DEVELOPING AN ENVIRONMENTAL SUSTAINABILITY INDEX FOR A BUILDING ASSESSMENT AND CERTIFICATION SYSTEM IN CHILE

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ABSTRACT

Instituto de la Construccion, with the participation and contribution of 14 public and private institutions of the construction sector, is developing a national Building Environmental Assessment System and Certification Scheme, "Certificacion Edificio Sustentable", in order to assess, qualify and certify compliance based on a set of requirements focused on design conditions, on site verification and performance of non-residential buildings. The certification scheme consists of a set of requirements, 14 of them mandatory, arranged in two main categories: Architectural Design and MEP Systems Design. The definition of the weights, scales and thresholds, was based on the Analytical Hierarchy Process (AHP), involving 39 public and private institutions and companies. To implement the system, it is consider the formation of assessment bodies throughout the country, which would give feedback and improve the system requirements at local level, facilitate on site verification, and increase opportunities for market players.

Keywords: AHP, Sustainability, Building Environmental Assessment Systems.

1. Introduction

Globally, the *green building* concept has positioned itself as a response from the construction industry to the global challenges of climate change and sustainable development. *Building Environmental Assessment* (BEA) *Systems* have become a tool for evaluating and communicating the environmental and social impacts of buildings, improve its design and construction, and encourage the market for services and associated technologies. With the heightened awareness of sustainability around the world and the need of rapidly developing regions to respond quickly, developing countries without a BEA system are confronted by a difficult choice. They can adopt one of the well-known methods such as LEED or BREEAM; or start from scratch but borrowing the best-of-breed criteria and measurements, as BEA methods need to be

adapted to local circumstances in order to provide an effective local regulatory or incentive based instrument (Malkawi, Augenbroe; 2009)
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“Instituto de la Construcción” (Construction Institute), a non-for-profit Chilean corporation, with the participation and contribution of 14 public and private institutions of the local construction sector, is developing a national BEA system and certification scheme, “Certificacion Edificio Sustentable”, in order to assess, qualify and certify compliance based on a system of requirements focused on design conditions, on site verification and performance of non-residential building. To assist the decision making process of the project, an AHP (Analytic Hierarchy Process) methodology was used, in order to define the priorities of the system, the rule of measurement and the assessment scales for each indicator.

2. Objectives

The main objective of applying the AHP methodology was to deliver one final indicator or "building Sustainability Index" (BSI), based on a multi-criteria rating matrix that should include the weights, scales and thresholds of each requirement and the final indicator or BSI. Since each of the requirements responds to different dimensions and have their own units of measure, and given the different actors and visions involved in the project, it was decided to use the AHP methodology in its "Group decision making" choice.

3. Research Design/Methodology

The AHP methodology was applied based on 2 *strategic workshops*, 4 *technical workshops,* and 1 *final general workshop*. A total of 64 representatives of 39 institutions attended the 7 workshops, including 9 associations, 11 public agencies, 4 academic institutions, and 15 companies, organized into 17 working groups.

The scope of this process was based on an office or service building of about 2.500m^2 (27.000 sqf) located in the central zone of the country (where 50% of the population of country lives), representing a typical building, which was defined based on an statistical analysis of new buildings built on the last five years. The scope was also narrowed down to the building design process stage.

The different working groups’ visions were aggregated using the geometric mean, and the inconsistencies were detected and corrected on-line in each workshop, using specific software for it.

4. Data/Model Analysis

For the first stage of this new local BEA system, the general scope of the environmental performance of a building has focused on three topics: Indoor Environmental Quality, Energy and Water, organizing under to main categories: Architectural Design and MEPS

Systems Design (Mechanical, Electrical and Plumbing). This matrix encompassed a total of 20 variables and indicators, grouped as:

- Architectural Design
    - Indoor Environmental Quality: Thermal Comfort, Natural lighting visual Comfort, Acoustic Comfort, Natural ventilation
    - Energy: Energy demand, Tightness, Embedded energy in structural materials
    - Water: Landscape water demand, Embedded water in structural materials
- MEP Systems Design:
    - Indoor Environmental Quality: Visual comfort, Mechanical ventilation and control, Controllability of heating and air conditioning, Systems noise.
    - Energy consumption: Lighting systems, HVAC, Other Uses, Renewable Energy
    - Water consumption: Indoor water use reduction, Irrigation system, water hardness.

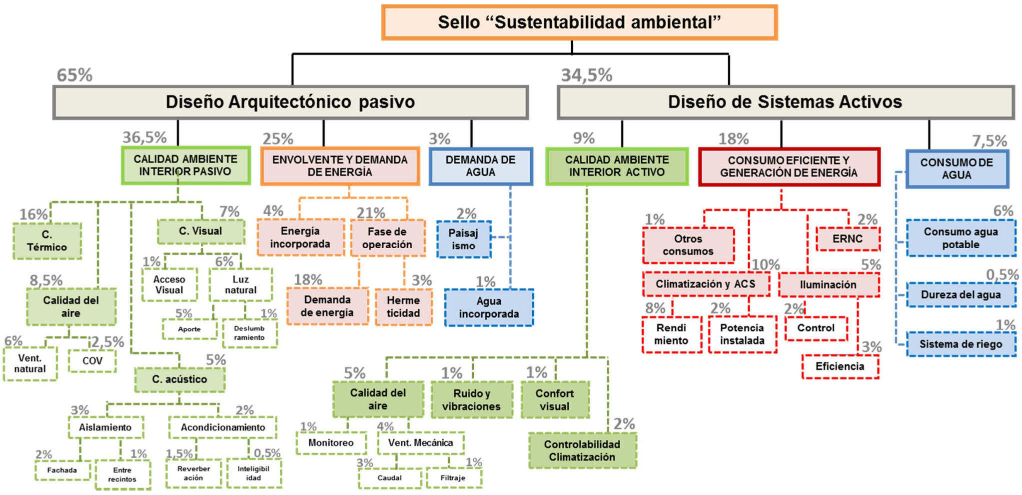

Figure 1: Matrix of the 2 main categories and its variables. *Source: Instituto de la Construcción.*

Along with this matrix, a set of 14 pre-requisites or border conditions were defined during the workshops.

5. Limitations

This BEA system identifies and evaluates other aspects to be assessed on a building, typically set on stages of a building life cycle different from the design stage. Those aspects were not within the undertaken decision-making process. Those aspects were: Integrative Project Design, Operation and Maintenance, Waste Management during Construction.

6. Conclusions

Along with defining the priorities of the system, the rule of measurement and assessment scales for each terminal criteria, it is interesting to mention the high degree of alignment (compatibility) of each group, compared to the combined priorities of the strategic criteria and the high degree of alignment between the different roundtables of this group. This summits the degree of agreement between the value systems of the various players.

This result was obtained with a new tool known as compatibility index support for tough environments "*G*", (Garuti's Index), which measures the compatibility of different workgroups (particular value systems) within a multi-environment with different weights respect to the combined value (global value system). In this case, the compatibility index "*G*" was between 0.963 and 0.989. [1]

7. Key References

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[1] An index equal or greater than 0.90 indicates high compatibility. The index ranges from 0.0 (total incompatibility) to 1.0 (full compatibility).