Characteristics of multimodal transport regarding economic factors

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ABSTRACT

Multimodal transport implementation allows connecting the point of origin and the point of destination in an optimal way. The goal of multimodal transport is to maximize the efficiency in connecting the economic elements of various traffic branches, i.e. their operations related to transport and communications, thus positively reducing the inventories of raw materials, semi-products and end products with the aim of increasing the balance in the overall economic system of a country. The development of multimodal transport and good organization of the traffic system make it possible to increase the existing and to generate new freight flows that would result in positive effects on the import-export balance.

KEYWORDS: multimodal transport, transport operations, economic elements

1. Introduction

Multimodal transport represents the basic precondition of efficient performing of all the traffic activities, and appears as an active promoter of economic and traffic development, and as a creator of the wealth in all the economic sectors. Regarding the influence of multimodal transport on the complete traffic system including the social and economic development, it comes to the fore by its direct contribution to more efficient integration of national economies into the international division of labour, above all to the more successful marketing of national products on the foreign markets and better import of production materials for the needs of national economies. The reason lies in the fact that multimodal transport, as a stochastic and dynamic system performs the transport services of goods and passengers in national and international maritime, rail, road, air and river traffic, and represents the backbone of national and European, i.e. world economic organism.

Multimodal transport of a country has to be compatible with adequate multimodal transports of other traffic systems. Therefore, the traffic infrastructure of different countries and regions should be reduced to identical level, which is not the case in practice. The region of Southern-Eastern Europe lags significantly behind the developed traffic system of the European Union countries, which is the consequence of historic events in this region. Therefore, the countries that form this region are making great efforts to develop multimodal transport networks in order to come closer to the rest of Europe.

Due to its high demands and significance in international and national economic systems the international multimodal transport should be regarded as a complex and stochastic system. It represents a set of interconnected and interdependent traffic and technological activities, such as the processes, functions and operation of direct and indirect participants, traffic and other staff and technical aids in their work, as well as other elements, in constant movement, changing and developing, which are the technical and technological, organizational and economic

and legal elements, which enable the manipulation and transport of goods from the manufacturer in one country to the consumer in another country, or via a third country, fast, safe and economically by a minimum of two different transport means and based on a unique transport contract, i.e. one transport document provided the entire transport process is performed or organized by one transport operator. Systemic definition of international multimodal transport contains all the essential characteristics of complex, dynamic, economic systems.

The use and popularity of multimodal transport in the world marks daily an increase in relation to other transport modes due to reduced costs and by achieving a shorter transport time. Therefore, there are many multimodal operators on the multimodal market creating mutual competition and providing different multimodal services to the users at different prices of these same services.

2. Multimodal market

Since market is the point of connection of the supply and demand, the traffic demand for multimodal transport needs to be defined first of all. The traffic demand is a set of all the needs that have their material base created as a source of tendencies to change place, regarding the place and time of origin provided the change of place cannot be realized unless traffic infrastructure and traffic means are used. Since the traffic demand depends on a series of parameters it can be expressed as a function. The initial parameters to calculate the traffic demand "P_q" are:

P – service prices,
m – place of demand,
t – time of demand,
r – level of economic development of a country.
Consequently, function "f" of traffic demand is:

$$P_q = f\left(p_1, p_2, p_3, r, m, t,\right).\qquad(1)$$

The traffic demand can be considered as a whole which can be divided and defined as a unit need or by groups of similar needs. If it is considered from the aspect of the place of its origin or termination, then we can speak of generated, i.e. sinking (target) traffic demand. The generated traffic demand matches the needs of delivery of goods, and sinking or target demand with the needs of dispatch of goods. In order to consider all the needs for the delivery i.e. dispatch of goods, we start primarily from the level of production in a certain area or areas and types of goods, and on the other hand for these areas the demand needs to be quantified per types of goods.

In a certain area, if we study the traffic demand, we will notice that it changes from period to period of

observation. A similar tendency occurs if we study these relations from place to place which depends on the economic and social level of development and structure of the economy of the respective area. The total traffic demand can be studied per segments and studied per individual needs for transport or per groups of similar needs, i.e. per types of goods and groups of goods. For the analysis of the current and the projection of future traffic demand various models of demand distribution are used, and the gravitation model is very suitable, i.e. monitoring in the gravitation area. These models are suitable for the analysis and monitoring of traffic demand in the gravitation area of intermodal terminals. This means that in this way we analyze the physical distribution of the traffic demand. This model is used to monitor the traffic demand in the gravitation area in source-target pairs, i.e. two parameters where the source is the studied area, and the target is the same area and environment. The mentioned model can be symbolically presented by:

$$t_{ij} = g_i a_j G_i A_j f_j\qquad(2)$$

where:
t_{ij} – traffic flow from the zone of origin "i" to the target zone (sinking) "j",
G_i – total originating traffic demand of zone "i",
A_j – total price (sinking) of traffic demand of zone "j",
f_{ij} – pondered traffic resistance between the zone of origin "i" and the zone of target "j",
g_i, a_j – balance constants.

Apart from the physical distribution we can calculate the distribution of the traffic demand per transport modes, by model:

$$t_{ij}^m = g_i a_j G_i A_j f_j^m\qquad(3)$$

where:
t_{ij}^m - traffic flow of the transport type "m" from the zone of origin "i" to the zone of target "j",
f_{ij}^m - traffic resistance for the type of transport "m" between zone "i" and zone of target "j".

The traffic demand cannot be fully broken down into individual types of transport, especially if transport is carried out by multimodal transport means. This method of traffic demand distribution per types, regarding the impossibility of accurate division, serves to determine the global relations among individual types of transport. In this way the determined traffic demand, which actually represents the traffic flow, is distributed in origin-target pairs along respective roads on which concrete transport is to be realized. The realization of transport will be checked

for that type of transport and on those roads that provide the least resistance, i.e. have least congestion and achieve optimal effects in transport. The traffic demand, either generated or sinking-target, is realized in traffic flows.

At the time when the service prices are becoming more and more unique, the crucial role on whether a job on the market of transport services will be secured or not belongs to numerous criteria of competitiveness of service provided to the users. Defining of the structure of criteria preferences in the selection of optimal multimodal operator by the service users means primarily defining who is the user and who participates in decision-making about the selection.

3. Structure of criteria preferences in the selection of optimal multimodal operator

Until some thirty years ago, there was a tendency to give absolute priority in the process of traffic planning and decision-making to the economic criterion, i.e. to the selection of the most economical version of traffic solutions or decisions as the optimal version of the solution. In the majority of cases such solutions have neglected the significant criteria out of which some are contained in the economic category, i.e. transport service price, but some are not. The increased awareness about the "real" value of the transport service as well as in accordance to the increase in requirements and needs of the transport service users, numerous criteria that emphasise the specific characteristics of the users' requirements, various standards and community requirements have the increasing role in the process of traffic planning and decision-making, including the selection of optimal multimodal operator.

As organizers of the transport process and advisers of their principals, the decision-makers (international forwarding agents, logistic operators) in the selection of optimal multimodal operator take over full responsibility for integral transport chain, where the use of connected multimodal services ceases to be the customer's choice, but rather the task of those who, as agents of their principals, ensure the logistic freight services. In this role, the focus is on the responsibility of the mentioned agents in the selection of the optimal multimodal operator for a certain type of freight, i.e. a multimodal operator who is considering certain criteria, and in accordance with the requirements and needs of customers, better than the alternative operator, and thus also more competitive on the market of transport services. The mentioned responsibility for the agent represents a complex task which requires the knowledge of numerous traffic elements and phenomena.

Consequently, the study should include the specific characteristics of the traffic market, i.e. supply, demand and environment, the specific characteristics of organization and types of transport, customer requirements, requirements of individual types of freight and types of transport, competitiveness criteria of the traffic route, criteria weights and other determinants important in the decision-making process regarding the selection of optimal multimodal operator.

The service user on a certain traffic route is the ordering party of the transport service or other transport services, which communicate with the subjects participating in the production of these services directly or indirectly via their agents. The importer or exporter, seller or buyer, consignor or consignee of freight and the carriers can act as the service ordering party.

The service ordering party usually engages an international forwarding agent, who as an agent and representative of the principal plays the role of: multimodal transport operator, shipper or consignor of goods, consignee of goods, and logistic operator.

The agents are entrusted with the basic and special jobs that they perform occasionally or regularly in organization as well as other operations and activities for complete logistic (traffic) service of dispatch, delivery and transportation of goods.

According to FIATA an international freight forwarder is a person who concludes a contract on international forwarding services with the customer, i.e. principal, where the international forwarding services represent all those services that are related to transport, warehousing, bundling, handling, packaging and distribution of goods as well as additional appropriate optional services related to customs clearance, goods declaration, taxation, insurance of goods.

A multimodal transport operator (MTO) is any person who on his own behalf or through another person acting on his behalf concludes a multimodal transport contract and who acts as a principal, not as an agent or on behalf of the consignor or of the carriers participating in the multimodal transport operations, and who assumes the responsibility for the performance of the contract.

According to the UNCTAD definition (United Nations Conference on Trade and Development) MTO has been categorized as maritime and non-maritime carrier. Maritime carriers as multimodal transport operators are represented by operators, i.e. shippers who expanded their services at the account of freight transport from port to port including land transport or air transport. They can but need not to have their own transport means (road, rail, air). If they do not own them, they negotiate these types of transport concluding contracts with carriers. Additionally, they can contract land stacking and warehousing

services as well as numerous other services. Non-maritime carriers as multimodal transport operators are represented by the remaining transport operators who neither own nor operate ships, but rather contract maritime transport. They operate only one type of transport, by trucks, rarely by aircraft or trains, in majority of cases only at one end of the route.

A logistic operator is a registered and authorized legal or natural person who as a rule on his behalf and for his account performs or organizes numerous logistic activities related to manipulation, transport, transfer, movement, distribution of raw materials, semi-products, production materials, finished products, goods, materials from the point of delivery (warehouses, terminals, customer, exporter, manufacturer, …) to the point of receipt (manufacturer, warehouses, terminals, customers, importers, users, consumers, ...) and who, with minimal invested resources (production, financial, human, ...), maximally meets the market requirements.

It should be determined what will interest the users and what will condition the method in which they will decide to address their transport and logistic needs to a certain multimodal operator. The research of multimodal transport market means the study in relation to supply (maritime lines, ports, land traffic routes, land terminals, warehouses, ...), demand (users requirements, freight requirements, ... price of service, quality of service) and environment (alternative traffic routes, catchment area, economic power of the hinterland, ...).

The study of multimodal transport supply refers to the study of internal quality of service determined and realized by the subjects participating in the production of the traffic service (carriers, logistic operators, ...), traffic infrastructure and suprastructure as well as conditions of transport and other activities.

The study of demand for multimodal transport services refer to the study of external quality of service which is determined by specific requirements (qualitative, economic, ...) of the service users who at the same time represent the criteria and indicators of multimodal transport competitiveness. Since these are usually different requirements and criteria of different market segments, the definition of competitiveness priority criteria i.e. the preference structure (weights of single criteria) is of great significance. The supply, demand and the environment of multimodal transport, i.e. value influence of criteria that determine them have to be analyzed in relation to market segmentation since the user requirements regarding preferences of certain criteria may differ from each other regarding the type of freight, method of transport, presence of long-term contracts, etc.

4. Selection of competition criterion of multimodal operator regarding user requirements

The price and the quality of service are one of the most important factors in the selection of the optimal multimodal operator and their transport technology and transport means.

The lack of understanding and the impossibility of unambiguous definition of criteria in selecting the optimal multimodal operator are justified for several reasons, and may be justified by different types of freight that prefer different transport modes, characteristics of traffic infrastructure, suprastructure, organization of transport, possibilities of its planning, transport effects. They are different for different types of transport, with any transport mode having its specific advantages and drawbacks and the fact that every user of the transport service can have different priorities or requirements.

The analysis and selection of the best solution was based on the economic criterion, i.e. on economic conditions and effects. This means also the analysis of costs and is used in the construction of certain traffic infrastructure facilities, analysis of the transport service price, overviews of the past investments, plans and estimates of the future investments, usually into traffic infrastructure, etc. Special studies were made which determined the traffic solutions assessed according to other criteria, social criteria, etc.

Criteria can be analyzed at several levels, i.e. basic criteria are analyzed regarding the less complex criteria – sub-criteria, components and categories. From the economic aspect, these are the economic criteria, which mean the price of the transport service (maritime fares, road tariffs, rail tariffs, tariffs for transport on inland waterways, tariffs of multimodal transport, ...), freight handling price (handling tariffs – port tariffs, handling tariffs – trucks, handling tariffs – rail cars, handling tariffs – inland navigation, ...), logistic costs (waiting costs – border crossings, freight handling; storage costs – stacking; sorting costs, designation costs – marking, ...), total price of the traffic service (price of road transport and operation, price of rail transport and operation, price of sea transport and operation, price of multimodal transport and operation).

5. Structure of criteria in selecting an optimal multimodal operator

The problems of selecting the optimal multimodal operator represent a complex task which includes analysis, planning and management of many factors and elements

that stipulate and determine it. Accordingly, there is a need for certain methodology in analysis, research or decision-making related to this problem.

These elements or criteria need to be defined regarding their weight, i.e. regarding the significance they have for the service user, respecting the specific characteristics of individual types of transport, types of freight, etc. The criteria need to be analysed parallel in environmental conditions, i.e. by comparing the state of other alternative multimodal operators who compete in attracting the same freight flows.

It is very difficult to determine which aspects are optimal for analyzing the weights of individual criteria of competitiveness and quality of transport service. Therefore, it has to be concluded whether these are the requirements of the freight itself i.e. of the transport substrate, whether these are objective and always the same advantages or drawbacks of individual transport modes and whether these are the market requirements i.e. service user requirements.

6. Conclusion

The multimodal market represents a continuous process of evolution. The basic task of the transport operator or international forwarding agent regarding transport and logistic requirements is to adapt the strategy and determine what will be of interest for the customers and to determine the method in which they will make the decision in selecting the multimodal operator.

The study of the offer of a multimodal operator and the traffic route refer to the study of so-called internal quality – IQ, which is determined and realized by the subjects participating in the production of the transport service, traffic infrastructure and suprastructure and the transport conditions and other activities. In other words, the supply refers to the transport potential that should reflect the diversity of the market and have a wide user-oriented offer of solutions and conditions. The study of service demand on a traffic route refers to the study of so-called external quality – EQ, which is determined by specific requirements (economic, qualitative, etc.) of the service users, which at the same time represent the criteria and indicators of traffic route competitiveness. Since this usually refers to various needs and criteria of different market segments, it is very important to define the

priorities of criteria of competitiveness, i.e. the structure of preferences, i.e. weights of individual criteria.

The mentioned internal and external quality of service, i.e. criteria that define them, should be analysed within the environment conditions, i.e. of competition as a general quality of multimodal operator service.

The offer, demand and environment of a multimodal market, i.e. value impact of the criteria that define it, have to be analysed in relation to the market segmentation since the user requirements regarding preferences of certain criteria may differ depending on the type of freight, method of transport, presence of long-term contracts, etc.

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