

SUSTAINABILITY: PRINCIPLE AT THE BASE OF THE ENGINEER'S FORMATION

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Summary

What today is considered as innovation, will become of routine in 2020. Therefore, there is the need to teach the future engineers to conceive and plan sustainable buildings. Sustainability must consider the following multiple aspects: energetic efficiency, the possibility of planning buildings to zero consumption, the sustainable use of renewable and not renewable resources, their recycle and the use of products deriving from other productive cycles and reusable for the creation of the building itself. For such aim it is necessary to introduce in the basic formation of the engineering planning student a multidisciplinary planning approach. This work is based on the results of a bioclimatic planning research carried out by the authors in communion with their own didactic experience in the course of Technical Architecture for Building Engineering–Architecture engineers. This work pinpoints the criteria and the contents that must be followed and introduced in the students' formative curricula, with the purpose of obtaining a designer able to plan and realize sustainable buildings. In the light of didactic experiences acquired in developing countries, this work also pays attention to the specific criteria that must be kept under consideration for the formation of engineers that will operate in such contexts.

Keywords: Sustainability, Engineer's formation

1 Introduction

Starting from 2020, with the directive 2010/31/CE, the European union will impose to its country members the construction of new buildings at nearly zero energy consumption. Therefore, it becomes necessary to introduce in the engineers' formative curricula, criteria regarding sustainability not only inherent to the aspects of energy efficiency, but also concerning all those natural resources consumption control aspects in all the phases of the building process. In the last years, the formative offer of engineering courses has increased in all European Countries, driven by the principle of the university autonomy and by the diffused perception that technological formation is a key factor for the development of a country's economic system and for the individuals' employment. This will be even more true if the formative offer will be able to adjust its own contents to market demands following, at the same time, the energetic policy of the European Union.

As a matter of fact, the demand for buildings at nearly zero energy consumption, with consequent reduced managerial costs, is very high. There has been an increased

awareness towards the environmental matter from which derives the need of decreasing the amount of waste produced and released into the environment and, simultaneously, of preserving as much as possible not renewable resources. All this led to the use of recycled and recyclable material even in the building process, contributing to a decrease of refusals destined to disposal and to a reduction in the natural resources consumption.

2 The contents in the formation

The engineer of 2020 that will operate in the building field, must have a multidisciplinary preparation so that his knowledge base can guide him towards the application of innovative methodologies. These have to be confronted both from a planning point of view and in the use of products and processes involving recycled material and recyclable building products. In order to reach the objectives listed above, it is strategic to adopt and apply the requirement method to the reading and planning of the Building System in order to satisfy the user's demands and to realise Zero Energy Buildings. The requirement approach is based on the classification of the user's demands and, in order to achieve its satisfaction, some requirements that drive the shift from statement of what is deemed necessary to technical and operational implementation must be individualized and imposed. The relationship demand – requirement – performance is applied to the Building System, that is a building thought as a complex system and analyzed by specific points of view, according to the problematics that must be studied and for which planning solutions must be identified. Such approach has methodological value because it allows a thorough analysis of the environmental contest, of the user's needs and it keeps into consideration of globality of the Building System. An example of the methodological planning path is illustrated in fig. 1.

The formative contents useful for the identification of the performance requirements are the following:

- Knowledge and usage of planning methodologies on building and urban scale that are able to optimally use the renewable resources present on site, such as sun and wind, limiting at maximum the appeal to equipment required for winter heating and the summer cooling;
- Knowledge and usage of innovative solutions integrated in the buildings, for the integrative and subsidiary function of the fittings. These must be able to use the natural resource of the solar energy so that the energetic consumption of not renewable resources approaches zero;
- Knowledge and usage of different software regarding simulations of indoor microclimate conditions, simulations and control of indoor optimum brightness, and simulation of outdoor wind speed and the determination of the coefficients of pressure in the building;

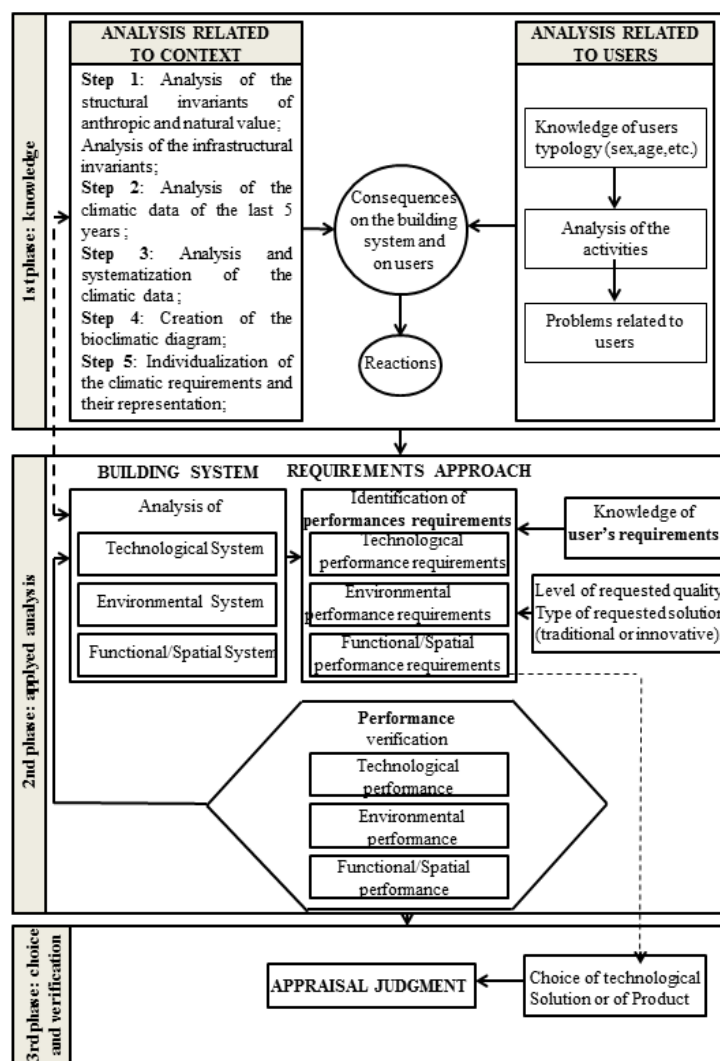


Fig. 1 Methodological pathway

- Knowledge and usage of intelligent technological solutions aimed to control the solar contributions for each climatic condition;
- Knowledge and usage of products that originate from other production cycles and that are usable in the building process with respect to the Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products and the EU Regulation 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonized conditions for the marketing of construction products and
- Deep knowledge of the problematic related to the applicability of the construction products originated from recycled refusals and of its different market, normative and informative aspects.
- Knowledge of the length of the products' useful life and elaboration of maintenance plans;
- Application of interchangeability concepts conjugated with the useful life of the different constructive elements;

- Knowledge and usage of local resources, for instance in the case of planning in developing countries; when these do not suit the requirement terms, it must be known how to find alternative technological solutions as a results of technological hybridization. Building technologies constitute a field for endless possible hybrid choices, where what is traditional and local, is adopted when it can be useful, and integrated, improved and transformed with techniques and knowledge deriving from other realities.

3 Conclusions

In this work, the necessity of competences, at different levels, is underlined: methodological, project and on a multidisciplinary base. There are many disciplines involved that can belong to different sectors of the industrial, chemical and civil engineering.

The analysis of the methodological path (see figure 1) underlines, in a first acknowledgement phase, the importance of the environmental context, and in a second phase, the importance of the application of the sustainability criteria especially in the choice of the requirements.

The application of the method facilitates the development of an analysis process finalized to the discovery of innovative planning solutions, for example buildings to zero consumption.

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