Shelter Selection with AHP Making Use of the Ideal Alternative

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INTRODUCTION

One technique with higher occurrence in the literature is the Analytical Hierarchical Process (AHP). However it is a technique widely criticized. Two of these critiques are: 1.The dependence of the value achieved by an evaluated alternative, the number of alternatives being evaluated and 2.The impossibility to recognize the quality of an alternative selected by the method.

To solve this second problem, a variant of the AHP was generated: The Ideal Alternative (IA), which consists of resolving problems making use of AHP but including in the analysis an IA. To illustrate what it is and how to use the IA will take a social problem, the selection of shelters, where you can locate the affected population in case of catastrophe.

From the above, the main contribution of this article is show how to choose a shelter, using the IA to gain insight into the true quality of alternatives evaluated through AHP.

As methodology to reach the proposed objective it will be used the Integrated-Adaptable Methodology for the development of Decision Support System (IAMDSS, in Spanish, Metodología Integradora-Adaptable para desarrollar Sistemas de Apoyo a las Decisiones [MIASAD]), which has been presented in different works of investigation (García, Hernández, & Hernández, 2010, 2011; Hernández, García, & Hernández, 2010) and of which, given that the methodology promotes it, they are taken some of their essential steps:

1. To define the problem that, than indicated in the contributions of this article, is to show how to choose a shelter, using the IA to gain insight into the true quality of alternatives evaluated through AHP,
2. To prepare the first prototype, where the users of the final product were identified, that is to say the readers of the article. Who will be applicators or not of AHP, that desires to do a better use of this technique, to which we add all those interested in helping to solve social problems. It also established the structure of the article, which besides the introduction consists of three main chapters, the last and main one divided into three subchapters,
3. Obtaining data, in this case on AHP, DEA, TOPSIS, the use of the IA and applications of these techniques in a catastrophe situation,
4. Establishing the alternatives, that would be the different options that can follow to illustrate the use of the IA,
5. Evaluate alternatives, considering the facility of presenting and to show the use of the IA in AHP,
6. Selecting the best alternative, as product of previous evaluation process, and based on the secondary objectives, tacit or explicit, being considered,
7. Implementing the best alternative, illustrate through simple examples, preferably hypothetical, for more generality, the use of the IA in AHP and
8. Establishing controls, Establishing the mechanisms, probably indicators, that permit to recognize if the alternative selected, continues being valid in the course of the time.

DOI: 10.4018/978-1-4666-5888-2.ch193

With regard to limitations and reaches, in this article no work of field will be carried out, but the illustration of the use of the IA in AHP, from a pair of previous work (García, Hernández & Hernández, 2010; Hernández, García & Hernández, 2010).

BACKGROUND

One technique with higher occurrence in the literature is the Analytical Hierarchical Process (AHP) (Al-Harbi, 2001; Güngör & Arikan, 2000; Limmeechokchai & Chawana, 2007; Millet & Schoner, 2005; Popovic, Milosevic, & Kuzmanovic, 2012). However despite having many followers this technique also has detractors and critics (Barzilai, 2008; 2010; Cho & Cho, 2008; Kwiesielewicz & Uden, 2004). Two of the main reasons why many researchers in the area of decision-making do not make use of AHP are: 1.The dependence of the value achieved by an evaluated alternative, the number of alternatives being evaluated and in some cases, a result 2.The impossibility to recognize the quality of an alternative selected by the method.

To solve this second problem, a variant of the AHP was generated, which takes a part of the philosophy of the techniques Data Envelopment Analysis (DEA) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS): The Ideal Alternative (IA), that consists of resolving problems making use of AHP but including in the analysis an IA.

To illustrate what it is and how to use the IA will take a social problem that certainly is a multicriteria problem. This is the selection of shelters, where you can locate the affected population in case of catastrophe. Next some comments on DEA, TOPSIS, Shelters and AHP, then make.

Data Envelopment Analysis (DEA) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The DEA whose origins are located to ends of the seventies (Mavrotas & Trifillis, 2006) it was introduced by Charnes and collaborators in 1978 (Cook & Seiford, 2009) and it was developed to offer a greater efficiency in processes with multiple entrances and multiple exits. As indicated *Wu et al. (2006)* DEA handled through linear programming measuring the relative performance of the Decision Making Units (DMUs). The original idea behind DEA is to identify the best practices of a comparable set of decisions. Among the main variant of DEA, Cook and Seiford (2009) upon being referred to models of a single level and of multiple levels.

Despite many points of agreement between Multicriteria Decision Analysis (MCDA) and DEA, its different methods developed in independent form and it was only at the end of the last century (Mavrotas & Trifillis, 2006) that DEA began to be considered a multicriteria model. Since the Decision Making Units (DMUs) of the DEA, began to be worked as alternatives.

Just as indicate Mavrotas and Trifillis (2006) in DEA each one of the alternatives is evaluated using the most favorable set of weighs through self-evaluation. The process is repeated and a square matrix is obtained in whose diagonal the self-evaluations of the alternatives are obtained and out of the diagonal approximations to these averages according to the other alternatives. The final evaluation of each alternative is obtained through the average of each column.

As for the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) (Chen & Tzeng, 2004; Jahanshahloo, Lotfi, & Izadikhah, 2006; Mansar, Reijers, & Ounnar, 2009), it is based on obtaining the alternative that more approach the ideal alternative, For it considers the positive ideal alternative and the negative ideal alternative. The alternative to be chosen will be that upon resolving the model approaches more to the positive ideal solution and at the same time move away more than the negative ideal solution.

Nevertheless in this article not greater emphasis to the complexities math will be done neither of DEA neither of TOPSIS, but it will only be used from these techniques the philosophy to do comparisons against the best alternative. For this work the Ideal alternative (IA), it is identified to a greater extent with the TOPSIS, although in this case the alternative will be chosen only pursuing to be near of the positive ideal alternative and without taking into account the negative ideal alternative. By which in this article will work itself with a completely ideal alternative. Understanding as ideal alternative the one exposed by Loken (2007, p. 1589) "an ideal solution is a theoretical solution where all the criteria have been respectively maximized or minimized" or as they indicate Jadidi et al. (2008, p. 106) "the ideal solution is composed of all best