Implementación de criterios de sostenibilidad económica, social y medioambiental para la selección de la cubierta en edificios de luces medias.

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ABSTRACT

The choosing of an adequate structural typology for a building in its design stage is a complex problem due to different tangible and intangible factors and the multiple alternatives that exist.

Nowadays sustainability, defined by triple bottom line englobing economic, social and environmental criteria, gains more and more relevance. However, in the construction sector, companies keep applying tools based on traditional bottom line referenced to one metric (financial performance or cost), to evaluate projects, ignoring, or underestimating, environmental or social values and forgetting about long-term impact on quality life of present and future generations. Moreover technological advances allow the development of new industrial solutions with a higher productivity rate and a lower impact, but construction is a sector that struggles to innovate and traditional solutions are still often applied without considering the solutions provided by industry.

Multicriteria methods are being set higher each day as key tools, capable of incorporating environmental and social matters to the decision- making process. Tools using multicriteria evaluation to assess sustainability of finished buildings and sustainability of a certain type of structures already exist. The objective of this thesis is to develop a hybrid method of multiple criteria, combining AHP with the Delphi method and the VIKOR technique, to apply economic, social and environmental criteria in the selection of a structural typology for medium spanned buildings, taking into account both the construction and the operation stages. Using AHP, a hierarchical structure is defined from judgements emitted by a panel of experts, with the following levels: goal, criteria, sub-criteria and alternatives. From this hierarchy, also following AHP and with the judgements emitted by the panel of experts, a priority vector of the sub-criteria with respect to the goal and the priority vectors' matrix of the alternatives with respect to each sub-criterion are obtained. The Delphi technique is used in order to handle the surveys in which experts emit their judgements, until consensus is reached. From the priority vectors, applying the VIKOR method, the compromise solution is reached, being this the closest to ideal.

For the elaboration of this tool, tangible criteria, like manufacturing cost, transport and assembly cost, emissions impact and embodied energy and operating energy; and intangible criteria like roof maintenance cost, aesthetic, satisfactory fireproofing and the use of local materials, have been considered.

The specific case of a 17 m span sports hall in a recreational level has been studied. Five alternatives have been evaluated: both of the traditional Prefabricated concrete and purlins and Steel lattice and purlins options and other three applying technological innovations developed by the building industry: Prefabricated concrete and self-

supporting curved system, Self-supporting curved system and Laminated wood and purlins, being the Self-supporting curved system roof option obtained as the optimal solution. Lastly, a computer tool is designed in which, for any medium spanned building, introducing data from companies offering the five studied alternatives, a compromise solution is obtained, taking into account sustainability criteria.

The developed tool will serve as help towards the choosing of a structural typology, applying sustainability criteria for the roof a medium spanned building.