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ELECTRE algorithm applied in informatics, an useful method for optimization multicriteria decisions

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Abstract

The present paper wishes to tackle from the point of view of computer science, the problem of decision rationalisation through using the Global Utility Method and the ELECTRE Method, in the case of multicriterial decisions with one decisional factor.

Key words: ELECTRE, decision, multicriteria

The use of the ELECTRE model in dealing with the problems with multicriterial decision was done for the first time in 1965 by a group of French researchers.

Management is primarily a chain of interdependent decisions. The decision represents the central point in management as it is found in all management –related activities and functions. To decide means to choose from many variants of action the one which is considered to be the most proper for attaining certain objectives, and to take into consideration several criteria while performing this activity.

Considering the knowledge of the environment by the decisional factor and the variables that influence the potential results, decisions are divided into the following categories: the ones taken in circumstances of certainty, the ones taken in circumstances of uncertainty and risk.

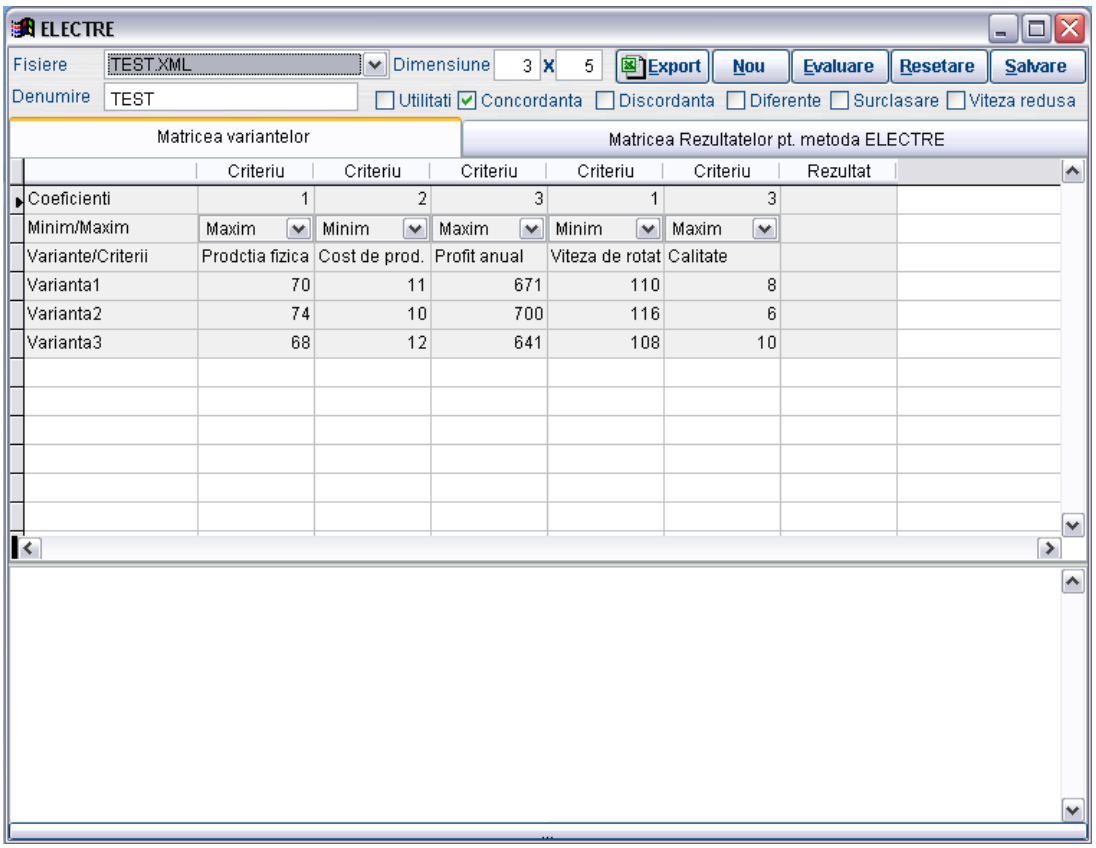
In the process of rationalising decisions, in circumstances of certainty, methods such as the Global Utility Method, the ELECTRE Method and the Onicescu Method can be used.

The present paper wishes to tackle from the point of view of computer science, the problem of decision rationalisation through using the Global Utility Method and the ELECTRE Method, in the case of multicriterial decisions with one decisional factor.

The first step in tackling the methods of decision optimisation in the case of decisions taken in circumstances of certainty is the realization of the utility matrix starting from the economic consequences matrix (criteria (minimum / maximum), variants, importance values).

The first step was the realization of an interface used for the introduction of the entry data.

Fig. 1. – The entry data



With the help of this interface, the user will have the possibility to establish the number of criteria, the importance value associated with them, whether a certain criterion is minimum or maximum, and also the number of variants and the corresponding economic consequences. All these data can be saved in an XML file, which can then be used for remaking the calculations.

By pressing the Assessment button, the utility matrix, the concordance and discordance values, the subsequent matrix resulted from comparing these values and the display of results are all automatically calculated.

ETAPA I

Calcularea utilitatilor

Coloana: 1

Valoarea minima: 68.0000

Valoare maxima: 74.0000

U11=(70.0000 - 68.0000)/(74.0000 - 68.0000)

U21=(74.0000 - 68.0000)/(74.0000 - 68.0000)

U31=(68.0000 - 68.0000)/(74.0000 - 68.0000)

fig. 2

Matricea variantelor | Matricea Rezultatelor pt. metoda ELECTRE

	Criteriu	Utilitati	Criteriu	Utilitati	Criteriu	Utilitati	Criteriu	Utilita
Coeficienti	1		2		3		1	
Minim/Maxim	Maxim		Minim		Maxim		Minim	
Variante/Criterii	Prodctia fizica		Cost de prod.		Profit anual		Viteza de rotat	
Varianta1	70	0.3333	11	0.5000	671	0.5085	110	0.750
Varianta2	74	1.0000	10	1.0000	700	1.0000	116	0.000
Varianta3	68	0.0000	12	0.0000	641	0.0000	108	1.000

Coloana: 2

Valoarea minima: 10.0000

Valoare maxima: 12.0000

U12= 1 - (11.0000 - 10.0000)/(12.0000 - 10.0000)

U22= 1 - (10.0000 - 10.0000)/(12.0000 - 10.0000)

U32= 1 - (12.0000 - 10.0000)/(12.0000 - 10.0000)

Coloana: 3

Valoarea minima: 641.0000

Valoare maxima: 700.0000

U13=(671.0000 - 641.0000)/(700.0000 - 641.0000)

U23=(700.0000 - 641.0000)/(700.0000 - 641.0000)

U33=(641.0000 - 641.0000)/(700.0000 - 641.0000)

Coloana: 4

Valoarea minima: 108.0000

Valoare maxima: 116.0000

U14= 1 - (110.0000 - 108.0000)/(116.0000 - 108.0000)

U24= 1 - (116.0000 - 108.0000)/(116.0000 - 108.0000)

U34= 1 - (108.0000 - 108.0000)/(116.0000 - 108.0000)

Coloana: 5

Valoarea minima: 6.0000

Valoare maxima: 10.0000

U15=(8.0000 - 6.0000)/(10.0000 - 6.0000)

U25=(6.0000 - 6.0000)/(10.0000 - 6.0000)

U35=(10.0000 - 6.0000)/(10.0000 - 6.0000)

****

ETAPA II

Calcularea coeficientilor de concordanta

Coeficientul de concordanta C[1,2]= (1.0000 + 3.0000)/ 10.0000

Coeficientul de concordanta C[2,1]= 1- (1.0000 + 3.0000)/ 10.0000

Coeficientul de concordanta C[1,3]= (1.0000 + 2.0000 + 3.0000)/ 10.0000

Coeficientul de concordanta C[3,1]= 1- (1.0000 + 2.0000 + 3.0000)/ 10.0000

Coeficientul de concordanta C[2,3]= (1.0000 + 2.0000 + 3.0000)/ 10.0000

Coeficientul de concordanta C[3,2]= 1- (1.0000 + 2.0000 + 3.0000)/ 10.0000

****

ETAPA III

Calcularea coeficientilor de discordanta

Ecartul maxim este: 1

Coeficientul de discordanta D[1,2]= (MAX(|0.3333-1.0000| ,|0.5000-1.0000| ,|0.5085-1.0000|))/ 1.0000

Coeficientul de discordanta D[1,3]= (MAX(|0.7500-1.0000| ,|0.5000-1.0000|))/ 1.0000

Coeficientul de discordanta D[2,1]= (MAX(|0.0000-0.7500| ,|0.0000-0.5000|))/ 1.0000

Coeficientul de discordanta D[2,3]= (MAX(|0.0000-1.0000| ,|0.0000-1.0000|))/ 1.0000

Coeficientul de discordanta D[3,1]= (MAX(|0.0000-0.3333| ,|0.0000-0.5000| ,|0.0000-0.5085|))/ 1.0000

Coeficientul de discordanta D[3,2]= (MAX(|0.0000-1.0000| ,|0.0000-1.0000| ,|0.0000-1.0000|))/ 1.0000

****

ETAPA IV

Calcularea diferentelor intre coef. de concordanta si cei de discordanta

Diferenta C12-D12 = -0.2667

Diferenta C13-D13 = 0.1000

Diferenta C21-D21 = -0.1500

Diferenta C23-D23 = -0.4000

Diferenta C31-D31 = -0.1085

Diferenta C32-D32 = -0.6000

****

ETAPA V

Calcularea matricei de surclasare

Verificam Dif[1,2] > DIF[2,1]NU

Verificam Dif[1,3] > DIF[3,1]DA

Verificam Dif[2,1] > DIF[1,2]DA

Verificam Dif[2,3] > DIF[3,2]DA

Verificam Dif[3,1] > DIF[1,3]NU

Verificam Dif[3,2] > DIF[2,3]NU

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ETAPA VI

Afisarea rezultatelor

fig. 3- Results

	Rezultat
Varianta1	1
Varianta2	2
Varianta3	0

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