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SEVKİYAT YÖNETİMİN DEĞERLENDİRİLMESİNE YÖNELİK BULANIK MANTIK YÖNTEMİ İLE ÖRNEK BİR MODEL

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ÖZ

Küreselleşme ile beraber bilgi ve kaynak paylaşımı hızla artmış ve tüm dünya adeta bir köy halini almıştır. Lojistik sektörü küreselleşme ile beraber çok önemli bir konuma gelmiştir. Öyle ki, lojistik ağının dışında kalan ülkelerin büyümesi olanaksızdır. Bu çalışma lojistik sürecinin önemli bir öğesi olan sevkiyat yönetiminin değerlendirilmesi konusuna katkı vermek üzere hazırlanmıştır. Çalışma karayolu taşımacılığı için düşünülmüştür. Sürecin belirsiz kriterlerden oluştuğu gözönüne alınarak bulanık mantık ile bir model önerilmiştir. Giriş olarak araç kapasite verimliliği, seyahat süresi ve operasyonel maliyetler verilip, çıkış olarak sevkiyat yönetim değerlendirmesi elde edilmiştir. 0-1 arasındadır.

Anahtar Kelimeler: *Lojistik, Sevkiyat, Bulanık mantık*

A FUZZY LOGIC MODEL PURPOSING EVALUATION OF TRANSPORTATION MANAGEMENT

ABSTRACT

By globalization information and resource sharing increased rapidly and the whole world becomes a village literally. The importance of sector of logistics has increased with globalization. By way of addition, development of the the countries that stay out of logistics network is impossible. This study is prepared to contribute to the evaluation of forwarding management that is an important component of logistics. Study is considered for highway transports. Taking the uncertainities of the process into account, a fuzzy logic model is proposed. Vehicle capacity efficiency, travel time and operational cost are given as input. Transportation management evaluation is gotten between 0-1 as output.

Keywords: *Logistics, Transportation, Fuzzy Logic*

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INTRODUCTION

Globalization has an important place in the age of information society. Globalization in world trade has first occurred with capital, then globalization of production and consumption. This situation has made it possible to develop rapidly of world trade. Logistics services have become an important way to provide strategic competitive advantage due to the rapid increase in global production, the shortening of product lifespan and the increasing global competition (Kara et al., 2009:70).

These transformations in world trade and the emerging new dynamics have caused many influences on the logistics sector. The logistics sector is almost related to all other sectors. This situation clearly shows that logistics plays a key role in creating international competitive advantage. The essence of the logistics is to deliver the product and / or service faster, more economically and better conditions to the desired point than the competitors (Çancı and Erdal, 2013:4). Logistics costs are range from 4% to 20% of the sale price of the product. Creating an effective logistics process in a market environment where profit rate is between 1% and 5% will provide a significant competitive advantage to companies (Kara et al., 2009:72).

Basically, logistics deals with the process of moving a product with right lunge from the production point to the consumption point. Managing this process has become much more difficult due to globalization. As an example of a global supply chain can be shown that 29 different companies from 18 countries work in collaboration for a cup of coffee at the table (Akçetin, 2010:7). With the help of this example, it can be said that the actual competition among the firms determines the optimum delivery of the product rather than the product quality. Companies, which manage well this complex process, will be economically and strategically more advantageous than other companies. Logistics activities have become very important both in creating customer value and in ensuring business success (Kayabasi and Ozdemir, 2008:196). Transportation has an important place in this process.

To today, studies have been carried out with fuzzy models for the selection of the appropriate transport type for the transportation or for the strategic planning of the multimodal transportation systems (Kazan et al., 2015: 1593) (Tuzkaya, 2007: 92). In this study, for roadway transportation a model that can evaluate the transportation management process independently and uses fuzzy logic method is proposed.

LOGISTICS SCOPE AND LOGISTICS ACTIVITIES

The Council of Logistics Management (CLM), now the Council of Supply Chain Management Professionals (CSCMP), defines logistics as "that part of the supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of

consumption in order to meet customers' requirements" (Neeraja et al., 2014:666).

Logistics deals with all material mobility between the exit and arrival points of the goods. Activities related to the flow of goods are transportation, warehousing, packaging, value-added operations. Activities related to service flow are customs, insurance, inspection, inventory management, order management and customer service (Emirkadı, 2015: 101). The management of all these activities is called as logistics management.

The goal of logistics management is to manage operations effectively and to minimize costs. Goods management will also reduce costs. Logistics cost ratios are as follows: transportation costs 45%, warehousing costs 26%, inventory costs 20%, and management costs 9% (Acar and Aslantaş Ateş, 2011: 16).

As you can see above, logistics process depends on many activities. The costliest of these activities is transportation. The transportation process includes bringing the goods to facility from the supplier and delivering the goods to the warehouse customer. Examples of factors that affect transportation include the choice of vehicle, operational costs (insurance, vehicle maintenance, fuel, etc.), distance, distribution optimization, routing, loading and unloading, traffic and weather. Transportation is a process involving transport systems. Transportation systems consist of roadway transportation, railway transportation, pipeline transportation, maritime transportation, river road transportation and airway transport. In this study, solution was sought on roadway transport.

FUZZY LOGIC STUDIES IN LOGISTICS ACTIVITIES

The more complex processes such as purchasing, distribution, inventory tracking, transportation, packing, labeling, bar coding, preparation of products, return, and route planning of vehicles have been provided to be managed more effectively with developing computer technologies. In addition to this, the processes can be managed more efficiently and effectively by examining the administrative activities and forming the decision support systems. Such improvement has a direct impact on both cost and customer satisfaction.

Fuzzy logic is a very useful method for the logistics sector, where there are many uncertainties. Fuzzy logic is a method based on a fuzzy set. Membership at the classic set is considered member or non-member (O or 1). Membership in fuzzy logic is a gradual concept and is between 0-1. Ownership grades to sets can be represented by functions such as triangle, trapezoid, or Gaussian curve. In cases where decision makers can not make definitive decisions, alternative decisions are evaluated. The most likely and most appropriate decisions are taken into consideration. The aim here is to be able to choose the events that are most likely to happen (Ergulen and Deran, 2009:229).

Since there are many uncertainties in the logistics process, it is necessary to think multidirectionally while taking decisions in administrative activities. In addition, information should be kept up to date, real-time and retrospectively analyzed. Many scientific studies have been carried out on the logistics sector. Examples of these studies are fuzzy models for selection of the appropriate transport type or for strategic planning of multimodal transport systems (Kazan et al., 2015: 1593) (Tuzkaya, 2007: 92). Scientific studies have also been done in the past which use fuzzy logic for planning and managing transportation systems. Examples of these are vehicle routing with fuzzy control and fuzzy logic in project management (Teodorovic and Vukadinovic, 1998:303) (Mon et al., 1995:227).

PROBLEM AND PROPOSED MODEL

The transportation is very dynamic process, which requires physical and mental labor. This process involves the stages between the loading of the products into the vehicles and the delivery of the products to the targets. If the decisions in transportation management are made quickly and accurately, also process efficiency increases.

Transportation is a process with considerable weight within logistics activities in terms of cost and movement and is very complicated. It is obvious that modeling in such processes is not easy. Being to lots of number of objects, variables and constraints, uncertainties in the model, and difficulties in attaining realistic data make modeling difficult (Tuzkaya, 2007: 92).

The model proposed in this study is intended to evaluate the transportation management process. A logistics company can assess how efficient of the transportation management system is by designing a sample fuzzy logic model according to its own data. If this evaluation is done correctly, the urgency of reviewing the managerial activities of the transportation process is determined and it is decided according to the situation in the case. If the decisions are given faster and more accurately, the process will be faster and more efficient.

In the proposed model, three input variables and one output variable are considered for the transportation problem. Here, capacity efficiency, travel time and operational costs are considered as input variables. The output variable will be the transportation management quality. While creating membership functions, it is necessary to clarify which criterion is to be considered and the degree of fuzzy. In addition, the model should cover the behavior between certain periods, and all the criteria should be revisited step by step in each period. For example, one or several years periods can be considered. At the end of each period, membership functions and fuzzy criteria are re-evaluated and updated, if needed. In the proposed model, some of the rules used in assessing the quality of the transportation management process are shown in Table 1.

Table 1. Some Rules For Assessing The Quality Of Transportation Management Process

Capacity efficiency	Travel time	Operational cost	Transportation Management Quality
Low	High	High	Poor
High	High	High	Good
High	High	High	Medium
Middle	Middle	Low	Medium
High	Middle	Middle	Good

First input variable is capacity efficiency. Capacity efficiency is very critical in respect to transportation. The low occupancy rate of the vehicles causes the decrease in capacity efficiency. In addition to low capacity efficiency, if the operational costs are high and the travel times of the vehicles are high, the problem of transportation is strongly possible. Membership functions of capacity efficiency are shown in Figure 1.

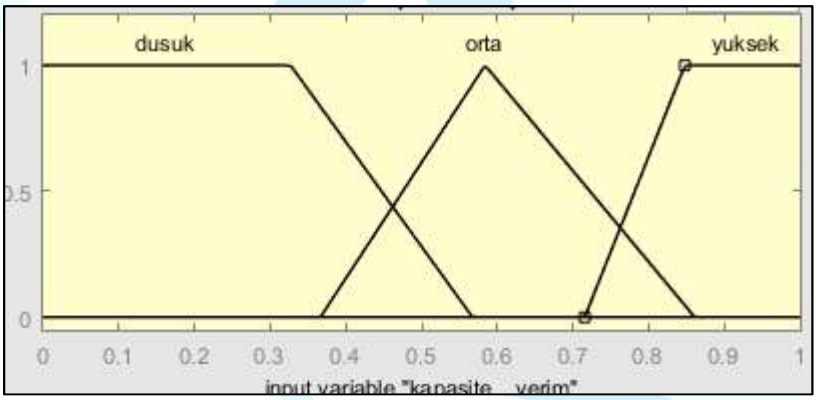

Figure 1. *Membership functions of capacity efficiency*

The second input variable is the travel time. If the operational costs are low, it is acceptable that the travel time is high. But if the operational costs are not low enough, the length of the travel time is critical. Membership functions of travel time are shown in Figure 2.

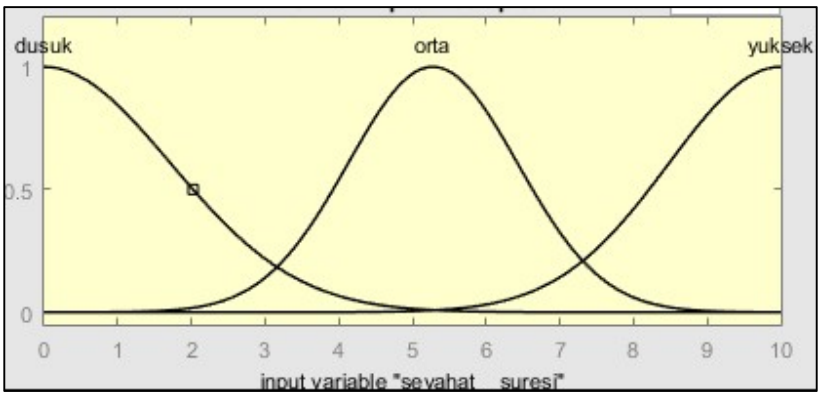

Figure 2. *Membership functions of travel time*

The third input variable is operational costs. High operational costs are not desirable at transportation management. However, if the operational cost is high and the occupancy rate of the vehicles is not sufficient, the transportation process is much more negative. Membership functions of operational costs are shown in Figure 3.

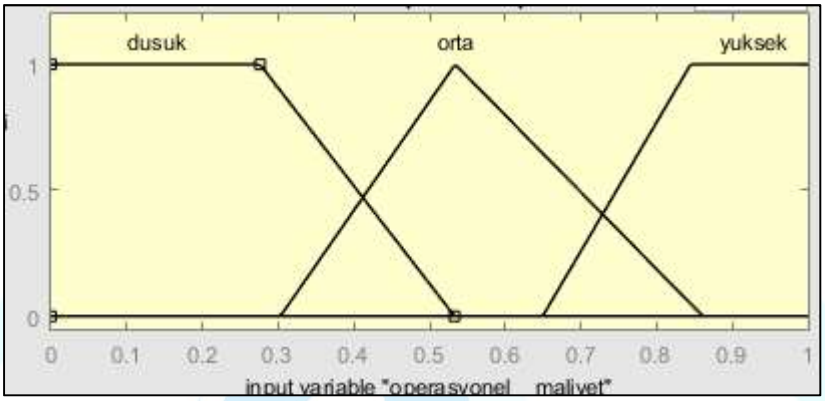

Figure 3. *Membership functions of operational costs*

The numerical equivalents of the inputs are processed according to the rules and an output occurs. Membership functions of transportation management quality to be used for output are shown in Figure 4. The limit values shown in all graphs need to be determined by the firms.

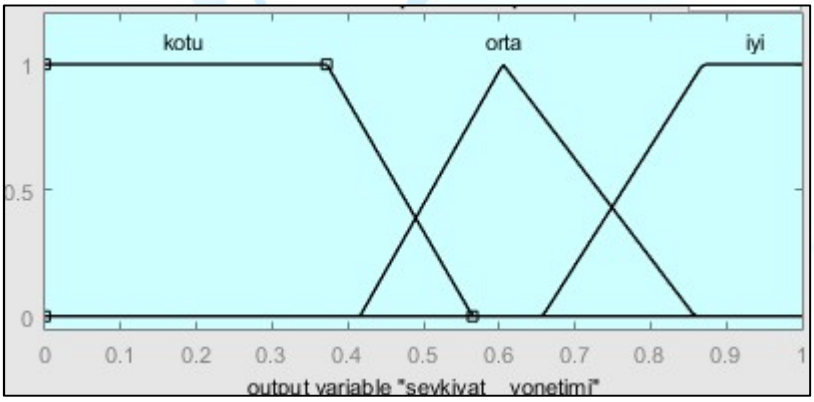

Figure 4. *Membership functions of transportation management quality*

CONCLUSIONS

The model proposed in the study aims evaluation of the shipment management activities of the road transport companies. In the proposed model, three input variables (capacity efficiency, travel time and operational costs) and one output variable (transportation management quality) are

considered for the transportation problem. All limit values and membership functions should be periodically updated according to the criteria for doing business. Companies set these criteria.

Fuzzing in the values can be visually monitored. A sample surface graph showing the capacity efficiency, operational cost and transportation management quality in the vehicles is shown in Figure 5.

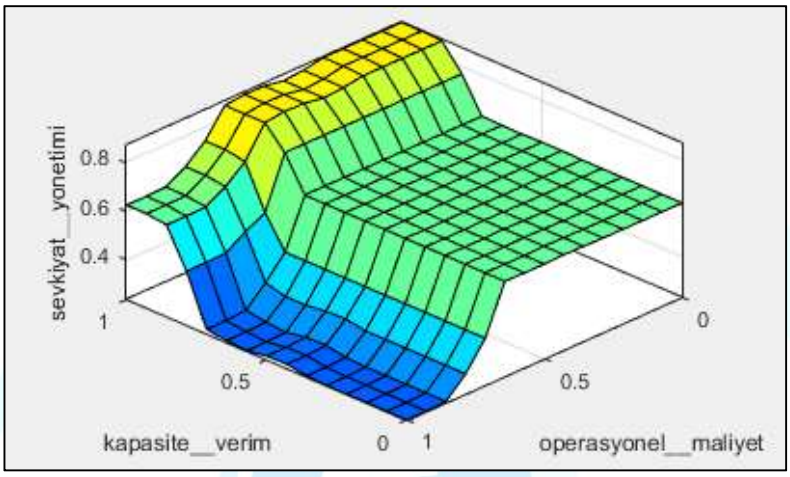

Figure 5. *Capacity efficiency - operational cost surface graph*

As a result, when the proposed model is fitted to the business processes, the shipment management can be reviewed and the process can be made more efficient by making correct decisions In subsequent studies, loading and unloading timing and service quality (items arriving just in time to the customer's plant, delivering without damage etc.) criteria's can also be added as input variables to the model.

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