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# EVALUATION AND CERTIFICATION OF THE SUSTAINABLE CONSTRUCTION

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**Abstract**. *Nowadays, the construction sector has a major responsibility in the growth of pollution and in environmental decline.*
*The uncontrolled increment of the natural resources consumption by the construction sector and the high pollutant emissions that it originates, are the field to study measures to help to reduce consumption and to ensure a sustainable future for the whole planet.*
*The emergence of tools for the evaluation and certification of buildings in different parts of the world has had a positive contribution to the reduction of the negative impacts related to the construction sector, by the recognition of the performance of the practices and processes of sustainable building and demanded the introduction of the principles of sustainability throughout the life cycle of building, improving the quality level of performance of buildings.*
*Through the study of different systems for evaluating and certifying sustainable construction, nationally and internationally, it is possible to identify the most common group parameters in each system and establish a common basis associated with good practices. That knowledge will contribute to the definition of the importance of evaluating of sustainable construction.*
*This research intends to contribute to the process of evaluation and certification by presenting the proposal for the System, adaptable to the Portuguese reality. The proposed system covers all the areas of sustainability in a simple and clear way, so that its implementation can be easy and effective, and contributes to highlight the importance of evaluation and certification in the construction sector as a way of ensuring the high level of efficiency of buildings, regarding the consumption of natural resources and energy, environmental comfort and durability.*

## 1. INTRODUCTION

Since the 1950's, the environmental issue has become a worldwide preoccupation. The development of society, the population growth levels and the increase in the quality of life of the inhabitants had led to an uncontrolled increase in the consumption of resources and materials available in nature [1].

This increasing preoccupation with natural resources availability and the way they are used by the society, particularly in the construction, have prompted reflection on both the causes and the solutions for this problem, and the need to introduce sustainable concepts applicable to the different sectors of our society has long been advocated [2].

The high number of new buildings built every year produces a huge impact in the consumption of natural resources. Yet only a small number of these buildings are in conditions to be classified as “green buildings”. Research indicates that is a great difference in the discourses, practices and governance of sustainability between the mainstream system of housing provision and green builders [3, 4, 5].

The built environment that we all inhabit is a major contributor to the increased consumption of energy and water, which are essential resources to human activities, and this consumption tends to increase over the years. This excessive consumption of energy and water is directly related to the needs in terms of comfort and quality of life of the modern society, which have yet to meet significant advances in alternative resources or more efficient standards for their use [2].

Another aspect that promotes excessive consumption of resources is the lack of quality of residential buildings constructed or, in other words, many recent buildings disregard the needs required by users, such as the level of thermal comfort, acoustic comfort, ventilation and indoor air quality, leading to unbearable energy costs over the long term [6].

The construction sector is also responsible for the excessive consumption of material resources. This situation only occurs because the use of non-sustainable materials, with high values of embodied energy, and the scarce inclusion of reusable and/ or recyclable materials is very scarce. This attitude is symptomatic of the great impact that the construction industry has on the environment, particularly in its contribution to waste generation [6, 7, 8].

The fact that, in Portugal, there are still no adequate plans for environmental management throughout the lifecycle of buildings leads to the production of waste from the construction, use and demolition of buildings that isn’t minimized, and again contributing to serious environmental damage [9]. The development of tools is important in order to overcome the increasing concern of today’s resource depletion and to address environmental considerations in both developed and developing countries [10].

Because of all these factors, there has been a growing preoccupation to reach new solutions for sustainable construction, to ensure a sustainable future for the planet, for which the assessment of its performance is a paramount importance.

## 2. SUSTAINABLE CONSTRUCTION

Over the years the world population has increased considerably. Currently, there are around 6,900 million people on the planet and it is expected that this number will reach 9,150 million by 2050 [11]. Population growth will require more consumption of resources caused by the need to build more homes that respond to the needs caused by this growth. These facts will lead to negative consequences for the environment and consequently to the development process of societies that has to be sustainable.

The housing sector is already responsible for 50% of the World’s natural resources consumption: 40% of drinkable water, 60% of arable land, 70% of wood products and 45% of the energy produced – intended for buildings’ heating, lighting and ventilation [12], thus the growth of the housing sector is one of the most important to intervene in.

In order to reverse this trend of environmental disarticulation (increased resource consumption, emissions, deteriorating health and biodiversity), Charles Kibert proposed a "new" concept adaptable to construction, called the Sustainable Construction [13, 14,15]. This new concept's main concern was to help preserving the environment, respecting natural resources and providing quality of human life. The fact that today over 80% of people's time is spent inside buildings [9], makes the construction sector the ideal vehicle to introduce the sustainable guidelines of development, given that the resource savings can be achieved.
In the process, Sustainable Construction adopts a set of fundamental principles, such as: minimizing the consumption of water and energy; using renewable energy sources like solar, biomass and wind energy; minimizing land use; using eco-friendly, local, low embodied energy and recyclable materials. In the design stage, the site and shape of the building should be paid particular attention, to benefit from favorable solar orientation, wind exposure, natural illumination and natural ventilation. Other aspects that should be considered when designing the building are its form factor and thermal mass, as well the use non-toxic materials that support the protection and cooperation with natural systems. To extend the durability of buildings, the project should also include orientations for the conservation and maintenance of these assets with goal of reducing costs in the life cycle, always considering the key aspects: use, efficiency, comfort and quality [9, 13, 14].

## 3. SUSTAINABLE CONSTRUCTION EVALUATION

The environmental assessment applied to the construction started towards the end of the 80's. This type of evaluation aims to assess the negative and positive impacts that the construction might have on the environment, developing further measures to minimize negative environmental impacts and valuation of positive [15].
The development of environmental impact assessment involves the creation of specific criteria in order to reduce and assess the environmental impact caused by the construction. However, it was observed that in many countries that have developed projects in order to minimize this impact, the means used to verify that the buildings met the criteria were not sufficient [16]. As a result, many buildings they had in mind the preservation of the environment when analysing the life cycle had higher energy consumption compared to the construction of the current solution [17].
The creation of assessment system was fundamental to the formulation of guidelines and methods for sustainable construction and its quality criteria and methods of evaluation and verification [18], leading to the fulfilment of various methods and systems for the evaluation of Sustainable Construction, that even today remain voluntary, but they offer advantages in all areas that influence the buildings' construction.

## 4. CURRENT EVALUATION SYSTEMS

The assessment systems are designed to be easily incorporated by designers and the market in general, they have a simple structure, usually formatted as a checklist and linked to some kind of performance certification [19].
The development of evaluation systems for specific buildings has the goal of verifying and certifying that the sustainability considerations are applied in construction. The existing systems are constantly evolving and expanding their scope. A major objective now is to "develop and implement an agreed methodology that can support the design of sustainable buildings and that can be, simultaneously, transparent and flexible enough so that it can be easily adapted to different types of buildings and to the constant evolution of technology that exists in the construction field "[20].
For a better understanding of evaluation systems, it's important to present some of the most relevant systems implemented in several countries nowadays, namely:

**BEPAC** (Building Environmental Performance Assessment Criteria)
The BEPAC was the first system developed in Canada to evaluate the environmental performance of

buildings, with the particularity of the development of regional versions in order to meet the local needs and environmental priorities [21].
This system was developed based on guidance from the BREEAM system, creating criteria for the design of the base building, base building management, occupation project and management of occupation [21].

**BREEAM** (Building Research Establishment Environmental Assessment Method)
Developed in the United Kingdom in the 1990's, the BREEAM system arises as the primary method of evaluating the environmental performance of buildings [22].
This system not only provides guidelines to minimize the negative effects of buildings in their areas but also aims to foster a healthy and comfortable indoor environment, addressing issues related to energy, environment, health, productivity, opportunities for improvement and financial benefits [23].

**CASBEE** (Comprehensive Assessment System for Building Environmental Efficiency)
This system was developed in Japan and is based on two categories: one for new buildings and another for the existing building.
The system has two aspects: the examination and balance of the positive and negative impacts during the building's life cycle and definition of the limits of the analyzed building. It also has the distinction of developing a concept, referred to as closed ecosystems, in order to determinate the environmental efficiency by relating the environment of the building in the study with public external environment [24].

**GBC** (Green Building Challenge)
The GBC was initially developed by Canada and later by an international consortium and labeled by SBTool. This system aims for the development of a method for the evaluation of the environmental performance of buildings, considering their suitability for different technologies, building traditions and cultural values of different regions of the same country or from different countries [25, 26].

**SBTool** (Sustainable Building Tool)
The SBTool methodology was based on GBTool Method and was developed by iiSBE (International Initiative for Sustainable Built Environment), through the participation of several countries. This methodology aimed at creating a system to evaluate performance of buildings at the international level, but making an adjustment prior to the country context where it's applied.
SBTool methodology has been used for development of several regional assessment tools like SBToolPT (Portugal), SBToolCZ (Czech Republic), Protocollo ITACA (Italy) and GREEN (Spain) [16, 26].

**HQE** (Haute Qualité Environnementale des Bâtiments)
Evaluation system developed in France, with the following principles and objectives: reducing the impacts of buildings on the outside environment globally, regionally and locally and creating a comfortable indoor comfortable for the users [15].
The structure of this system is subdivided into management of enterprise and environmental quality, and is composed by the following evaluation areas: eco-construction, management, comfort and health [27].

**LEED** (Leadership in Energy & Environmental Design)
Developed in the United States of America by United States Green Building Council (USGBC), aspiring for the development and implementation of environmentally responsible practices of project and construction, responsible to encourage the creation of environmentally efficient buildings and healthy places to live and work [28, 29, 30].
This system is the most recognized worldwide; it is present in 41 different countries and is undergoing successive updates to its members.

**LIDERA** (System Volunteer for Evaluation of Sustainable Construction)
The LIDERA is a voluntary evaluation and recognition system of sustainable construction and built environment, developed in Portugal that aims to support the development of plans and projects and seeks to achieve sustainability through the evaluation of the level of sustainability in the various stages of the building, and to support management during the construction and operation phase and finally to certify it through an independent evaluation [31].

**NABERS** (National Australian Buildings Environmental Rating System)
The NABERS arises in Australia, with the distinctiveness of having developed an online project that allows the possibility of self-evaluation of the level of sustainability in a global and by area classification. This self-evaluation is done through a questionnaire available on the website. This system addresses issues such as Energy, Land, Materials, Water, Internal Environment, Waste, Resources and Transportation [32, 33].

### 4.1. Structure of assessment systems: areas of evaluation, parameters of evaluation and weights

The evaluation systems existing despite being built on a common basis differ from each other, essentially determined by the following reasons: levels of concerns about the environmental aspects vary from one country to another, the design and construction practices are different, climatic conditions, latitude, social and economic aspects are different and the receptivity of markets to the introduction of methods and measures are different [19, 34].
The search for sustainability in the field of assessment of buildings has been characterized by structural transformation and operational requirements of the assessment methods [18], since some of systems have their priority focus on the environmental assessment while others seek to evaluate the sustainability of buildings [35].
Table 1 summarizes the requirements that constitute the basic structure of each system evaluation presented, as well as their relevance.

Table 1 - Areas, parameters and weightings of the evaluation systems

| Evaluation Systems | Areas of Evaluation | Parameters of Evaluation | Weighting (%) | References |
|---|---|---|---|---|
| BREEAM | Management | Aspects global of policy and environmental procedures | 12 | BREEAM, 2008 |
| | Health and Wellbeing | Internal and external environment of the building | 15 | |
| | Energy | Operational energy and CO2 emissions | 19 | |
| | Transport | Location of the building and CO2 emissions related to transportation | 8 | |
| | Water | Consumption and leakage | 6 | |
| | Materials | Environmental implications of materials selection | 12,5 | |
| | Waste | Resource efficiency by effective management and proper construction waste | 7,5 | |
| | Land Use and Ecology | Directing of urban growth; Ecological value of site | 10 | |
| | Pollution | Pollution of air and water, excluding CO2 | 10 | |
| | Innovation | Innovation in the field of sustainability | 10 | |
| CASBEE | Indoor Environment | Sound and Acoustics; Thermal Comfort; Lighting & Illumination; Air Quality | 20 | CASBEE, 2008 |
| | Quality of Service | Service Ability; Durability & Reliability; Flexibility & Adaptability | 15 | |
| | Outdoor Environment | Preservation & Creation of Biotope; Townscape & Landscape; Local Characteristics & Outdoor Amenity | 15 | |

| | | | | |
|---|---|---|---|---|
| | on Site | | | |
| | Energy | Building Thermal Load; Natural Energy Utilization; Efficiency in Building Service System; Efficient Operation | 20 | |
| | Resources & Materials | Water Resources; Reducing Usage of Non-renewable Resources; Avoiding the Use of Materials with Pollutant Content | 15 | |
| | Off-site Environment | Consideration of Global Warming; Consideration of Local Environment; Consideration of Surrounding Environment | 15 | |
| SBTool | Energy and Resource Consumption | Water, Energy, Land and Materials | 23 | SBTool, 2007 |
| | Environmental Loadings | Emissions, Effluents and Solid Waste | 27 | |
| | Indoor Environmental Quality | Air quality, Ventilation, Illumination and Comfort | 18 | |
| | Service Quality | Flexibility, Adaptability, User controllability, Outside spaces and Impacts on adjacent properties | 16 | |
| | Social and Economic aspects | Socio-Economic aspects | 5 | |
| | Site Selection, Project Planning and Development | Planning of the construction, Verification, Pre-delivery and Planning of the operation | 8 | |
| | Cultural and Perceptual Aspects | Culture and Patrimony | 3 | |
| HQE | Eco-construction | Relation of the building with its surroundings; Choose Integrated Product; Construction Systems and Processes; Construction with low environmental impact | - | Silva, 2007 |
| | Management | Energy Management, Water Management, Waste Management of use and operation of the building; Maintenance (remaining environmental performance) | | |
| | Comfort | Hygrothermal, Acoustic, Visual, Olfactory | | |
| | Health | Sanitary quality of the environment; Air Quality; Water Quality | | |
| LEED | Sustainable Sites | Construction Activity Pollution Prevention; Site Selection; Development Density and Community Connectivity; Brownfield Redevelopment; Alternative Transportation-Public Transportation Access; Alternative Transportation-Bicycle Storage and Changing Rooms; Alternative Transportation-Low-Emitting and Fuel-Efficient Vehicles; Alternative Transportation-Parking Capacity; Site Development-Protect or Restore Habitat ; Site Development-Maximize Open Space; Storm water Design-Quantity Control; Heat Island Effect-Roof; Heat Island Effect-Nonroof; Light Pollution Reduction | 23,6 | LEED, 2009 |
| | Water Efficiency | Water Use Reduction; Water Efficient Landscaping; Innovative Wastewater Technologies; Water Use Reduction | 9,1 | |
| | Energy & Atmosphere | Fundamental Commissioning of Building Energy Systems; Minimum Energy Performance; Fundamental Refrigerant Management; Optimize Energy Performance; On-site Renewable Energy; Enhanced Commissioning; Enhanced Refrigerant Management; Measurement and Verification; Green Power | 31,9 | |
| | Materials & Resources | Storage and Collection of Recyclables; Building Reuse-Maintain Existing Walls, Floors and Roof; Building Reuse-Maintain Interior Non-structural Elements; Construction Waste Management; Materials Reuse; Recycled Content; Regional Materials; Rapidly Renewable Materials; Certified Wood | 12,7 | |

| | | | | |
|---|---|---|---|---|
| | Indoor Environmental Quality | Minimum Indoor Air Quality Performance; Environmental Tobacco Smoke (ETS) Control; Outdoor Air Delivery Monitoring; Increased Ventilation; Construction Indoor Air Quality Management Plan-During Construction; Construction Indoor Air Quality Management Plan-Before Occupancy; Low-Emitting Materials-Adhesives and Sealants; Low-Emitting Materials-Paints and Coatings; Low-Emitting Materials-Flooring Systems; Low-Emitting Materials-Composite Wood and Agrifiber Products; Indoor Chemical and Pollutant Source Control; Controllability of Systems-Lighting; Controllability of Systems-Thermal Comfort; Thermal Comfort-Design Thermal Comfort-Verification; Daylight and Views-Daylight; Daylight and Views-Views | 13,6 | |
| | Innovation in Design | Innovation in Design; LEED Accredited Professional | 5,5 | |
| | Regional Priority | Regional Priority | 3,6 | |
| LIDERA | Land | Territorial Enhancement; Environmental Optimization of the Implantation | 7 | LIDERA, 2009 |
| | Natural Ecosystems | Valorization ecological, Habitat Interconnection | 5 | |
| | Landscapes and Patrimony | Local Landscape Integration; Protection and Valorization of Patrimony | 2 | |
| | Energy | Energetic Certification, Passive Design, Carbon Intensity (and efficiency) | 17 | |
| | Water | Consumer of potable water, Management of local waters | 8 | |
| | Materials | Durability, Local materials, Low-impact materials | 5 | |
| | Food Products | Local food production | 2 | |
| | Effluent | Treatment of residual waters; Reuse flow of waste water | 3 | |
| | Air Emissions | Flow of Air Emissions - Particles and / or substances with acidifying potential (Emission of other pollutants: SO2 and NOx) | 2 | |
| | Waste | Production of waste; Management of hazardous waste; Recycling of waste | 3 | |
| | Outside Sound | Fonts sound to the outside | 3 | |
| | Illumine-Thermal Pollution | Thermal effects (heat island) and luminous | 1 | |
| | Air Quality | Levels of Air Quality | 5 | |
| | Thermal Comfort | Thermal comfort | 5 | |
| | Illumination and Acoustic | Illumination levels, sound insulation / sound levels | 5 | |
| | Access for All | Access to public transport, Low impact mobility, Inclusive solutions | 5 | |
| | Lifecycle Costs | Low life cycle costs | 2 | |
| | Local Economic Diversity | Flexibility - Adaptability to the uses; Economic Dynamics; Local Labor | 4 | |
| | Amenities and Social Interaction | Local amenities; Interaction with the community | 4 | |
| | Participation and Control | Capacity Control; Governance and Participation; Control of natural risks - Safety; Control of human threats - Security | 4 | |
| | Environmental Management | Conditions of use the environment; Environmental Management Systems | 6 | |
| | Innovation | Innovations | 2 | |

| | | | | |
|---|---|---|---|---|
| NABERS | Land | Biodiversity | 16 | Vieira & Barros Filho, 2009 |
| | Materials | Environmental impact of materials used in building | 7 | |
| | Energy | Energy consumption during construction and operation of building | 17 | |
| | Water | Consumption and pollution of waters; Reuse of rainwater | 7 | |
| | Indoor Environmental | Indoor air quality | 13 | |
| | Resources | Efficiency of resources | 10 | |
| | Transport | Access to public transport in order to reduce air pollution | 17 | |
| | Wastes | Emissions to the environment | 13 | |

Although there are differences between the systems, they are needed since each country has different performance levels. Therefore there is a need adjustability of the system, such as the possibility to: establish higher or lower water requirements; reduce or increase the importance given to the wood resource; set the conditions for acoustic and thermal isolation and lighting for the reality of each country; adjust the ways of calculating the energy balance; or to introduce specifications regarding the determination of $CO^2$ emissions and energy recovery.
However, these adjustments aren't only made only between the various systems in different countries. An evaluation criterion was developed, which focuses the importance for regional evaluation of buildings. This means that in the same country, different regions have different realities in terms of social and cultural aspects, land occupation, climate or even on the construction practices level. This ensures the establishment of distinct evaluation parameters and the performances towards the region's specific needs [36].

## 5. "ECO" EVALUATION SYSTEM PROPOSAL TO PORTUGAL

ECO is a system of evaluation and certification of sustainable construction. The ECO was developed to evaluate the environmental performance of buildings, in order to stimulate, advice and encourage the market for practices that enhance environmental protection.
The ECO encourages the minimization of the negative effects of the buildings in their areas, promotes a healthy and comfortable indoor environment and contributes to minimizing the use of natural resources in order to contribute to an effective sustainable development. Some of the objectives of this system are: to differentiate the buildings with less environmental impact, encouraging the use of best environmental practices in all phases of the lifecycle of the building, create parameters that are not imposed in the legislation and highlight the importance and benefits of buildings with lower environmental impact to owners, users, designers and operators.
So the ECO aims to encourage the creation of buildings environmentally responsible, profitable and healthy places to live and work.
This evaluation system intends to be applicable to residential buildings, in the final stages of construction and/ or the operation phases of the building.

### 5.1. Structure of the "ECO" system

In order to contribute to the sustainability of construction, the system is based on five factors (Comfort, Surround, Management, Project and Planning and Resources) which in turn aggregate areas of environmental performance (Internal Environment, Socio-Economic and Political Model, Environmental Loading and External Environmental Impact, Environment Integration, Environmental Management, Innovation, Planning, Water, Energy and Materials) and are translated into parameters of sustainability, which are operationalized through criteria which enable the evaluation of the built environment to the level sustainability.

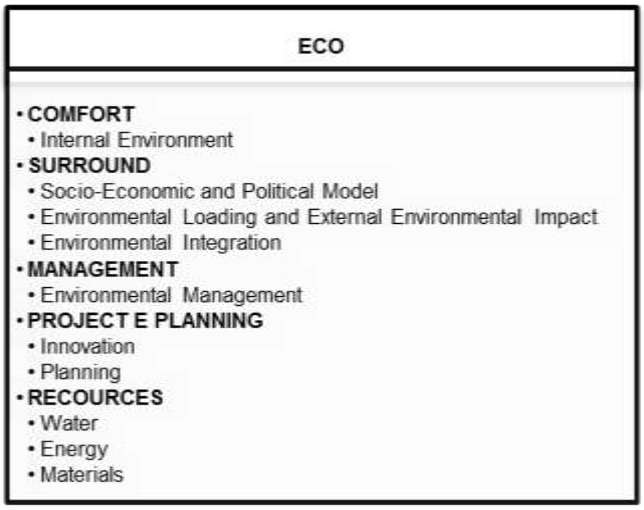


Figure 1 - Sustainability Factors and Areas

Each area is detailed by a group of parameters sustainability to reduce the impact on the environment caused by the building. Accordingly, shown are a group of criteria in the different parameters. The criteria require compliance with the Portuguese legislation including regulations applied to buildings, and the minimum essential requirements necessary for the sustainable development process of construction.

Table 2 – Parameters of “Eco” System

| FACTOR | AREAS OF EVALUATION | PARAMETERS OF EVALUATION |
|---|---|---|
| COMFORT | Internal Environment | Acoustic Comfort |
| | | Hygrothermal and Thermal Comfort |
| | | Lighting Comfort |
| | | Visual Comfort |
| | | Indoor Air Quality |
| | | Internal Ventilation |
| | | Healthy Environment |
| SURROUND | Socio-Economic and Political Model | Amenities and Social Interaction |
| | | Access for All |
| | | Lifecycle Costs |
| | | Local Economic Diversity |
| | | Participation and Control |
| | Environmental Loading and External Environmental Impact | Effluent |
| | | Atmospheric Emissions |
| | | Impact on the Surroundings and External Spaces |
| | | Impact on Local Ecology |

| | | |
|---|---|---|
| | | Illumine-Thermal Pollution |
| | Environment Integration | External Environment |
| | | Land Use |
| | | Public Transport and Smooth Mobility |
| MANAGEMENT | Environmental Management | Recycled Content |
| | | Waste Control of Use of Building |
| | | Control of Construction Waste |
| | | Climate Control Systems |
| | | Reuse of Materials |
| PROJECT AND PLANNING | Innovation | Innovation and Design Process |
| | Planning | Adaptability, Durability and Flexibility |
| | | Planning the Operation of the Building and Construction |
| RESOURCES | Water | Water Conservation and Efficiency |
| | | Water Recycling |
| | | Efficiency of Building Systems |
| | Energy | Energy Conservation |
| | | Renewable Energy |
| | Materials | Materials – Durability e Reuse |
| | | Materials of Low Impact |
| | | Local Priority |

### 5.2. Weightings “ECO” System

The balance between each of the areas and their relation with the others is evident through the weightings assigned to each. The weights are assigned according to the greater or lesser concern with the different principles of sustainability, the objective being that the weights attributed to become understandable by users of the system relative importance of each area.
The following figure illustrates the weightings assigned to each area of sustainability that constitute the system, given the adaptability to the Portuguese context.

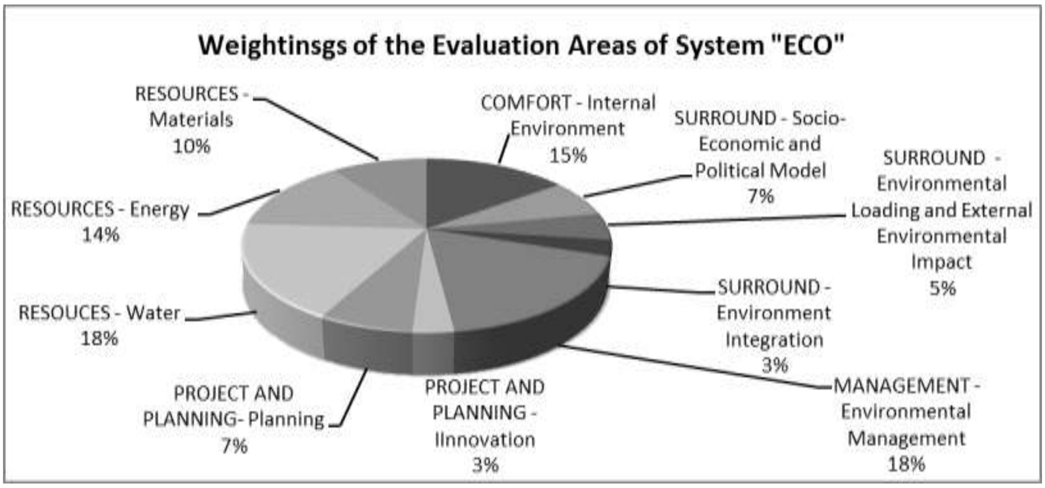


Figure 2 – Weightings of the Evaluation Areas of System “ECO”

The decision of assigning more weight (18%) to Water results from the importance that this element has in terms of sustainability, related to the overall context of population growth and the consequent need for new buildings. In the same way, the Environmental Management presents itself with the same weight of Water because of amount of resources handled in the construction sector.

### 5.3. “ECO” system certification levels of sustainable construction evaluation

In the system, to guide and evaluate the performance, there is a scale of values that the end will correspond to the index assessed overall performance of the building framing it in a level of certification. The levels of certification system intended to recognize the building in terms of sustainability, intended to help select the solution that significantly improves its performance. These levels also allow indicating on which areas it needs to improve – a situation that can be accompanied through the monitoring process.

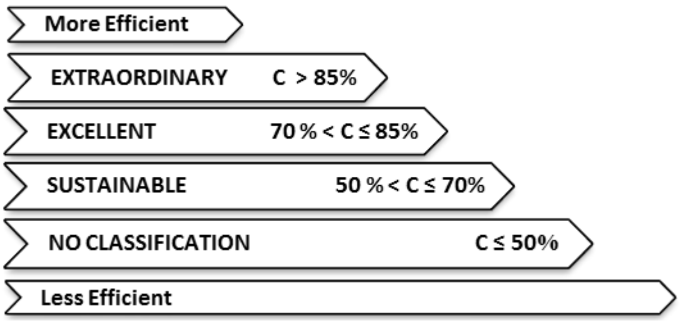


Figura 3 – Levels of Certification System “ECO”

At the first level (NO CLASSIFICATION) the building is classified as not having the required minimum sustainable conditions. The second level (SUSTAINABLE) performance based on the most widely used technology, that is, meets the minimum allowable sustainable conditions. In the third (EXCELLENT) the building is considered to have a better performance of construction

practices and four (EXTRAORDINARY) based on an extraordinary level of sustainability.
The building to be considered sustainable, it must be level "SUSTAINABLE" and have to ensure in all areas of sustainability evaluation, the minimum acceptable practices for a good performance. These are defined, according to the relevance of the evaluation areas, the minimum allowable percentages of each area which constitute the system.

Table 3 – Minimum allowable percentage of area of evaluation system “ECO”

| FACTOR | AREAS OF EVALUATION | PERCENTAGE OF AREA | MINIMUM ALLOWABLE PERCETAGE OF AREA |
|---|---|---|---|
| COMFORT | Internal Environment | 15,00% | ≥ 7,5% |
| SURROUND | Socio Economic and Political Model | 7,00% | ≥ 3,0% |
| | Environmental Loading and External Environmental Impact | 5,00% | ≥ 2,5% |
| | Environment Integration | 3,00% | ≥ 1,5% |
| MANAGEMENT | Environmental Management | 18,00% | ≥ 7,5% |
| PROJECT AND PLANNING | Innovation | 3,00% | ≥ 1,0% |
| | Plannig | 7,00% | ≥ 3,0% |
| RESOURCES | Water | 18,00% | ≥ 10,0% |
| | Energy | 14,00% | ≥ 8,0% |
| | Materials | 10,00% | ≥ 6,0% |

## 6. CONCLUSIONS

The systems of evaluation and certification of sustainable construction are constantly being developed and perfected by various institutions and governments, particularly in countries that have signed to environmental treaties and protocols. The process of evaluation and certification of constructions is intended to assess in construction techniques and processes, in order to contribute to the sustainable development of societies.
It was found that the construction sector is responsible for much of the environmental degradation because of the level of emissions, resources consumption and energy consumption. This sector is also characterized by several problems on the level of water and energy efficiency, environmental comfort within homes, lifestyles and consumption patterns of the users of the buildings - all factors that determine the quality of life of the users.
Based on these problems in the construction sector, it became necessary to promote knowledge and awareness of the performance of the processes and practices of sustainable building by implementing evaluation and certification systems for both new and existing constructions.
Examining the evaluation and certification systems for sustainable construction, it can be concluded that countries with greater economic development have opted by developing their own certification systems.
The study of each system has given the opportunity to compare them according to their evaluation parameters. This enabled to perform useful comparisons for the knowledge of the processes and techniques used in the certification of buildings, and allowed the identification of strategies and the most important factors to take in consideration.
The proposal for the “ECO” System aims to strengthen the level of efficiency of the construction through the evaluation and certification of its sustainability. This system was elaborated based on a set of parameters of sustainability that were subdivided into criteria of evaluation, which in turn

were pondered according to their degree of sustainability. To ease the application of this system, a tool (spreadsheet) was developed to ensure that the use is simple and clear.
Finally, this tool allows the classification of the building according to defined levels of certification. This proposal intends to contribute to an easier execution of the process of evaluation of sustainable constructions, with the rigor of the good practices in sustainability.

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