Comparative Analysis of Evaluation Algorithms for Decision-Making in Transport Logistics

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Abstract. The analysis of existing methods and approaches for solving transport logistics problems was performed in this paper, particularly, for optimal choice of transport company. In the working process the complex of decision making criteria was formed and the hierarchical structure of decision support system (DSS) for corresponding tasks was made. Thereby the list of different-type methods (classical and fuzzy) for synthesis of developed DSS was defined. A comparative analysis of the application of fuzzy analytic hierarchy process and the method based on fuzzy inference was held for synthesis DSS for the optimal choice of transport company. The final results prove the effectiveness and reasonability of using fuzzy modeling in problems of transport logistics.

Keywords: fuzzy AHP, fuzzy inference system, decision support system, transport logistics.

1 Introduction

Decision support systems (DSS) for solving different-type problems help for decision makers (DM) to form and use corresponding databases of a priory and current data, models, algorithms and criteria of making effective decisions [1] in automatic and interactive modes.

Different methods, models, theories and algorithms are used for analysis and creation of alternative decisions in DSS [1], among them are: intelligent analysis of data, simulated and fuzzy modeling, genetic algorithms, neural networks, decision making theory, fuzzy-sets theory and fuzzy logics, etc.

Any intelligent system can be presented as generalized model, the structure of which is described with the help of corresponding approaches and mathematical relations upon availability of clearly defined (formalized) information, which can be presented by quantity characteristics. Thereby the necessity in processing fuzzy, in other words quality information, which is hard or impossible to formalize, becomes more actual [2].

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Information systems and program complexes play important role in transport logistics as they serve for analysis, planning and supporting of decision making processes, and also for providing the necessary level of services quality and increasing of transport cargo traffic effectiveness [3].

2 The Analysis of Researches and Publications

Today there exists a lot of publications on the research of DSS based on the fuzzy logics [4-6], which examine methods of the theory of fuzzy sets for modeling, analysis and synthesis of intelligent hierarchically-organized systems. Researches, which are conducted in different countries, have proved that for many subjects of management, parameters of which change in the process of operation, it is appropriate to use fuzzy computerized automatic control systems [7, 8].

The research of fuzzy logics was associated with the necessity of intelligent systems development, which is able to interact with a human taking from him verbal (fuzzy) information. For this a new mathematical tool is needed, which translates ambiguous statements to the language of clear and formal mathematical formulas.

Fuzzy systems comparing to others have a list of advantages [9]:

– possibility of processing and analysis of fuzzy input data;
– fuzzy criteria formalization of estimation and comparison;
– qualitative evaluations of input information as well as output results;
– quick simulation of complex dynamic systems and their comparative analysis with a given degree of accuracy.

In the process of DSS development based on fuzzy logical inference there is a possibility of sharp increase in the number of fuzzy rules, which leads to difficulty of their formalizing and increasing of simulation time. This is due to the fact that when there are a great number of input system parameters, it is hard for expert to describe cause-and-effect by means of fuzzy rules as human memory can simultaneously store no more that 7 ± 2 states of investigated system [4].

One of the unsolved problems when using hierarchical approach for developing DSS on basis of fuzzy logical conclusion is complexity of structuring and consideration of a large number of input parameters of such systems [7].

Using the theory of fuzzy sets and fuzzy logics when building DSS allows solving problems on intellectual level with the help of fuzzy databases of rules and also provides an opportunity to estimate alternative decisions and choose the best among them [10].

To measure customer's expectations different assessing methods are used, including questionnaires, expert analysis, statistical methods, etc. The difficulty is that most of system parameters cannot be measured quantitatively, so it is difficult to get explicit evaluations. The customer's expectation usually are based on his subjective opinion, experience of his work and more often they are expressed in such statements as "it is desirable that the cargo has been delivered at 12 o'clock", "it is possible to pay in range of 2000 to 3500" and so on. In the relevant statements there are elements of