

Czech University of Life Sciences Prague

Faculty of Economics and Management

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Thesis of bachelor thesis

Application of mathematical model in decision support

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Abstrakt

Bakalářská práce se zabývá aplikací matematického modelu při rozhodování. Hlavním cílem je vybrat a aplikovat metodu operačního výzkumu pro vybranou firmu.

V teoretické části jsou popsány hlavní pojmy analýzy rozhodování s více kritérii, metody hodnocení a kompromisní metody. V praktické části jsou provedeny výpočty založené na metodách, které byly dříve popsány v teoretické části. Výsledky jsou nabídnuty společností jako prospěšné řešení problému řízení.

Keywords: managerial decision-making, mathematical model, operation research

Objectives

Main goal of bachelor thesis is to select and apply method of operational research for real managerial decision-making problem. The partial goals are systematic description of the decision situation and collection of the real data. The theoretical studies will describe chosen methods and will serve as a basis for the mathematical model construction.

Methodology

The bachelor thesis deals with multi-criteria decision making problems, which is divided into two main parts.

The first part of the methodology is based on the study and analysis of literature.

In this part describes methods of weighting criteria:

- Sequence Method
- Score method
- Fuller triangle
- Saaty's method

and methods of choosing compromise variants:

- Conjunctive and disjunctive methods
- Simple additive weighting method
- TOPSIS

In the second part are applied the most suitable method based on the studied materials for the real problem and consider selected method in practice.

According to the detail description of the decision situation, the mathematical model is constructed. The input data are collected and the results calculated according to the

selected methodology. The results are interpreted and solution of the managerial problem proposed.

Results and Discussion

In order to determine the most appropriate solution to the problem, two multi-criteria decision analysis were used. The weights of each criterion were determined by using Saaty method. Method of simple additive weighting and TOPSIS were used for estimation of individual variants.

Using simple additive weighting method, Heine Beta 200 was chosen as the most preferred ophthalmoscope. This device has a high power of lenses; this variant has one of the highest value of performance characteristics. There is large number of filters. The price for this product is quite high, but it is commensurate with its characteristics.

The second applied method was TOPSIS, which also suggested Heine Beta 200 to us as the most peered, compromise variant. Based on the received data, this variant has a big gap from the second and third alternatives in the rating. At the same time, the second and third variants have a relatively small difference.

Comparing the results of these two methods, we can confidently say that the Heine Beta 200 is considered as the most acceptable for buying according to the results of simple additive weighting method and TOPSIS. At the same time, simple additive weighting method represents WelchAllyn Coaxial as an alternative to a better choice, since the differences of these alternatives are very small. The third place occupies Prestige Coaxial-Plus. According to the evaluation of TOPSIS, WelchAllyn Coaxial is the most similar to KaWe Eurolight E36, 2.5B, and those alternatives occupy 2 and 3 places in rating.

Table 1 - Final order of given alternatives

	SAW		TOPSIS	
	Trade-off	rank	c_i	rank
V1	0,2315	12	0,4188	12
V2	0,2701	10	0,4534	10
V3	0,7619	1	0,6192	1
V4	0,1571	13	0,3313	13
V5	0,2421	11	0,4370	11
V6	0,3684	6	0,5293	4
V7	0,3859	5	0,5071	5
V8	0,6211	3	0,4839	7
V9	0,2973	9	0,4578	9
V10	0,3663	7	0,4928	6
V11	0,3649	8	0,4821	8
V12	0,7544	2	0,5573	2
V13	0,4182	4	0,5431	3

(Source: own processing)

Conclusion

The main goal of the bachelor thesis is to determine the most appropriate ophthalmoscope for optical center Glaz using mathematical models. The decision was resolved by method of the multiple criteria decision analysis. To determine a compromise alternative were used: Saaty method, Simple Additive Weighting method and TOPSIS.

The literary part was describes basic concepts and models of multi-criteria analysis. Also, based on theoretical knowledge, appropriate models were chosen to extend based on the situation.

In the practical part, the medical device (ophthalmoscopes) was introduced. Selection criteria have been set according to user requirements and wishes. Using Saaty method, weights were calculated to determine the most important criterion for the optical lens and price.

For determination the most appropriate solution was used Simple Additive Weighting method and TOPSIS. The first method, Simple Additive Weighting, determined that the Heine Beta 200 is the most acceptable for buying according to the results. The same TOPSIS confirmed that the Heine Beta 200 is the best option for the acquisition. Comparing the solutions of two mathematical methods, we obtained only one compromise solution.

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