SELECTION OF OPTIMAL PRODUCTS BY USING EXPERT MODELS IN DECISION

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Abstract: *How to know if a certain decision is good? This issue is present every day in all spheres of life, especially in the economy. It is very important that the decision to be made is as precise and based on as many relevant, clear information as possible. When making decisions, account must be taken of the selection of information in their importance for solving the given problem. For making simple decisions, it is often enough for the decision maker to solve the problem itself. However, it is often not necessary to use scientific methods to make decisions in order to avoid potential mistakes. For this reason, this paper will show on the case of practical application of expert models, the procedure of choosing an optimal alternative.*

Key words: *decision, economy, prbolem, scientific methods, expert models.*

1. INTRODUCTION

Decision making in a business environment involves the consideration of all relevant factors. How well is the analysis of relevant indicators of a particular company's business performed, the better the decision is made. The same decision-making principle is for any segment or level of enterprise, ranging from the operational level to top management. Decision making is everyday and we are constantly faced with decisions in all spheres of life. Making decisions is a process that has its own stages that are in certain correlations. The basic function of each company's management is precisely decision making. This process can sometimes be extremely complex and the choice of the best decision according to [4] depends on the accurate and timely information, the experience of the decision maker, the nature of the problem, etc. In this paper we will show an example of how to choose the optimal product using the expert modes in the sensing.

The decision-making process - the theoretical basis

According to the source [1], decision making is the most important part of the management, as shown in Figure 1.

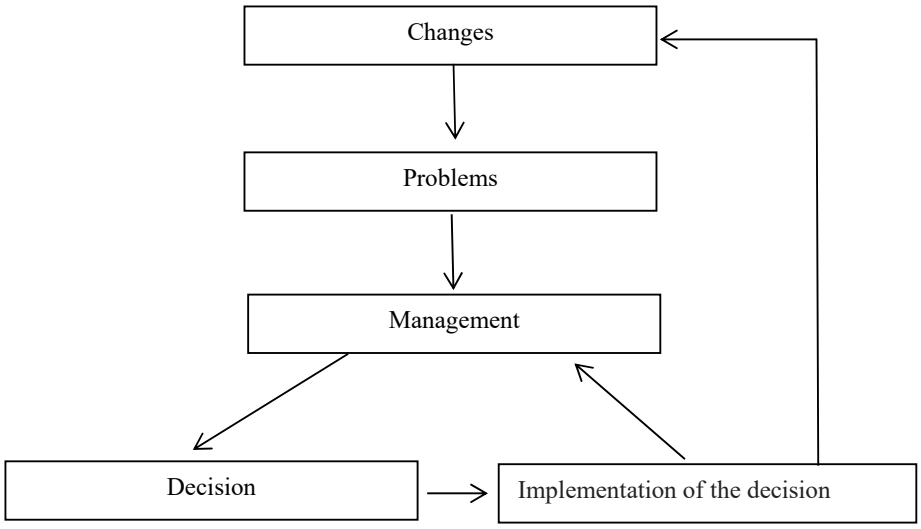

Figure 1 - Decision making in management

Sometimes there are several criteria according to which we must choose the best decision or alternative. In such cases, especially when it comes to business decisions, it is best to approach systemic scientific analysis. In this way, we get instructions on how to choose the best possible alternative in a variety of indicators and criteria. In this paper we will show an example of making an optimal alternative to multi-discriminatory decision-making methods. For example, the choice of the optimum product according to the given.

2. METHODOLOGY OF SCIENTIFIC WORK

In this paper, the lexicographic, conjugate and simple additive weight methods of the multi-discriminatory decision-making method will be applied. These methods as well as other methods of multitributive decision-making are used when there are several criteria for making an appropriate decision. Common to these methods is that, according to the same source [3], a matrix of decision-making that contains the criteria and their values by alternatives is first formed.
In the lexical method, the alternative is chosen which according to that criterion has the highest value. If there are two or more alternatives with the same criterion value, then it goes to the next criterion, which by essence is defined at the beginning of this analysis as the second.
In this way it goes until one alternative with the highest value of the selected criterion is found.
A conjugate method introduces another important segment, which is the so-called vector of the desired value. Namely, the decision maker prescribes the minimum or maximum values of certain criteria in advance, and then an alternative whose values of the criteria fall within the desired value range is chosen. By the simple additive weight method, the best alternative is obtained as the sum of the individual quality assemblies.
In accordance with the rules of Methods, according to the source [3], this paper will also begin from the formation of the decision matrix based on the obtained practical data. All relevant criteria and the value of the assessment of a particular alternative will be entered in the decision matrix. Depending on the type of criteria it is necessary to quantify all the factors of the matrix.
After defining the basic sizes, the following steps will be taken in deciding what will be said in the next section of the text.

3. CHOOSING AN OPTIMAL PRODUCT BY A LEXICOFRAPHIC METHOD

As an example of applying Methods, problems of choosing the optimal product will be taken. Namely, we will take the assumption that the decision maker must select one of the four products offered on the basis of the given values of the criteria. It will be the selection of the optimal product of the US-IZ brand, company "AutoVentil doo" Uzice. This company is known for the production of valves, valves and valves for valve ventilation. With the use of modern technology and quality standards, the obtained products are characterized by high quality. In order to protect the company's business data, the values of the criteria will be quantified in advance and no currency units will be used. The whole of this paper is an independent analysis with the obtained data and additional assumptions of the author himself. Only one of the possible ways to choose the optimal product is shown.
According to the data obtained from the company, the selection criteria for alternatives are determined. A type of extreme was also determined. For the price of production, a type of minimization is determined, which means that it is desirable that the value of the criteria be as low as for the sale is a type of maximization, which necessitates a higher value of the criteria. For the last criterion, quality, it's also about maximizing. An arbitrary weighting was selected, which can be seen from Table 1.

Table 1: The decision matrix

Valve mark	Type of valve	Material mark	Production price	Sales	Quality
VV151	US-IZ	Ms	5	6	8
VV181	US-IZ	CuZn	4	7	7
VV231	US-IZ	A1	3	8	6
VV390	US-IZ	A1	3	5	5
Weight	-	-	8	6	7

According to the defined importance of the criterion, a set of criteria was formed.

Table 2: The order criteria

Criterion	Production price	Quality	Sales

Prema leksikografskoj metodi izbor najbolje alternative vršimo prema najznačajnijem kriterijumu, a to je u ovom slučaju kriterijum: cena proizvodnje.

Tabela 3: The production value criteria

Valve mark	Production price
VV151	5
VV181	4
VV231	**3**
VV390	**3**

According to this, we see that the optimal choice, the choice of the last two valves. This is a type of extreme, minimization, so that they are desirable as low as possible. Since here we have two alternatives chosen according to the best value of the criterion, then we need to take the analysis of the alternatives according to the values, the next in the order of the criterion, which is the quality.

Table 4: Value of criterion quality

Valve mark	Quality
VV151	**8**
VV181	7
VV231	6
VV390	5

In this case, the optimal choice would again be the choice of the first alternative

4. CHOOSING THE OPTIMAL PRODUCT BY A CONJUGATE METHOD

Kao što je već ranije pomenuto, konjuktivnom metodom se dolazi do idealnog rešenja uključivanjem vektora željenih vrednosti. Prilikom izvođenja ove metode, odabira se ona alternativa čiji kriterijumi zadovoljavaju sve ili većinu željenih vrednosti. Ukoliko dođe do nemogućnosti odabira adekvatne alternative, onda se vrši korekcija željenih vrednosti i to onih kod kojih je to, za donosioca odluke, prihvatljivo.
Here, we will arbitrarily assume that the donor has defined minimum or maximum values which criteria must satisfy.

Table 5: Limits of desired values by criteria

Criterion	Production price	Quality	Sales
Value	<=4	>6	>=7

For the sake of transparency and in accordance with the source [6], evaluating a certain alternative according to its value of the given criterion will be reduced to indices 0 and 1. Namely, if the value of a particular criterion is in the required framework, we will put in the decision matrix 1. If it does not meet the initial conditions , we will put 0.

Table 6: Evaluation of alternatives by criteria

Valve mark			Production price	Quality	Sales	Total
VV151			0	1	0	1
VV181			1	1	1	**3**
VV231			1	0	1	2
VV390			1	0	0	1

Based on this method, it can be concluded that it is best to choose the VV181 product because it meets all the desired values.
In order to be as safe as possible in decision making, the best decision-making process is to use as many methods as possible, so that in the next part, another method and method, the Simple Additive Weight Method or JAT, will be applied.

5. CHOICE OF OPTIMUM PRODUCT BY SIMPLE ADDITIVE WEIGHT METHOD

The basic method for this method is defining the coefficients of zoos. These are actually weightings. In this way, the value of the alternative is viewed as the sum of the value of the criterion. According to the source [3] we will mark an alternative as Ai (i = 1, ... n). Let the criterion of weight be wj. xij value of the criterion j alternative i. Calculating the estimation of Alternative Ai would be:

$$v(A_i) = \sum_{j=1}^{n} w_j x_{ij} \quad [1]$$

Before applying this method to the selected case of decision making, it is necessary to note that it must be observed that the sum of all the weights is 1. If it exceeds this value it is necessary to make the distribution of each weight with a weight of weight. The new value of the weight is taken into account.

$$w_j^f = \frac{w_j}{\sum_{j=1}^{n} w_j} \quad [2]$$

According to the same source that this method was made according to the rules, it is necessary to unify all the criteria. All must be the same kind of extreme. Inverting is done to the same type.

$$x_{ij} = \frac{1}{x_{ij}} \quad [3]$$

By this method, L1 first approaches the normalization of weight values. In this case, the sum of all the weights is: 8+6+7=21

Table 7: Weight normalization

Criterion	Price	Sales	Quality
Weight	8/21	6/21	7/21
	0.38	0.28	0.33

Further we reduce all the criteria to the same type of extreme.

Table 8: Shuffling to the same type of extreme

Valve mark	Type of mark	Material mark	Production price	Price	Quality
VV151	US-IZ	Ms	1/5	6	8
VV181	US-IZ	CuZn	¼	7	7
VV231	US-IZ	A1	1/3	8	6
VV390	US-IZ	A1	1/3	5	5
Weight	-	-	0.38	0.28	0.33

After this, the value is normalized.

Table 9: Normalization of values

Valve mark	Type of valve	Materijal mark	Production price	Sales	Quality
VV151	US-IZ	Ms	(1/5)/(1/3)	6/8	8/8
VV181	US-IZ	CuZn	(1/4)/(1/3)	7/8	7/8
VV231	US-IZ	A1	(1/3)/(1/3)	8/8	6/8
VV390	US-IZ	A1	(1/3)/(1/3)	5/8	5/5
Weight	-	-	0.38	0.28	0.33

By setting the values in the table we get new values:

Tabele 10: The values obtained after normalization

Valve mark	Type of valve	Material mark	Production price	Sales	Quality
VV151	US-IZ	Ms	0.610	0.75	1
VV181	US-IZ	CuZn	0.757	0.875	0.875
VV231	US-IZ	A1	1	1	0.75
VV390	US-IZ	A1	1	0.625	1
Weight	-	-	0.38	0.28	0.33

The most important part of this method is the calculation of the value of the alternatives obtained in this case as the sum of the weight products and the values of the criteria.

v(VV151) = 0.610 * 0.38 + 0.75 * 0.28 + 0.33 * 1 = 0.2318 + 0.21 + 0.33 = 0.7718
v(VV181) = 0.757 * 0.38 + 0.875 * 0.28 + 0.875 * 0.33 = 0.287 + 0.245 + 0.288 = 0.82
v(VV231) = 1 * 0.38 + 1 * 0.28 + 0.75 * 0.33 = 0.38 + 0.28 + 0.247 = 0.907
v(VV390) = 1 * 0.38 + 0.625 * 0.28 + 1 * 0.33 = 0.38 + 0.175 + 0.247 = 0.802

Table 11: The final value of the alternative

Valve mark	Type of valve	Material mark	Production price	Sales	Quality	Value
VV151	US-IZ	Ms	0.610	0.75	1	0.7718
VV181	US-IZ	CuZn	0.757	0.875	0.875	0.82
VV231	US-IZ	A1	1	1	0.75	**0.907**
VV390	US-IZ	A1	1	0.625	1	0.802
Weight	-	-	0.38	0.28	0.33	

On the basis of the obtained data, we conclude that the best solution is to choose the product VV231. By this process, the bad features of the alternative are compensated for by better qualities, which automatically have their own shortcomings and advantages. The disadvantages are that you can choose alternatives with bad qualities that can later be decisive.

6. CONCLUSION

Here is briefly shown the principle of applying some methods in decision making. In addition to these methods, there are other scientific methods used in decision making. Some of them are still a pessimistic, optimistic method, Promethee method, group decision making, AHP method, Phase decision making, etc. Depending on the complexity of the problem and the decision maker, the most appropriate method for decision making is selected.

7. LITERATURE

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