Matrixes of Weighing and Catastrophes

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ABSTRACT

An easy to apply multi-criteria technique is the Matrixes Of Weighing (MOW), but many of the professionals that use it, in their respective fields, do it in intuitive fashion. In this regard, applications are rarely reported in specialized literature, which explains how few references exist about them. One of the application areas for MOW is the handling of catastrophes, in particular the pre-catastrophe and post-catastrophe phases where a series of problems are usually handled which solution leads to a choice, which could be done by using multi-criteria techniques. The objective of this investigation is to present the MOW with multiplicative factors, and showing their application in the pre-catastrophe phase, when choosing possible shelters and in the post-catastrophe phase, by aiding to hierarchies which infrastructures to be recovered after a catastrophe.

Keywords: Catastrophes, Group Decisions, Infrastructures, Matrixes Of Weighing (MOW), Multi-Criteria Models, Multiplicative Factors, Resource Distribution, Shelters

INTRODUCTION

The contribution of this work is mainly focused in establishing the essential concepts on Matrixes Of Weighing (MOW), to present its variants and how them can be used for group decision making, simultaneously presenting its applicability in decision support during a catastrophe, particularly in the pre and post catastrophe stages.

Of all the above the main objective of the investigation can be established, which is: To present the MOW with multiplicative factors, and to show their application the pre-catastrophe phase, when choosing possible shelters and in the post-catastrophe phase, by aiding to hierarchies which infrastructures are to be recovered after a catastrophe.

From this main objective, two specific objectives arise: Presenting the MOW, its variants and how they can be used in group decision making and presenting how this MOW can be used to aid the decision making when catastrophes occur.

To achieve this main objective and the specific objectives, it will be used as methodology the scientific method to solve problems, or applied to research operations (Hernández & García, 2010; Hernández, García, & Hernández, DOI: 10.4018/jdst.2011010102

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2009), in which, instead of proving hypothesis, a series of steps are followed:

To define the problem, as indicated in the objectives is to present how the pre and post catastrophe phases can be aided by the MOW.

Searching for data, particularly on aspects related to pre and post catastrophes and on MOW.

Establishing alternatives, meaning the different models based in MOW, which can be used for supporting decision making in case of catastrophes.

Evaluating alternatives, consisting in the feasibility of the proposed alternatives to achieve the desired objectives.

Selecting the best alternative, based on previous evaluations and secondary objectives, whether tacit or explicit.

Implementing the best alternative, in this case done by an hypothetical case of shelter selection and infrastructure to be recovered hierarchy, when affected by a catastrophe and establishing controls that would be a mechanism to recognize if the proposed models remain current with time.

As results there will be two examples of how to use MOW on catastrophes, one for the selection of possible shelters, and other to hierarchies the order in which the affected infrastructure by the catastrophe should be recovered.

PRE AND POST CATASTROPHE

In this work, following Noji (1997) catastrophes will be defined as the result of an important ecological rupture of the relation between human beings and their environment, by sudden severe event (like an earthquake) or slow (like a drought) of such magnitude that the struck community will need extraordinary efforts to face it, often with external aid or international support.

The terms catastrophe and disaster, in this work, would be used as synonyms, and unless it is necessary, catastrophe will be used in general, without clarifying if they are caused by man or by nature.

Although there are other focuses (Cutter, 2003; Hsu, Wu, & Lin, 2005) a generally accepted scheme is to divide the catastrophes, whether they are of natural origin or caused by man, in three great phases: The pre-catastrophe, the catastrophe itself and the post-catastrophe.

Models, including mathematical models have been used to explain the catastrophes (Makowski, 2009; Yahaya, Ahmad, & Abdalla, 2010; Zhou et al., 2009) and to give support before, during or after them (Frysinger et al., 2007) and many of these models have been integrated to decision support systems (DSS) Hernández & García, (2010). Even though support systems to decision making could be of great use during a catastrophe (Borysiewicz, Potempski, & Galkowski, 2001; Gadomski et al., 2001; Mendonça, Beroggi, & Wallace, 2001; Sanders & Tabuchi, 2000) there is also a considerable value for them in the pre-catastrophe phase, when no event that caused an important rapture has occurred, but the population is preparing for such event, especially those that had been determined as possible shelter, as in the post-catastrophe phase, when the event has already occurred and the goal is to recover, at least, the life conditions that existed before the catastrophe.

In particular, in this work two aspects are paid special attention, the pre-catastrophe case, in the selection of possible shelters to which the affected population could be directed, and the post-catastrophe, in the order to be recovered the infrastructure damaged by the catastrophe.

MATRIXES OF WEIGHING

As indicated Matrixes Of Weighing (MOW) is one of the multi-criteria techniques simpler to implement and to use. As its name indicates, the MOW are no more than a numerical adjustment of rows and columns, as it is shown in Figure 1. But although extremely used, as it is indicated in Hernandez & García (in press), there are not many direct references of them and the
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