

PROGRAMMING OF METHODS FOR THE NEEDS OF LOGISTICS DISTRIBUTION SOLVING PROBLEMS

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Abstract: Logistics has become one of the dominant factors which is affecting the successful management, competitiveness and mentality of the global economy. Distribution logistics materializes the connection of production and consumer market. It uses different methodology and methods of multicriterial evaluation and allocation. This thesis addresses the problem of the costs of securing the distribution of product. It was therefore relevant to design a software product that would be helpful in solving the problems related to distribution logistics. Elodis – electronic distribution logistics program was designed on the basis of theoretical analysis of the issue of distribution logistics and on the analysis of the software products market. The program uses a multicriterial evaluation method to determine the appropriate type and mathematical and geometrical method to determine an appropriate allocation of the distribution center, warehouse and company.

1 Introduction

Placement of production process, after identifying the product we're going to produce and the way we're going to produce it, is one of the main strategic decisions which we make in case of establishing a new production or company and in a case we're trying to take control of new markets, invest and increase production capacity [1].

Allocation brings a problem which is connected with high expenses for providing distribution of products. Therefore it was advisable to build a software product which will be helpful with creating and solving problems connected with distribution logistics. Also elaborateness of multi-criteria evaluation and allocation predetermine to solve distribution with the help of computer techniques.

1.1 Allocation

Suitable placement of company influences all the activities which distribution includes. We take into consideration many factors which are important within allocation. Two approaches were created and they serve for calculation of a correct allocation:[2]

- Multi-criteria decision-making
- Mathematical and geometric approach

“The allocation is the process that results in a particular position to determine the location of the storage, company, machine, manufacture, people, animals, things and activities in a particular area, respectively area that best meet the defined conditions and limitations in terms of requirements, eg. supply, production, distribution and trade, strategies and tactics [2].”

2 Analysis of software products

Today's time offers a wide range of different applications and software programs to calculate various examples, methods and solutions. Development of information systems is rising along with the exponential growth of information technology. Finding high-quality free software is quite complex. For less demanding users, the company offers a variety of freely available software, which can be very useful for them. In case the user wants more features and more options should you pay extra for the licensed version, which offers a wide range of user interface.

Area of professional products for decision-making provides some softwares or web applications which are orientated on methods of multi-criteria decision-making, e.g. [3]:

- Programme MCA7
- Expert Choice
- Criterium Decision Plus
- 1000 Minds
- IDS
- DEXi 4.00
- Priority Estimation Tool
- D- Sight
- Transparent Choice

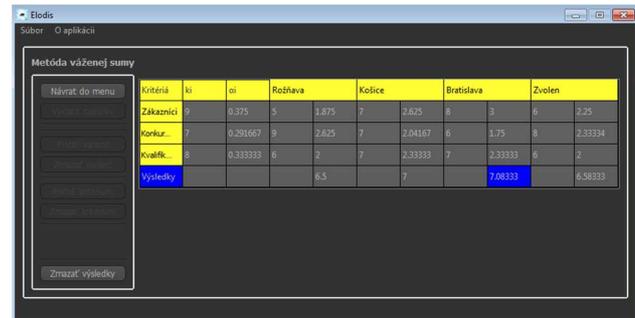
Analysis of professional products for multi-criteria decision-making demonstrated us that nowadays many products like this exist and provide solutions to the professional level. Simpler programmes mostly contain only one method and the way of calculation. Complexity of other programmes discourages the users from their application. Therefore it was suitable to create a software

product which would combine a bigger amount of methods and with its simplicity make work of users easier and simultaneously providing professional solutions for the needs of practice.

when we can economically assess the factors which influence the allocation of production process, storage or centre [2].

3 Programme ELODIS

Programme ELODIS – „Electronic Logistics of DIStribution“ (Figure 1) solves problems of multi-criteria decision-making and allocation which have strategic importance for a company. Overall effectiveness of particular criteria and overall effectiveness of particular variants is calculated by methods of multi-criteria decision-making. Mathematical and geometric methods help with calculations for a suitable allocation of distribution centre, storage, company, etc



Kritéria	ci	ci	Rožňava	Košice	Bratislava	Zvolen				
Zákazníci	9	0,375	5	1,875	7	2,625	8	3	6	2,25
Konkuz...	7	0,291667	9	2,625	7	2,04167	6	1,75	8	2,33334
kvantit...	9	0,333333	6	2	7	2,33333	7	2,33333	6	2
Výsledky			6,5	7			7,68333			6,58333

Figure 2 Filling of the ELODIS table

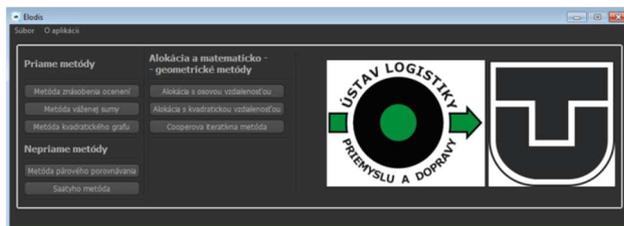
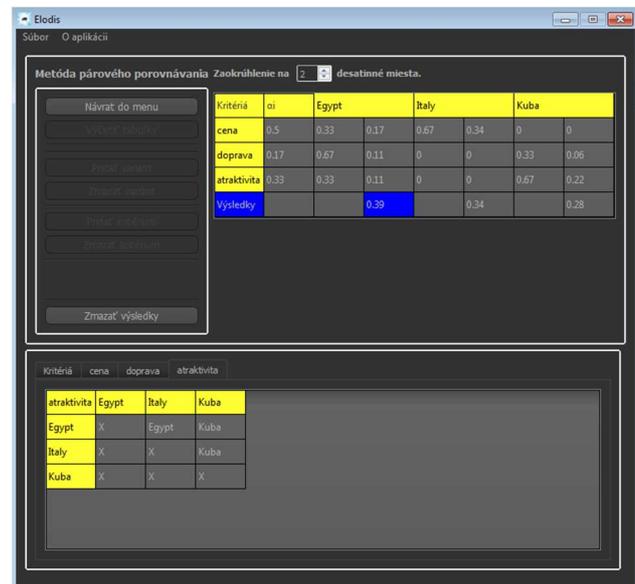


Figure 1 Programme ELODIS, main window



Kritéria	ci	Egypt	Italy	Kuba			
cena	0,5	0,33	0,17	0,67	0,34	0	0
doprava	0,17	0,67	0,11	0	0	0,33	0,06
atraktivita	0,33	0,33	0,11	0	0	0,67	0,22
Výsledky			0,39		0,34		0,28

Kritéria	cena	doprava	atraktivita		
atraktivita					
Egypt	X			Egypt	Kuba
Italy	X	X			
Kuba	X	X	X		

Figure 3 Filling of the ELODIS help tables

3.1 Charakterization of programme ELODIS

Programme ELODIS is written in its developmental environment Microsoft Visual Studio 2010, in programming language C++. It's a universal, simple programme made for complex processing of multi-criteria evaluation and allocation.

Within multi-criteria evaluation, the programme offers a method of score multiplication, weighted sum method and methods of quadratic graph (Figure 2).

The more complicated methods like method of paired comparison and Saaty's method are created to be as easy for user as possible (Figure 3).

Within allocation, it offers mathematical and geometrical methods like method of allocation with axial distance (Figure 4), allocation with quadratic distance and at the end also Cooper's iterative method.

3.1.1 Allocation and multi – criteria decision making

If companies want to be competitive, it is necessary for them to try to minimize expenses what is the reason of distribution logistics and well-placed storage becoming an important and essential part of company functioning. Decision about place of storage allocation and necessity of building it has a strategical importance. Method of multi-criteria decision-making serves as a helping tool for distribution logistics with making this important decision. We use the multi-criteria decision mainly in a situation

Indirect methods of multi-criteria assessments are based on mutual comparison of all defined criteria and variations between them. Methods are more complex and have a lesser degree of subjectivity.

Comparing the methods paired comparison and Saaty's method we came out that the results are not the same. It is caused by different computing technology of these methods. For paired comparison determine which of the criteria / variants is important. Whereas for Saaty's method we determine which of the criteria / variants are important, but also the number of times they are more important. Using both methods reduces subjectivity user / evaluator. To ensure even lesser extent personality is possible to use a larger number of evaluators.

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3.1.2 Allocation and mathematical and geometrical methods

Mathematical and geometrical methods solve problems of optimal placement of distribution centre, storage, company, operational report or a machine and an accurate determination of coordinates in a defined area. It uses a cost criterion during calculation with the aim to minimize expenses [2].

Allocation and mathematical - geometric methods are based on the calculation of the coordinates operational reports, distribution warehouse centers and subsequent cost reductions, which are used in the evaluation.

Comparing the practices of three methods we figured out that the results are similar but not the same. It is caused by different computing technology of these methods. When allocations with axial distance can only be the result of a combination of points already defined in the table. When allocations with quadratic distance improves the precision of the calculation and the calculated points can be used in the Cooper's method. Cooper's method, thanks iterations, guarantees the most calculating of these three methods for the allocation distribution storage.

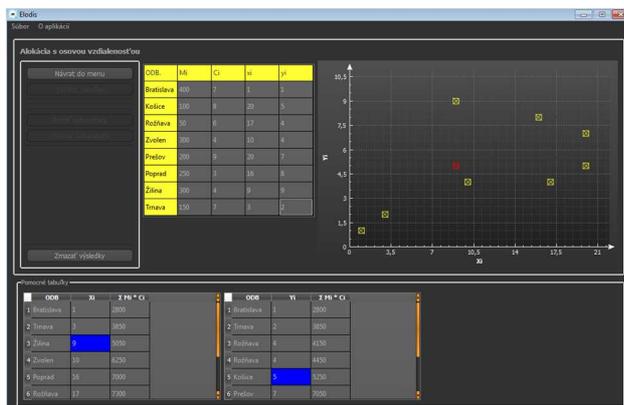


Figure 4 Application of geometrical approach for allocation

3.2 Advantages of programme ELODIS

Programme ELODIS solves problems of multi-criteria decision-making and allocation which have a strategic importance for a company. It calculates the overall effectiveness of particular criteria and overall effectiveness of particular variants by methods of multi-criteria decision-making. Mathematical and geometrical methods help with calculation of suitable place for allocation of distribution centre, storage, company, etc. It is a universal, simple programme made with aim of complex processing of multi-criteria evaluation and allocation. ELODIS is a programme which contains 5 methods of multi-criteria decision-making and 3 mathematical and geometrical methods.

There is no similar software on the market which would combine all these methods. This makes programme ELODIS unique. Working with this programme is very simple and easily understandable for a user. Installation is clear and it's completed in a few seconds. User has a possibility to compare particular results with more methods what decreases the rate of subjectivity.

Programme is very well-arranged and right after opening it offers an option to choose a method for solving a problem. The main advantage is the speed of calculation. If we tried to count all the examples without the programme, it would take us a few hours, if not longer. If user makes a mistake when filling in data, the programme warns him about mistakes.

The programme offers a well-arranged manual which helps the user to solve any problem.

It is possible to save entered data and also to export the results to Excel or print them. It is also possible to re-read a file.

This programme would be a miracle for decision-making in company. It would help to solve every-day problems with distribution, allocation and evaluation of problems. Decreasing of costs would help companies to save not small financial amounts.

Conclusion

Logistics became a phenomenon of the 20th century which influences functioning, managing and thinking of people, organizations and world economy. Multi-criteria evaluation and allocation became an important part of management and running of company. Every decision in company is made according to multi-criteria evaluation. Allocation of production process is one of the main strategic decisions when establishing a new company, production and taking control of competitors. Uniting logistics and information technologies forms a new way for future orientation and development of logistics.

With all the results we came to an opinion that programme ELODIS could mean a huge contribution because it makes many operations easier, it decreases costs for distribution logistics and costs for similar software programme, it saves time and the programme is very complex.

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References

- [1] MALINDŽÁK, D. et al: Výrobná logistika I., Košice, Štroffek, 8-45, 1996.
- [2] STRAKA, M.: Logistics of distribution, How effectively to put product into the market, EPOS, Bratislava, p. 400, 2013.
- [3] RUIZ, F.: International Society on Multiple Criteria Decision Making, 2014.

Review process

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