

## CHOOSING THE RIGHT MODE OF TRANSPORT IN FREIGHT TRANSPORT

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*Summary: The choice of a suitable transport mode greatly affects the effectivity and profitability of realized transportation. Within the research conducted at the Department of Railway Transport, University of Žilina, was choosing the right mode of transport constructed by method of constructing matrix of benefits, or using selective diagram. Those methods largely objectify decision process and are supporting its optimization. Decision-making is performed on the basis of the assessment of the qualitative criteria predetermined for each particular transportation according to the type of goods.*

*Key words: mode of transport, effective, matrix of advantages, selective diagram*

### INTRODUCTION

Choosing the right mode of transport in freight transport is very important part of transportation realization, because it has to ensure the right parameters of transportation depending on the characteristic of transported goods, but also provides a suitable duration of transportation. Last but not least, the selection of a suitable transport system provides considerable financial savings. Choosing the right mode of transport is essential to ensure your import or export operation is efficient and cost-effective (1). The decision process was divided to four phases. Concrete phases are shown in table 1.

Tab. 1 - Phases of decision process

Phases of decision process	
1.	Identification of problem
2.	Process of examining options
3.	Selection process
4.	Subsequent evaluation

Source: (2)

### 1. THE CHARACTERISTICS OF THE VARIOUS TRANSPORT SYSTEMS

In conventional transport systems it is essentially a choice between air, water, rail and road, and each mode has its advantages and disadvantages. All these characteristics of the various transport systems are ultimately decisive in selecting a particular mode of transport

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for the realization of the transport itself. Advantages and disadvantages of different transport systems are described below and subsequently summarized in table 2.

Tab. 2 - A comparison of the advantages and disadvantages of transport modes

Mode of transport	Advantages	Disadvantages
Air transport	Speed Safety Reliability Level of customer service	Costs Availability
Water transport	Low costs High transportation capacity Safety	Low speed Availability
Rail transport	Ecology High transportation capacity Safety	Availability Reliability
Road transport	Flexibility Availability	Costs Low transportation capacity Safety

Source: (2)

### **Air transport**

Air transport is mainly characterized by safety, high speed and high level of customer service, but its availability is limited. This fact alone may significantly extend transport "from door to door". Air transport is also considerably expensive.

For these reasons, air transport is particularly suitable for transport of objects of high values for long distances. In this case, the higher cost is acceptable in view of the requirement for speed and reliability of the delivered consignments.

### **Water transport**

Water transport is characterized especially by low-cost and high-capacity. Travel speed is in the case of water transport relatively low. The disadvantages of water transport include limited network of transport routes, as well as higher costs for loading, unloading and transshipment of goods.

Water transport is suitable for the transport of consignments of large volume or large amounts of objects transported, especially over long distances, when the delivery time is not much important.

### **Rail transport**

Among the advantages of rail transport belongs that it can carry relatively large quantities of goods, and the goods large and heavy, relatively low transport costs, environmental aspect and higher reliability compared to road transport, especially in poor weather conditions. The disadvantage is the need for transshipment for transportation "from house to house".

Rail transport is suitable for the transport of bulk substrates to the medium to long distances.

## Road transport

Road transport excels by excellent access, the ability to deliver cargo "from door to door" without need for further transshipment and by high flexibility. The disadvantage is a lower amount of transmission capacity as well as higher transport costs over longer distances.

## THE SELECTION PROCESS

The selection process of mode of transport should be based on pre-established criteria and assess a number of factors that ultimately affect the final quality of realized transports. The criteria are determined by the transporter or by the person who arranges the transport.

These criteria can be partly subjective, but varies greatly depending on the characteristics of the goods transported, as well as on transport parameters such as distance, quantity of goods and other requirements. Examples of some qualitative criteria that affect the decision making are shown below in figure 1.



Source: Authors

Fig. 1 - Quantitative criteria of transport modes

### Availability

Availability - a qualitative level of access to the freight transport system, as well as the level of interconnections with other transport systems. Availability should be assessed in terms of transport "from house to house." It largely depends on the level and extent of the infrastructure of the transport system (3).

### Speed

Speed is assessed against the total time of the journey, including the periods necessary for the case of transshipments and waiting times in case of transportation "from door to door". Travel speed is currently often the most important for decision on the selection of transport mode (4).

### Price

Price - total cost of transportation, including loading, unloading and transshipment, packing and protect goods from damage and any other additional charges. While in the past this criterion was more or less priority, today are more decisive speed of transport, transport capacity and ability to guarantee a predetermined delivery time of transported goods (5).

### **Reliability**

Reliability can be defined as the ability of the transport system to eliminate the randomness and unforeseen circumstances that can lead to delays of transported goods at transport infrastructure and the consequent increase of the total time of transport and non-compliance of the stated delivery times (3).

### **Safety**

Safety - ability of transport system to protect goods before their partial damage, loss, or complete destruction. Safety is assessed in terms of accidents but also in terms of possible crime since taking over of goods for shipment, until its takeover by designated beneficiaries (3).

### **Additional services**

Additional services - currently are largely influencing decisions about the mode of transport. Complementary services includes for example the exact position of items, delivery time, delays at the transport infrastructure, loading and unloading goods, the possibility of customs clearance, providing the necessary documentation, as well as various benefits provided to transporter for regular use of certain system (4).

## **MATRIX OF BENEFITS**

Research conducted at the Department of rail transport at the University of Žilina has demonstrated the appropriateness of the selection process through the construction of matrix of advantages, where to the individual quality criteria were assigned weights depending on the importance of a particular criterion for a particular transport. Weights were determined on a scale of 1 - 4, wherein:

- 1 – Not important.
- 2 – Less important.
- 3 – More important.
- 4 – Very important.

It was subsequently assessed the ability of the various transport modes to meet requirements in terms of specific criteria. This ability was expressed on a scale of 1-4, wherein:

- 1 –Meeting the requirements.
- 2 – Little meeting the requirements.
- 3 – More meeting the requirements.
- 4 – Completely meeting the requirements.

The resulting suitability of the transport system was calculated as the sum of multiples of weights of criteria and assessments of ability of the transport system to meet the requirements of criteria (1):

$$X = \sum_{k=1}^k a_n \cdot b_n \tag{1}$$

Where:

X – The resulting value of the benefit.

k – Number of criteria (6 in this case).

$a_n$ – Weight of criterion n.

$b_n$ – Ability to meet the requirement of criterion.

There is the matrix of benefits in the figure 4, which has been designed for fast transport of perishable goods for middle- long distance (300-500 km). In this case it is best to obtain the most points.

Weight[ $a_n$ ] fulfillment[ $b_n$ ]	Air transport	Water transport	Rail transport	Road transport
Availability	3 2	3 1	3 3	3 4
Speed	4 4	4 1	4 2	4 3
Price	3 1	3 4	3 3	3 4
Reliability	3 4	3 2	3 3	3 2
Safety	2 4	2 2	2 3	2 1
Additional services	2 3	2 1	2 2	2 4
X	51	31	45	52

Source: Authors

Fig. 2 - Matrix of benefits

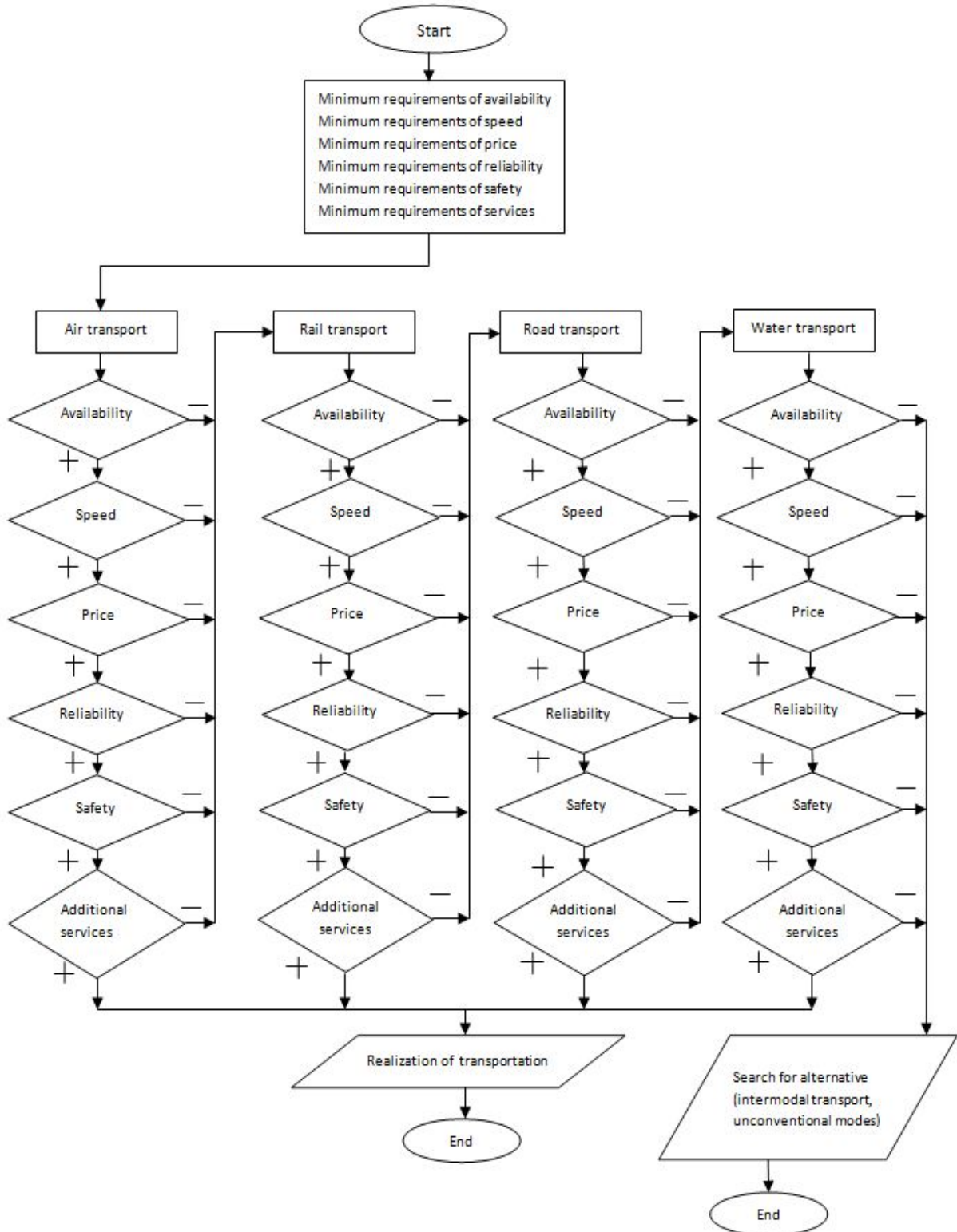
In this case, the criteria as well as their weights were set based on research conducted at the Department of Railway Transport, University of Žilina. This research was conducted on a sample of 50 transporters. At first, transporters set the criteria. Then they set the weighting of the criteria on a scale 1-4. The final weights of criteria were calculated as the arithmetic average of ratings.

### SELECTIVE DIAGRAM

Research has shown that when the minimum level of any criterion is strictly set, is the best to do the decision process by using selective diagram. Selective diagram illustrates the sequence of steps according to the ability of the transport mode to meet the laid down minimum criteria.

If the assessed mode of transport does not meet those minimum requirements, this mode of transport is excluded and the assessment is switched to another mode of transport, which is assessed the same way. For the below diagram it is necessary to appropriately select the

sequence of assessing of transport systems and criteria specific to the needs of transport and how they fit for the realization of the transport (Fig. 3).



Source: Authors

Fig. 3 - Selective diagram

## CONCLUSION

One of the basic tasks before carrying out a shipment is the selection of a suitable transport system. Research conducted at the Department of rail transport at the University of Žilina demonstrate the suitability realize the process of selection on the basis of drawing up the matrix benefit, which provides comprehensive information on all transport systems and the effectiveness of their use for realized transportation. In the case of strict requirements to the minimum levels of key criteria, the process should be realized by selective diagram, which assesses the ability of the various transport systems meet these requirements. The selection must be realized on the basis of the assessment of relevant criteria which the transport system has to meet. These criteria are reviewed and compared with the parameters of the realized transportation and with transportation requirements. The method of assessing the suitability of transport modes by the matrix of advantages as well as assessing the suitability of transport modes by the selective diagram are considerably optimizing the process, because the choice of appropriate mode of transport system significantly influences the level of efficiency and profitability of realized transportations.

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