



METHODOLOGY FOR THE APPLICATION OF SUSTAINABLE CONSTRUCTION CONCEPTS APPLIED IN COMMERCIAL BUILDINGS

Luciana N. Jesus and Manuela Almeida
Department of Civil Engineering
E-mail: luciana.njesus@gmail.com

KEYWORDS

Sustainable construction, effective outcomes, commercial building.

INTRODUCTION

The main challenges and contributions for the sustainability dissemination in construction are to recognize and prove the effective outcomes (economic and environmental) that could be obtained with the implementation of sustainability criteria. It means that more important than recognize the sustainability through the implementation of a sustainable voluntary tool, it is to assure (and verify) the positive effects that could be reached with the application of the methodology or the classification obtained. In this perspective, the present abstract will present the results obtained within a research project developed at University of Minho, which had the goal to encourage sustainable practices in the real state market based on two crucial objectives:

- 1st objective: To develop a database named as “Management of the Sustainable Project” (in Portuguese - Gestão do Projecto Sustentável - GPS). This one is based on sustainable measures applied to buildings and is targeted to some themes (sustainable categories), different construction phases, technical competences and evaluation tools. The GPS tool is presently in constant change and was exclusively developed to be used just by the internal management of the Company that was co-financing this research;
- 2nd and main objective: To determine the economic and environmental feasibility of the criteria defined by a British Sustainable Voluntary Tool (BREEAM – Building Research Establishment Environmental Assessment Method),

where was defined a comparison between different conventional and sustainable solutions applied in a Shopping Centre located in Braga and during the construction phase.

THE METHODOLOGY

The methodology applied to accomplish the first objective was based on sustainable measures that were collected from different manuals and voluntary sustainable tools developed in different countries and which would be adaptable to the Portuguese reality. After data collection, the next step was to promote brainstorming sessions with building experts in different technical competencies (namely Architects and Engineers). In this phase the objective was the classification of specific measures for each building phase, and how it will be better framed, as well as the identification of the main responsible for its implementation. Thereby, the referred database, which is structured by categories, is also defined by different building typologies, project competencies and building construction phases.

About the second objective of this research, which is the methodology applied, was based on the application of BREEAM - the sustainable evaluation method - in one of the commercial buildings of the Company Chamartin Real Estate. The building project is a Shopping Centre called Dolce Vita Braga (DVB) and actually is in the construction phase. In this context, the analysis consisted on the definition of four scenarios with different sustainable levels (classification defined by BREEAM, namely PASS, GOOD, VERY GOOD and EXCELLENT), where were evidenced the economic and environmental results, as well as, their comparison between the studied buildings.

Besides the definition of different scenarios, was also featured that BREEAM criteria were primarily identified through four analysis groups.



This segmentation had the objective of identifying the criteria easily adapted and not adapted to the Portuguese reality, as well as, how to identify those which demand an additional investment cost when implemented in the project.

One of the key elements needed to carry out the analysis of the cost benefits for each one of the principles (criterion) was the use of a holistic analysis, whenever possible, not only examining the initial investment (cost of construction) but also other expenses, like operation and maintenance costs, incurred throughout the lifecycle of the building under analysis (considering a period of analysis of 20 years).

The selected criteria applied in the Sustainable Proposal were compared against the Initial Proposal (with conventional solutions). The economic assessment criteria used in this study were based on the following presuppositions:

- 5% discount rate used when calculating the NPV;
- 20 year analysis period;
- Annual inflation rate of 2%.

The results were framed according to the following indicators:

- Initial investment – this refers to the difference between the investment on the initial proposal and the investment applied on the sustainable proposal;
- Return on Investment (expressed in years) – period (years) that the promoter will have to wait to recover the investment made on the project;
- NPV (Net Present Value) – in a simple manner, this value is used to determine the net value of an investment at time 0 (date of investment) calculated based on the annual cash flows generated by the investment during a period of 15 to 20 years;
- IRR (Internal Rate of Return) – to measure the profitability of the project through the IRR implies obtaining a IRR (%) that is higher than the stipulated interest rate (stipulated at time of financing), in this case 5%.

The environmental indicators are expressed according to the reduction in energy and water consumption and the reduction of CO_{2eq} emissions.

RESULTS

In reference to the first objective, the work of gathering and criteria organization through different perspectives originated the GPS software (Management of the Sustainable Project), which is just for restricted use of the co-financing Company referred above. The referred tool became an important communication channel among the company's stakeholders, identifying, through each special project competencies, the sustainable measures to be accomplished in the different development phases of the building.

Concerning the second objective, was concluded through this research project that it was possible to obtain a better rating (from Good to Excellent) with relatively low financial investment, and significant environmental advantages. In the concrete case of the Dolce Vita Braga Shopping Centre, an additional investment of 7,61% over the initial cost of construction would allow the building to obtain a rating of Excellent. This amount would be rapidly recoverable, with a 15 year NPV two times greater than the amount invested. In relation to the environmental results, the reductions obtained in energy and water consumptions and CO_{2eq} emissions were quite reasonable, taking into consideration that the avoided consumption could supply the consumption needs of a significant number of European inhabitants.

AUTHOR BIOGRAPHIES



Luciana N. Jesus is a Doctoral Student at Minho University in Civil Engineering. She has two Post - Graduations by Minho University and Lusíada University (2002-2004), and a degree in Architecture (2002) by UFJF- MG Brazil. She is Independent Consultant. her e-mail address is: luciana.njesus@gmail.com

Manuela Almeida is Associate Professor at Minho University. She has a PhD in Mechanical Engineering (1995), a MSc in Thermal Engineering (1988) and a degree in Civil Engineering (1982) all by Porto University .