

Building's Rehabilitation towards sustainable behavior

Mendes da Silva, J.A.R.ⁱ, Ramos, Ana Ferreiraⁱⁱ

ⁱFaculty of Science and Technology

ⁱUniversity of Coimbra, Portugal

ⁱe-mail: raimundo@dec.uc.pt

ⁱⁱSuperior School of Technology

ⁱⁱPolytechnic Institute of Castelo Branco, Portugal

ⁱⁱe-mail: ana_amos@ipcb.pt

Key words: Sustainable development, rehabilitation, constructive traditions, sustainable construction

Abstract

To achieve a sustainable building's behaviour and preserve the environmental balance, three laws must be taken into account: (i) the resources' consume must not be faster than the rate at which nature can restock them, (ii) the creation of systems that consume maximum energy-quality and (iii) the maximization of the use of renewable and recycled materials. Therefore, the buildings' rehabilitation process must increase, instead of the proliferation of new buildings, in order to provide the sustainability of the built environment and minimize its ecological impact. The sustainable rehabilitation process is even more difficult in historical areas, in general sited in central zones of the urban mesh, with fragile comfort conditions and a rigid structure. In this paper, different evaluation tools for sustainable buildings were analysed in order to provide a set of evaluation criteria to be applied in the rehabilitation process in historical zones.

1 Introduction

The first step in a Sustainable Development way was taken with the creation of the Agenda 21 by the United Nations in Rio (1992) [1]. This document relates the main problematical aspects in the environment along the last 40 years. The several environmental accidents in the 60's gave origin to countless manifestations and to a new conscience about the world impact of the current use of land and resources.

The understanding of the natural sources characteristics, its limits and its scarcity, namely after the oil crisis in the early and late 70's, produced a new world overview. However, the need of changes in the world's life style is a huge challenge: how can it be possible to change the costumes of so different cultural, traditional, economic, political and social societies? There's no doubt that it has to be the local government to incentive and provoke this change in reality.

The impact of the civil engineer industry, at social and environmental levels, deserves a first and careful analysis. In the European Union, this industry contributes with 11% of the GDP, 26 million

employees and around of 40% of the total energetic consume. The “Agenda 21 on Sustainable Construction” [2] turns clear the guidelines to the civil engineer sector in face of the quite large number of agents in the process, namely since the industry activity of materials production, the use and maintenance of buildings, to, finally, its deconstruction and residues destination.

2 Sustainable Construction

The impact of the sustainable development has been subject of several intervention levels: global, regional and local ones, from the city to the housing buildings. This intervention must be carefully planned, not only in terms of new buildings and urban space, but mainly, at the built environment that urgently needs to be renewed and invigorated in order to promote less use of resources and less production waste.

It's possible to define sustainable construction as the creation and responsible administration of an environment of healthy construction, based in ecologic principles and effective resources [2]. The sustainable construction parameters lie in this principle and they converge to the minimization of natural resources consumption and garbage production, and maximization of the recycling process. This issue is extended to the building life cycle analysis and it includes the aspects related to the building's use and maintenance [2] [3].

The identification of a set of indicators that enable the evaluation of the building's performance - according to its use - is fundamental to evaluate and certify the applied sustainable strategies.

3 The Construction in Portugal

3.1 Context

One of the major principles to come into the sustainable way consist in identify the need, the potentialities and the deficiencies of every single market [1]. In this sense, a reflection upon the constructive framework in Portugal and its market characteristics is now performed.

Nowadays, Portugal possesses a unique situation because it registers high levels of construction, in a lower tendency when compared with other developed countries.

The difference in the impact on the environment registered in the developed countries and in the developing countries it's fundamental to understand which are the intervention areas that should be followed. Countries like Brazil present growth rates around 30, in cities like S. Paulo (in terms of official buildings).

3.2 Housing buildings increase

Fig. 1 presents the growth rate of new housing buildings in three different decades. In this figure is possible to establish a comparison between the new housing buildings level in Portugal and in other major EU countries and the United States. All these countries present a reduction of the new housing buildings number to 77% of what it used to be in the 60's. Countries like Italy present a 23% decrease of new housing buildings, the United States declines about 46% and Finland with a 52% reduction. These numbers emphasize a decrease in about 50% or higher, except in the case of Portugal that, in the last 30 years, present a decrease of only 23% [4] [5].

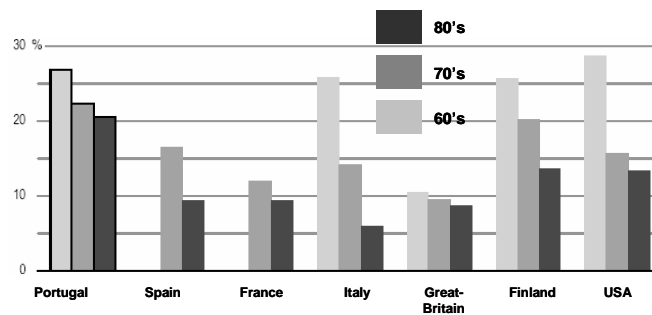


Figure 1: New housing buildings growth rates [5]

Underlying this fact, Portugal possesses the larger number of housing buildings *per* family, as shown in Fig. 2. When this value is compared with the reality of other countries, Portugal presents one of the highest indexes; only Spain has a higher value. This reality becomes difficult to understand when confronted with the economic performance of the country, which is, actually, passing through a profound crisis.

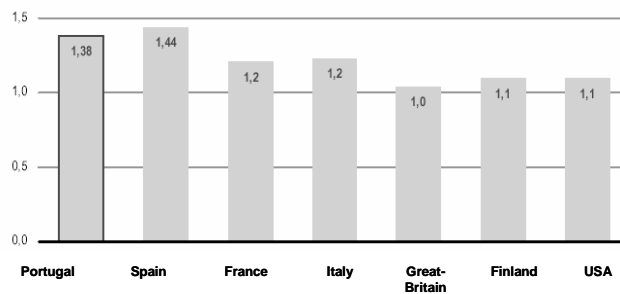


Figure 2: Number of housing buildings per family (2001)

3.3 Analyzing this frame

In order to turn simpler the correct understanding of the issue presented in the previous item, it becomes necessary to analyse the construction framework within the Portuguese territory.

In Portugal, the seasonal housing buildings are specially located in the North, Northeast and East regions. These regions, sited in the interior of the country, present huge difficulties of economic development and growth with very few market opportunities in order to guarantee the families' sustenance. Nowadays, they are rural areas, based in livelihood agriculture activity and with a very aged population. The younger inhabitants migrate to other regions, hoping to find new opportunities, namely to the more developed urban areas of the Portuguese coast. In such a way, this migratory wave leaves behind old constructions that, usually, are part of familiar patrimony, with very little real estate value due to the low demand of housing buildings in these regions.

These facts can contribute to understand the reality as putted before: the need of new housing buildings due to the migration process, which turns possible the financial effort on the acquisition of a new housing building in the coastal area, but keeping a second housing building in the interior provenience area.

4 Impact of Civil Construction Industry

4.1 Portugal overview

Portugal has been reducing the number of new housing buildings in the last three decades, although it is still one of the countries that have the highest percentage of new housing buildings. In this specific case, the housing buildings have doubled concerning the number of housing buildings in the 80's; these housing buildings are regarded as having low construction quality and they represent a massive load to the surrounding environment due to the correspondent amplification of the energy consumption, rising at a level of about 7% every year [5].

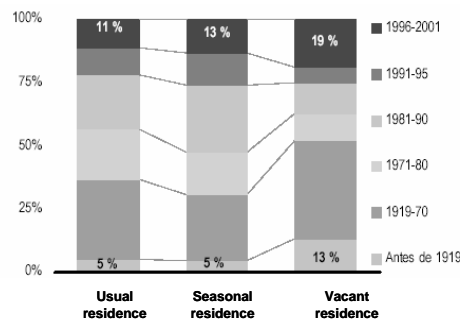


Figure 3: Housing buildings (2001) by occupation regime, according to the time of construction [4] [5]

Fig. 3 shows that Portugal is today, undoubtedly, a country with a high level of new housing buildings, where the construction sector is one of the most important and dynamic sectors of economic activity (in 2003, it represented 7,5% of the portuguese GAV and 9,2% of total employment).

4.2 Portuguese codes

It is important to relate that the greater part of the regulation in the construction sector, in the comfort area in the interior of the building, have appeared after the decade of 1990. Once in this analysis a great relevance to the question of the energy consumption is taken into account, is important to relate that regulation in this sector appeared in 1990, with all the difficulties of implementation in a sector without any tradition in these matters. This initiative had some objectives, as the reduction of the energy consumption, the incentive to the implementation of passive solar systems and the reduction of the pathologies in the buildings, namely in what concerns to the moistness [6].

These objectives had not been reached; even so the quality of the construction and the constructive solutions has suffered some improvements. Currently a revision of this regulation is being studied, directing it to the reduction of the indexes and to compel the implementation of constructive systems with better performance.

4.3 The housing building sector and the sustainable construction

Some initiatives have been related in this sector in order to find sustainable solutions for new constructions. These efforts are very punctual and they are normally used as strengths for real estate promotion. A country that intends to grow and to prepare its housing buildings park to a reality connected to lower energy consumptions and to the optimization of the alternative use of energy with improved constructive solutions, must think about the sector altogether, considering global solutions

stimulated by the government in order to make possible its implementation. This viability would be connected to the compulsive use of renewable energies, considering the existing housing buildings park, and in conditioning the new constructions to the use of passive solar technologies as obligatory solutions.

5 The Evolution of the Sector

Based in the analysis made for the construction sector in Portugal, is possible to state that the existing housing buildings amount constitutes a great concern and a challenge to sustainable development. The implementation of passive solar systems to new housing buildings is rather easy and it passes for formation and initiative. The work that is going to be developed, of which this article is an integrant part, it demonstrates the need of understanding the rehabilitation of the built park as an urgent inevitability [7] [8]. While today's constructions emerge in a new reality, with an implemented regulation scene, the doubling of the constructed park in the decade of 80 is a result of the need to, rapidly, solve the housing buildings lack in a context of low constructive and technical quality. These housing buildings constitute a stock of buildings with constructive characteristics that don't allow achieving acceptable levels of interior comfort without the aggravated energy consumption.

The sustainability in the construction sector market is closely linked to the rehabilitation of the constructed park as one of the major strategies for energy consumption reduction. Although the study falls on the physical aspects of the rehabilitation, the intervention at the building's level must be understood that amendments in consolidated urban zones have to respect all the existing social and cultural questions. The rehabilitation of structuralized areas constitutes a very delicate question because it deals with zones that possess its proper history, normally with a well-established cultural and architectural background. These interventions must, further than the improvement of the space as a physical factor, put back the area in the urban structure to where it belongs, producing its integration at various levels: social, cultural, economic and physical (this last one as target of the work).

6 Constraints to Sustainable Construction Implementation

The profound alterations in a consolidated market are extremely difficult and they only could be achieved for the governmental incentive (in a compulsory manner). Isolated initiatives, explored as a factor of real estate sales promotion, they aren't the solution for the attainment of increased quality, resulting in benefits in the reduction of resources consumption [2] [9].

To the implementation of these issues there are common problems which are characterized by the constructive tradition - that constitutes an obstacle. Among the more relevant questions we can find: the resistance of the status quo; deficient understanding of the problems; insufficient means of participation; backwardness of the market; insufficient data; lack of communication, lack of customers; politic instability.

In general, there are a series of factors that makes more difficult to make people realize and face a new reality. In this context, it's possible to enhance the backwardness of the market and the difficulty in accepting new forms of how to construct, the challenge to learn new techniques, to try new materials and to relearn concepts, producing a new construction scene. Therefore, the user assumes a preponderant role as a factor of change and a supervisor of the market in the search for the best constructive quality and final performance.

The political aspect constitutes a fundamental factor in the modification of the market, as a motivational and regulating element of this change. This factor is one of the pillars of the sustainable development, altogether with the social, economic and environmental matters. The fact of assuming

the politics as a main pillar it concerns to the decisional process and the recognition of the politic influence in all of the process.

7 Confront between Sustainable Construction and the Traditional Process

7.1 Main challenges

Among the main challenges that the construction market as to face, six aspects of extreme importance are now mentioned: education, recycle, life cycle, codes, resources and decision making process, as represented in Fig. 4.

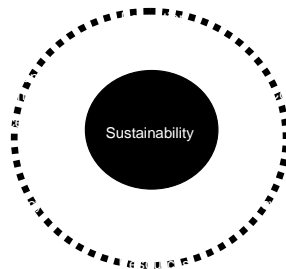


Figure 4: Main challenges to sustainability

The implementation of the sustainability process comprises the understanding of the building as an element capable to assume new aims that register low consumptions of resources and contributes for the recycling process - this last one is a fundamental link in the concept of sustainability.

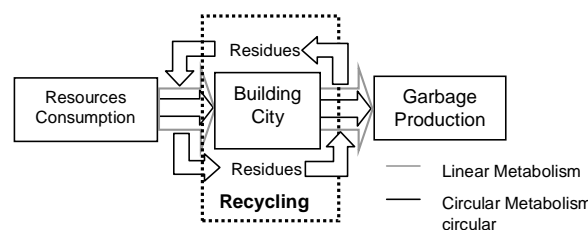


Figure 5: City and Building Metabolism (based on [10])

With this perspective the cities will go beyond, to a phase of less consumption, once part of the resulting garbage is re-entering as a resource in the course of the recycling process (Fig. 5). The same principle can be applied to buildings, even if consumption, production and recycling become part of the urban context.

Still, sustainability will have to be part of the decision making process, as a condition of the project's options and approval. In a sector that comprises so many agents and actors as civil engineering, it's important that this factor lies implicit in all the project phases – from the project options, organization and management to the construction, maintenance and rehabilitation activities.

It is fundamental the incentive to the investigation in this area of knowledge, as well as its integration in the scholar curricula, in order to define global concepts that start to incorporate the vocabulary of the technicians that are involved in the different phases of the constructive process and use.

The user still assumes a preponderant factor as motivator of changes in the market. The requirement for a high quality level and the conscience of the impact that the “bad construction” produces in the

environment, are key factors that allow the demand of better construction performance, a extended life cycle, durability e adaptability of the building to its needs. These requirements will be able to constitute essential factors and regulators of the real estate market. The conscience that people are entitled to “more and better” and that the environmental conscience started to be a factor of life quality and a guarantee of healthy environment legacy to our children constitute, without any doubt, an incentive to respond to the new market requirements.

To the government, as a intervening agent in this process, suits the responsibility to legislate better and more demanding norms, forcing the practical changes in the construction sector. The political power still possesses a fundamental role in the verification of the imposed norms fulfillment, compelling its implementation at all levels.

7.2 Evaluation of sustainability

Sustainability will have to be evaluated in order to realize if the objectives had been achieved; in this sense it’s necessary to understand this process and to analyze the decisions taken regarding a continuous improvement, trying to make more and better. Among these factors of evaluation and having in mind the object of our study, a series of parameters are suggested below, currently in development, in order to define the sustainable strategies to adopt (Fig. 6) [11] [12] [13]:

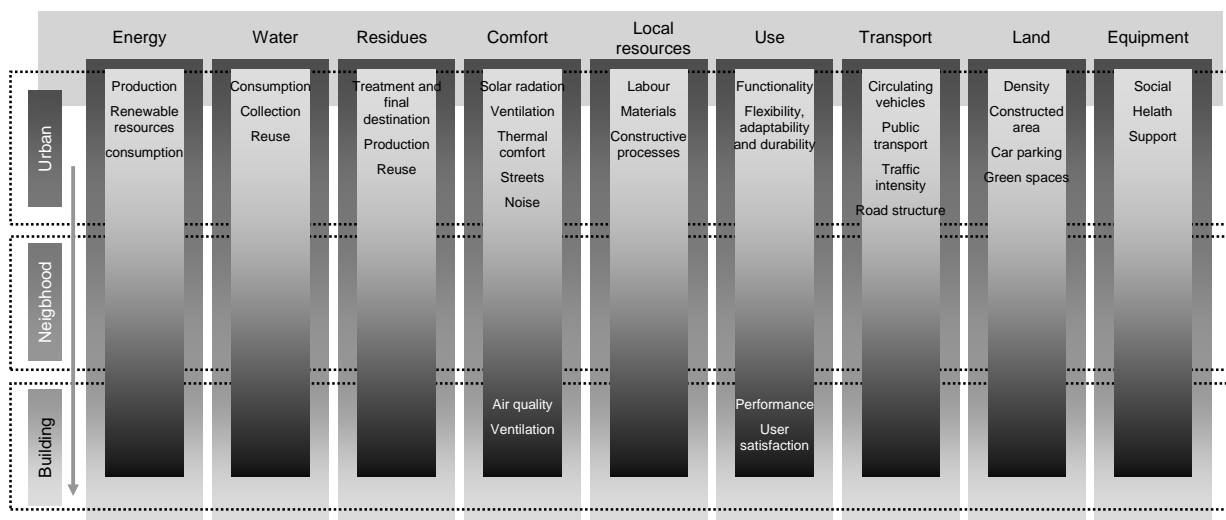


Figure 6: Evaluation of Sustainability - criteria

8 Conclusion

The analysis of the construction sector and its understanding constitute a fundamental factor to recognize the influence of both the politic power and the user. These two intervening agents of the process they are essential elements to motivate and to compel market modifications. These changes must occur in a global way and in wide scale so that it produces some sort of impact in the improvement of the quality of the exterior and interior space.

The effort that is demanded to the technicians, to the professionals of the civil construction, to the industry and to the product they are essential to produce profound transformations in a traditional market that has a great social and economic impact in all the European Union, responsible for about 26 million jobs, 11% of the GDP, 30% of the CO2 emissions, 40% of the energy consumption and 40% of the garbage production.

Education and public conscience must be a goal of an intensive effort so that the population in general understand the real dimension of the challenge that imposes the sustainable development way. This work it will be continued in the direction of the setting up of parameters allowing to evaluate the presented criteria, having always as background the urban rehabilitation, assuming, this way, the huge importance of the existent built park (the stock of housing buildings).

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