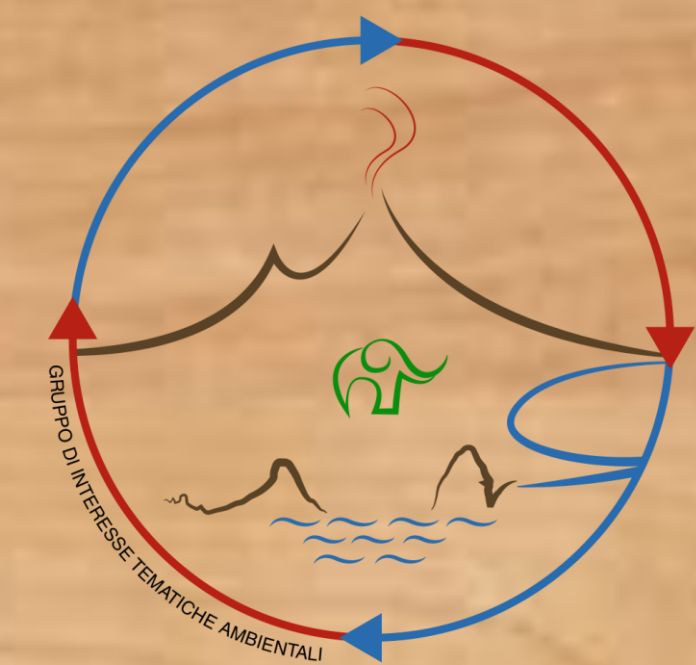


COST AND BENEFIT ANALYSIS AS A TOOL TO SUPPORT DECISIONS ON ENERGETIC STREAMLINING IN THE GREEN BUILDING SECTOR



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Introduction

The building sector is considered capable of meeting new needs in terms of energy saving and climate changes. This can be shown by the percentage of energy consumption in the building sector related to many countries, such as the USA, Europe and Russia: 40% in 2008 (www.dime-eu.org) and 30% in 2016. The demand for residential and commercial buildings and higher standards of living are rising, entailing a greater consumption of energy. Among energy-intensive activities, electricity for heating and cooling (Arvey, 2009) should be considered to make better decisions in terms of energy saving. Therefore, since the energetic impact of global urbanization is due to high levels of urban population (expected to grow from 47% of the total in 2000 to 70% in 2050) (www.iea.org), the growth of single-person households should be encouraged. The main aim of this case study is to analyse in terms of costs and benefits the wooden building structures, analysing the Sicilian firm "Prefabbricati Martelli Salvatore & C.", specialized in the production of wooden structures. Wooden buildings are considered to be more expensive than other kind of buildings, thus people generally back out from investing in this market, instead the main factors causing these costs are: architectural design time, with the support of Computer Aided Design (CAD); engineering design time, with the support of Computer Aided Engineering (CAE); the relation between demand and supply; the cost of materials.

Case study

The Sicilian building sector can boast significant achievements in the field of environmental care and awareness. As a matter of fact, just looking at the firms belonging to this sector is enough to become aware of the great attention they reserve to the environment, such as the Prefabbricati Martelli. This small firm, situated in Bronte (CT), deserves mentioning in this context, first of all because of the environmental certifications it has. The company is nowadays specialized in the production and restoration of wooden structures, whatever their dimensions are. Moreover, it offers consultancy services and produces innovative buildings, revolutionizing the concept of living so that it can fit the one of sustainability. As far as certifications are concerned, the Prefabbricati Martelli deserves to be mentioned because of the great attention paid to this unique symbol of awareness and responsibility. It has: the SOA certification, category OS32 to guarantee the presence of quality in the execution of public works; the UNI EN ISO 9001:2015 to guarantee the quality of its structural elements; the UNI EN ISO 14001:2015 to guarantee the respect of the environment, to underline its real commitment and the desire to control and protect the environment, looking for the continuous improvement



In order of comparison, the X-lam panel, the concrete panel and the punctured brick panel

Results and discussion

Analysing the stratigraphy of a wooden structure made by Prefabbricati Martelli, using the Cross Laminated Timber (CLT) System (the so-called X-lam panel), it is possible to show that the thermal and acoustic insulation is relevant, due to the low specific weight of materials. The analysed wooden wall has the following stratigraphy: plasterboard sheet, fiber sheet, rock wool, with a density of 70kg/m³ and 50mm thick, X-lam panel 95mm thick, rock wool panel with a double density equal to 155-80 kg/m³ and 160mm thick, final panel. The thermal performances of the wall's stratigraphy show that the thermal transmittance is equal to 0.14 W/m²K and assume significant values if compared to other construction materials. The thickness of the wall is 34 cm. To reach the same thermal result with brick (traditional building sector), it is necessary to reach a thickness of 55 cm. The comparison among three different constructive solutions (X-lam, concrete and punctured brick one) with different leading elements but the same thickness and the already mentioned stratigraphy has shown that the X-lam panel is characterized by performances better than the others (Figure). As a matter of fact, the thermal wave takes on 16 hours to pass through the X-lam panel, 12 hours to pass through the concrete and 13 hours to pass through the punctured brick. Moreover, the first one has a transmittance of 0.14W/m²K, the second one of 0.16 W/m²K and the third one of 0.15 W/m²K. Consequently, a house built with the X-lam system is warm in winter and fresh in summer.



Materials and methods

The Cost-Benefit Analysis (CBA) was developed for the first time by the French engineer Jules Dupuit in 1848. The main objective is both to verify the effectiveness of any investment opportunity and give a basis for making comparisons with other offers. This method allows all the positive and negative aspects of the analysed projects to be identified and quantifies them in monetary terms. During the evaluation, it is necessary to consider direct and indirect values. The former directly derives from the project, the activity or the investment considered for the application of the CBA. The latter derives from indirect effects that the activity causes: for this reason, it is harder to find and quantify them. The indirect costs are often connected with environmental matters: it could be hard to give a monetary value to them. In order to evaluate indirect costs, it is possible to consider the potential damage caused to one or more environmental resources, and so, their marginal variation. Thus, it is possible to quantify the extent of the loss of benefits. In an alternative to this indirect method, further methods can be implemented, such as: the contingent valuation, the hedonic pricing method, the travel costing method and the opportunity cost method.

Concluding remarks

Considering the advantages already mentioned, there is no reason why people should not adapt to these amazing changes: wooden buildings are the best example of green structure, since wood is a natural element. Recently the tendency to choose buildings with high thermal performances has caused a cultural change, related to the spread of wood in the building sector, combining excellent thermal performances with high quality. Moreover, it has been shown that the new wooden buildings need less materials to produce better performances than traditional ones. A well-built wooden structure is excellent for satisfying people both in winter and in summer.