

# Chapter 22

## Novelty on the Matrices of Weighing

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### ABSTRACT

*This chapter relates some social aspects, such as playfulness, customer service, and citizen safety with one of the simplest multicriteria techniques to implement, matrixes of weighing (MOW, matrices de ponderación [MDP]). Taking as starting point the work matrixes of weighing and catastrophes, a brief review is made of the MOW, highlighting new applications of the same, as well as new concepts that have emerged from its use. The objective of this work will be to present some applications of the matrixes of weighing, while explaining what they are and how they apply, the multilayer matrix of weighing with multiplicative factors (ML-MOWwMf). To achieve this general objective and secondary objectives, this chapter will make use of the integrated-adaptable methodology for the development of decision support system (IAMDSS [MIASAD])*

### INTRODUCTION

To beginnings of the second decade of the XXIst century, it was commented, in the work *Matrixes Of Weighing and catastrophes* (Hernández, García & Hernández, 2011), that the *Matrixes Of Weighing* (MOW [MDP]), although, undoubtedly, one of the multicriteria models, simpler to implement, does not produce many quotations in the specialized literature. They may even be confused with other decision making methods, which make use of matrices, as is the case of the linguistic decision matrix (Xu, Wu & Zhang, 2014; Wu, Xu & Xu, 2016), or the meta-matrix with which she works Gaspars-Wieloch (2017), or the extreme case of Chow et al. (2015), who mention the transition matrix, the stochastic matrix, and

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the perturbation matrices, but when they use the abbreviation MDP, are referring to Markov Decision Process and not to Matrixes Of Weighing (MOW, Matrices De Ponderación [MDP]).

Different is the situation in relation to the decision matrix presented by Jassbi, Ribeiro & Dargam (2014), which in its structure coincides with the MDP, differing in the management and subsequent use made by their authors. A similar situation occurs in the work of Li, Kou & Peng (2016), where the initial individual decision matrix practically coincides with a MDP, only that it follows another series of steps, including fuzzy logic, which leads to very different results.

In recent years, in the sense of missed appointments and cross quotes, the situation has not varied much, however, if new possible applications of the MDP are found, as well as new ways of expressing them.

This paper discussed the Matrixes Of Weighing with multiplicative factors (MOWwMf [MDPcFm]), which had already been mentioned in the work of Hernández, García & Hernández (2011) and are discussed the Multilayer Matrix Of Weighing with Multiplicative factors (ML-MOWwMf [MDPcFm-MC]), which have been presented in more recent works (García et al., 2017; Hernández, García & Hernández, 2012; Jeney, 2014).

At the same time comments are made on MDP applications in different fields of human endeavor, such as the Sports fantastic leagues (SFL [LFD]) (Hernández et al., 2014), the location of vehicles to protect the population (García, Hernández & Hernández, 2014) and in the effects, that can have on the citizens the control of inventories (García et al., 2017).

From the above the objective of this work is to present some applications of the Matrixes Of Weighing, while explain what they are and how they apply, the Multilayer Matrix Of Weighing with Multiplicative factors (ML-MOWwMf).

In pursuing this overall objective, the following specific objectives arise:

Present an update of the Matrixes Of Weighing (MDP), including a discussion of the Multilayer Matrix Of Weighing with Multiplicative factors (MDPcFm-MC).

Examine some situations where MDP can be useful: participate in Sports fantastic leagues (SFL [LFD]), Location of vehicles to handle emergencies (LVHE [UVAE]) and to face measures that affect the control of inventories (IC [CI]).

Construct three MDPcFm-MC to solve, each one, of the previously mentioned situations: the LFD, the UVAE and the CI.

## **Methodology**

In order to achieve the general objective and the specific objectives arising from it will use, 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, mainly for its flexibility, has been shown to be very useful, to complete research in different fields of knowledge (García, Hernández & Hernández, 2014; Jeney, 2014; Schwarz & Schwarz, 2015; Schwarz et al., 2016).

Similar to what was done in other works (García et al., 2017; Hernández, García & Hernández, 2011; Jeney, 2014; Schwarz & Schwarz, 2015), for this investigation the following steps were followed:

1. Define the problem, which as highlighted in the objectives is to present some applications of the Matrixes Of Weighing, while explain what they are and how they apply, the Multilayer Matrix Of Weighing with Multiplicative factors (ML-MOWwMf [MDPcFm-MC]);

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