related to environmental themes of sustainability and to architecture, which had been classified in agreement of the use of natural resources [7], and can be summarized in the following form:

a) Water: Protection of oceans and all types of seas - also closed and semi closed seas - and protection of the coastal zones; rational use and development of its livings resources; protection of the quality and the supplying of the water resources: application of integrated criteria in the development, handling and use of the water resources.

b) Land: Integrated approach of the planning and the management of the terrestrial resources; fragile ecosystem handling: the fight against the dries; fragile ecosystem management: sustainable development of the mountains; and promotion of sustainable agricultural development.

c) Other natural resources: Fight against deforestation. Biological diversity conservation and environmentally healthful handling of the biotechnology.

d) Atmosphere: Protection of the atmosphere.

e) Residues: Environmentally healthful handling of toxic chemical substances, including prevention of illegal international traffic of toxic and dangerous products; environmentally healthful handling of dangerous residues, including prevention of the illicit international traffic of dangerous residues; environmentally healthful handling of solid residues and questions related with sewers; and safe and environmentally healthful handling of radioactive residues.

f) Human settlements: Promotion of the sustainable development of the human settlements; and integration between environment and development in the decisions making.

### 2.3 LEED® (Leadership in Energy and Environmental Design)

The environmental certification systems for constructions constitute today a great advance in the search of a sustainable development for architecture and cities in general. They stimulate the thought of sustainability in constructions, going beyond the environmental component, being considered other important factors in architecture, such as cultural, regional, social and economic context, aesthetic and the functional component.

In Latin America in general, including Brazil, there are still no programs for environmental evaluation, and the most used as reference for sustainability for constructions are the LEED® and the GBC (Green Building Challenge).

LEED® is divided into some categories: sustainable site, water efficiency, internal air quality, energy and atmosphere, materials and resources and process innovation.

### 2.4 GB Tool - Green Building Challenge – (GBC)

The GB Tool, developed by GBC, allows the evaluation of new constructions or reforms of any species of building of 4 different types of occupation, in accordance with a regional context.

The regional information used says:

- a) Consumption and generation of energy;
- b) Urban and neighbouring context of the land in which the project is going to be implanted; and

The information on the project related to:

- a) architectural systems;
- b) Technical systems and consumption of energy;
- c) Areas of floor, wall;
- d) Material;
- e) Management and operations of the construction; and
- f) Economic cost of the life cycle.

### 2.5 Agenda 21 for Florianópolis: Local sustainable criteria

The Agenda 21 of the City of Florianópolis (2001) consists [5], in a document that has the objective of searching for sustainable development attending the local context of the city. The global approach of the natural resources management guides the attempt of finding ideal parameters for successfully managing plans, culture and citizenship, infrastructure, quality of life, generation of jobs and income.

With this, they have been getting information regarding problems, potentialities and pointers of solutions, being the involved theme areas the ones below:

- a) Sustainable development for the region;
- b) Management of the natural resources and environment;
- c) Planning guidelines and the community;
- d) Culture and citizenship;
- e) Infrastructure and quality of life;
- f) Generation of job and income.

## 3. COMPARISON

The LEED® version taken as reference for the study was version 2.1, of the LEED®-NC (LEED® for New Constructions), that is considered for constructions or renewals and focused specifically for commercial and multifamily residential constructions, among others. There were considered the credits analyzed for LEED® in its checklist, with the main characteristics for each credit. GB Tool version taken as reference was the 2005 version. Again there were considered all the credits analyzed for the GB Tool, summarizing the most important characteristics.

After that, they were classified into categories based on similarities between the criteria within each one of the Brazilian Agenda 21, LEED and GB Tool. And a comparison table was made were it was possible to identify which parameters could help the project phase and in which way they could help to get direction lines for sustainability for projects in Brazil.

## 4. RESULTS

Based on the categories observed in the documents, there were 5 categories established which contain all the concepts of the documents and each one of them contains some topics that have to be taken into consideration in searching for sustainability in projects, and these are:

### a. Choose a sustainable surrounding

**Choosing a place for the project based on sustainability criteria:** Having sedimentary erosion control plan; selection of a site without ecological or agricultural value, that is not a flooding site, and that if is close to water do not represent danger to it; considerer urban revitalization, integrating old and new buildings, restoration of brown fields; use of surfaces that allow the water to penetrate; to protect and restore open space in at least 50% (excluding the building footprint); planned use of native or well

adapted plants and conservation of biological biodiversity.

**Sustainable location of the project:** Use of less occupation rate for the building than required from the local codes (at least 25% less).

**To give priority to the pedestrian and support the use of alternative transportation inside and outside the project:** Considerer proximity from site to local transportation, work places, commercial and cultural places and public green space; support the use of bicycles in a urbanistic way and also with facilities inside the building; support alternative fuel vehicles and public transportation; and do not exceed minimal local requirements for parking capacity.

**Use of exterior landscaping to reduce heat island effect inside and outside of the building:** Reduction of heat island effect in open and close spaces through the use of green roof and high reflective roof in the building; use landscaping an open grid for the exterior floor to be with more permeability and use ground floor for parking as a preference.

**Promotion of urban quality through the project:** Promote mixture of uses in the project: residential, commercial; compatibility of urban design with cultural local and heritage values; offer public green space with planned landscaping and maintenance and conservation of wild life corridors.

#### *b. Natural Resources*

**Promotion of the rational use of water through the project:** Protection of the sea environment and the water courses; protection of the quality and supplying of the water resources; limit the use of potable water for irrigation through the use of rain and recycled water and use of efficient water fixtures; minimize the use of potable water for the sewer; promote infiltration of rain water on the site and design characteristics to minimize send non treated rain water outside the site; to take into account the water incorporated in the materials.

**Promotion of energy efficiency in the building:** Design the building and its envelope with high levels of energy efficiency, reducing its energy cost and increase the use of renewable energy that include solar, geothermal, photovoltaic, wind energy, small hydroelectric, biomass and biogas.

**Avoid atmospheric emissions from equipments installed in the building that affect the ozone layer:** Protection of ozone layer through characteristics that minimize the emission of substances that compromise it; specify equipments for HVAC that do not use CFC.

**For reuse of buildings, promote planned use of existing local structures as part of the new project and make the specification of materials for**

**the building based on sustainable criteria:** Make reuse of buildings keeping as much as possible the structure and façade with components such as floor, walls, ceiling and ceiling tile; use reuse materials (5%) for the building as well as recycles materials (5% to 10%), local and regional materials (20%), rapidly renewal materials (5%) and certification wood (half of the wood used); and planned use of cement substitutes for concrete.

**Promotion of recycling and recovery of materials during the construction phase:** Promote recycle in the building of materials different from organics, such as paper, glass, plastic, metals; recover 50% to 75% of the materials used in the construction and give education in recycling in the building.

#### *c. Internal environmental quality*

**Maintenance of the internal air of the building free of pollutants:** Prohibited of smoking into the building or assigned a space for smoking with no recirculation or air in the building; establish permanent control of CO<sub>2</sub> in the internal spaces of the building; control pollutant sources through the design between occupation areas; specified materials with low level of VOC.

**Promotion of natural ventilation in the building:** Design characteristics to maximize the use of natural ventilation between the spaces with a good level of air quality.

**Design the building to achieve thermal comfort levels in accordance with the established for the bioclimatic zones in Brazil:** Maintain the air temperature and humidity in acceptable levels for natural and conditioned spaces. Use design strategies for the project in accordance with ABNT NBR 15220-3 [8] for the different bioclimatic regions in Brazil.

**Maximize natural illumination and efficiency artificial illumination in the building:** Use the orientation of the site to maximize the use of passive solar energy; offer a daylight factor of at least 2% in 75% of all occupied spaces with critical visual task; give access to exterior view from at least 90% of regularly occupied spaces; take into account reduction of light pollution that comes from the building; design characteristics to minimize glare and take care of the impact of the building to give access to natural light to the property next to the building.

**Promote a good performance of the building in relation with noise and acoustics:** Design noise attenuation in the occupied spaces through the envelope, walls and floor; avoid noise conveyance from the buildings equipments to the different occupation areas; and prevent the occupants of the building to exposure of electromagnetic pollution.

*d. Project characteristics*

**Promote flexibility and adaptability in the project for new users and technical systems:**

Design to make easy to modify technical systems in the building; design to disassemble, to reuse and recycle; consider efficiency of the space occupation; design to promote easiness of adaptation for future changes in the type and provision of energy.

**Process of design integrated and multidisciplinary:** Promote an integrated and multidisciplinary process of design since the beginning of the project; prepare an environmental impact report.

**Promote maintenance of the building without the necessity of mechanical uses and give high control to the occupants over the technical systems:**

To give a high level of control to the occupants over the technical systems of ventilation and illumination; design to maintain the fundamental functions of the building in case of energy lack and to assure partial operation of the technical systems; permanent monitoring of temperature, humidity, energy and water; design the building thinking in its maintenance; prepare as built plans for the building; give incentives for outstanding performance for the rent users; prepared the operation team; and make commissioning of the building.

*e. Social economics aspects*

**Consider social aspects in the project decision making:**

Minimize construction accidents and design to maximize the wellness of the occupants; offer universal design through the project; warranty access to direct solar light from the living areas as well as to open private space in residential units and give visual privacy from exterior on the main areas of the residential units.

**Considerer economical aspects for the project decisions:**

Consider life cycle cost for the whole building; give incentive to planned measures in order to minimize cost of construction, maintenance, and operation; make a market evaluation in order to see if future prices for rent and selling are in accordance with the market; maximize support to local economy through the use of local and regional materials, systems and construction workers; analyse the economical consequences in all the decisions make such as the decision for the construction site; make planned measures to minimize external costs, such as make an evaluation on the impact that the project is going to have on the neighbourhood or urban region.

**Human settlements:** Promotion of sustainable development in human settlements by means of: dwellings, use of land, environmental infrastructure, energy and transportation, sustainable activities in the building construction and development of human resources; integration between the environment and development in the making of decision process through the creation of a efficient normalization

structure, utilization of market incentives and establishment of a system of environmental accounting and integrated economy.

## 5. CONCLUSION

The study of sustainable criteria of some important documents world wide can be a helping tool to architects for their work, and specially the certification systems for environmental evaluation of the buildings can help also as guide lines for projects. These guidelines shown above can be use in projects for Brazil in general and when considered a region the use of local criteria such as Agenda 21 for each city it will be necessary and of great importance.

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