USING THE MULTI-CRITERIA ANALYSIS (MCA) FOR YES-NO TYPE DECISION MAKING

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The first part of the paper presents the valences of the multi-criteria analysis. Other types of unconventional applications are presented. The second part of the paper presents a concrete application of Multi-Criteria Analysis in the case of a yes-no type decision making.

Generally, the Multi-Criteria Analysis technique is useful at compiling classifications, **at the same time quantitative and qualitative**, for some variants of: products, objects, methods, models, apparatus, structures, creations etc.

A first valence would be that the result of such an analysis orders the variants based on a score value, scientifically established.

The classifications, in a great measure, have a high degree of subjectivity and in most cases refer only to the qualitative aspect. The Multi-Criteria Analysis technique gives, from the point of view of the user, largely objective results (in other words, this technique makes the results mostly objective). For example, in the case of choosing what car to buy, the results would be quite different for a person that is financially well-off and another that is not, even if the used criteria and the regarded vehicles are the same. Therefore, **a second valen**ce would be the high degree of objectivity of the results.

A third valence: with such an analysis "the incomparable can be compared". In this direction in [BOC2003, p. 251-258] or in [www01], an example is given of a classification of the first best 10 people in art, respectively science, in the world, a task that seems impossible at a first look (because those subjected to the analysis have worked in different areas and times). Within a doctorate thesis there can be compared methods (of calculus, measurement, evaluation, quantification, investigation, analysis, synthesis etc.) of a completely different nature.

In a first phase, the method presumes establishing a set of criteria by which the analysis will be made. All criteria have to be found, not only those that are considered to be important. Since every criterion will contribute with a certain weight factor to the analysis, it is important that the minor criteria are not neglected. This consideration gives additional value to the Multi-Criteria Analysis, because most of the other similar techniques that are used, many of the less important criteria are not taken in consideration.

In a second phase the weight factor for each criterion has to be established. This technique doesn't estimate the weight factor for the criterion, it calculates it. For the calculation of the weight factors all criteria are compared against each other, but the comparisons are made by comparing only two criteria at a time. A criterion compared to another may be: either more important, of the same importance or less important than the other. The ordering of each 2 criteria into one of these 3 comparative categories, that are strictly logical and extremely simple to achieve, make up **the fourth valence of this analysis**. Afterwards, the weight factors are calculated (with a detail modification introduced by the author) according to the "Frisco" formula, proposed by a creative group from San Francisco U.S.A. The formula was initially created as an empirical one, but thousands of analyses detailed in literature, and also those performed at the University "Transilvania" from Braşov, confirmed that the formula is correct.

The third phase is the evaluation of the regarded variants. One by one each criterion is taken and exclusively through its prism marks from 1 to 10 are awarded to each

variant. The same mark can be awarded for 2 or more variants, if the author of the analyses considers it. The evaluation with 10 marks and through the prism of only one criterion at a time for all variants is also concluding, fine tuning the results, these is **the fifth valence** of the Multi-Criteria Analysis.

Finally, in an single table, the mark are multiplied with the score of the weight factors and summed up for each variant separately. The ordering of the variants by these scores leads to a classification that is concomitantly quantitative and qualitative.

The Multi-Criteria Analysis may also be used in other, more unconventional applications:

- Establishing the order in which investments are to be made in a certain place. In this case the variants are actually the investment types, broken down in work types.
- Choosing the most adequate firm to equip, to set up, to collaborate with an interested beneficiary. In this case, the variants are represented by the firms that have shown interest and intent.
- Establishing the members of a jury, if more have manifested the intent than the available number of places. Here, the variants are all the interested people.
- YES – NO type decisions etc.

In this paper an approach is shown for the Multi-Criteria Analysis when a YES – NO type decision is taken in consideration. In this particular case, only two variants are taken in consideration: the YES variant and the NO variant. In every day activity, there are numerous situations when the decision is reduced to a YES – NO type:

- The change, looking for a new job (variant YES) or staying at the current work place (variant NO).
- Making an investment (variant YES) or not making it (variant NO).
- Moving to a new place (variant YES) or staying at the current one (variant NO).
- Modernizing (variant YES) or keeping unchanged (variant NO) a certain: product, method, apparatus, building, ambient etc.

Generally, such problems are solved by gathering "for" and "against" arguments and weighting them against each other. A much more complex scientific approach is through the Multi-Criteria Analysis. Following, the example of changing or not changing the job is given. For this very common problem, some general criteria can be regarded, such as:

- Salary = SA.
- Stress Factors = SF.
- The problem of transportation to the working place = PT.
- Professional perspective = PP.
- Maintenance expenses = ME.
- Seriousness of the firm = SF.
- Facilities, such as trainings = FA.

The relations between criteria, from the point of view of the author are:

Line of the criterion	Correlation (value)	Column of the criterion
The salary is	more important than (**= 1**)	stress factors
The salary is	more important than (**= 1**)	the transportation issue
The salary is	of the same importance as (**= ½**)	professional perspectives
The salary is	of the same importance as (**= ½**)	maintenance expenses
The salary is	more important than (**= 1**)	the seriousness of the

The salary is	more important than (= **1**)	firm other facilities
The stress factors are	of the same importance as (= **½**)	the transportation issue
The stress factors are	of the same importance as (= **½**)	professional perspectives
The stress factors are	more important than (= **1**)	maintenance expenses
The stress factors are	more important than (= **1**)	the seriousness of the firm
The stress factors are	more important than (= **1**)	other facilities
The transportation issue is	less important than (= **0**)	professional perspectives
The transportation issue is	of the same importance as (= **½**)	maintenance expenses
The transportation issue is	less important than (= **0**)	the seriousness of the firm
The transportation issue is	more important than (= **1**)	other facilities
The professional perspective is	of the same importance as (= **½**)	maintenance expenses
The professional perspective is	of the same importance as (= **½**)	the seriousness of the firm
The professional perspective is	more important than (= **1**)	other facilities
The maintenance expenses are	less important than (= **0**)	the seriousness of the firm
The maintenance expenses are	more important than (= **1**)	other facilities
The seriousness of the firm is	more important than (= **1**)	other facilities

With the correlations above, the weight factors γ_i result:

	SA	SF	PT	PP	ME	SF	FA	γ_i
Salary = **SA**	½	1	1	½	½	1	1	**4.857**
Stress factors = **SF**		½	½	½	1	1	1	**2.889**
Transportation issue = **PT**			½	0	½	0	1	**0.923**
Professional perspectives = **PP**				½	½	½	1	**2.889**
Maintenance expenses = **ME**					½	0	1	**1.333**
Seriousness of the firm = **SF**						½	1	**2.200**
Other facilities = **FA**							½	**0.118**

Afterwards, the following marks are awarded, also strictly from the point of view of the author:

	YES	NO
Salary = **SA**	7	10
Stress factors = **SF**	8	3
Transportation issue = **PT**	10	2
Professional perspectives = **PP**	8	8
Maintenance expenses = **ME**	10	1
Seriousness of the firm = **SF**	10	3
Other facilities = **FA**	5	5

The final results, in the form of a diagram, are given on the last page.

As a result the YES option acquired 125.375 points and the NO option only 90.717 points. Therefore, exclusive from the perspective of the author of the comparison, the

present Multi-Criteria Analysis can lead to the correct and scientific decision of changing the current job.

Bibliography:

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[www01]   http://webyn.unitbv.ro/ Structură – Departamente – Doctorat – Cursuri – Semestrul I – Cursuri 2007/2008 – Creativitate si Inventica (prof. dr. ing. Serban BOBANCU) – Suport curs: format .pdf (Cap. Analiza multi-criterială avansată, Cap. A5) – analiza multicriteriala .ppt.
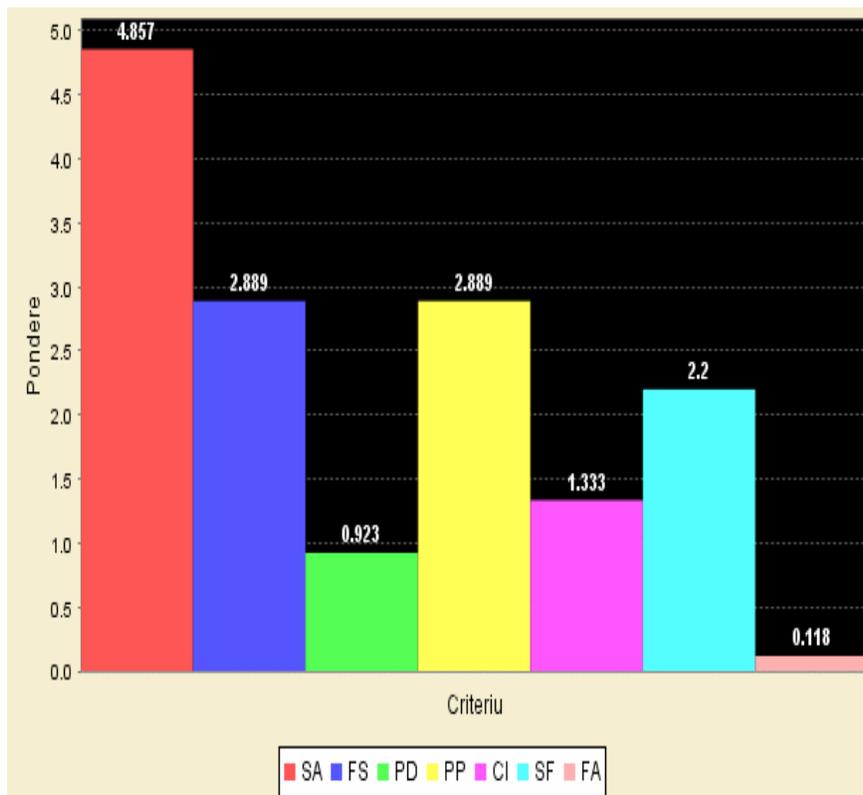
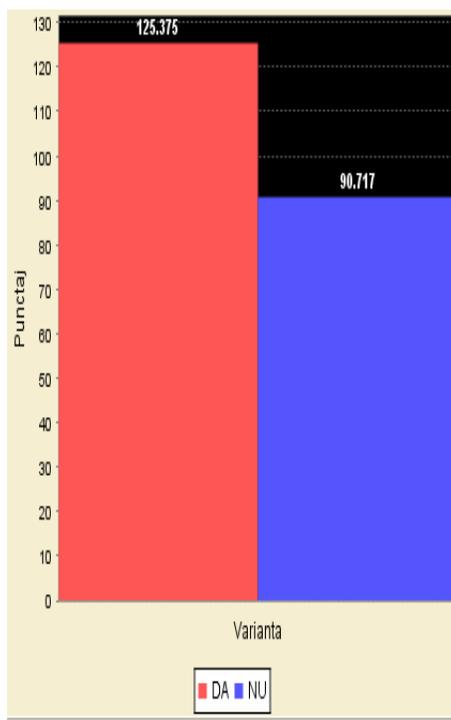Results presented in the form of a diagram:

Fig.1 Weight factors

Fig 2 Final results