The Process of Choosing Transport Modes in a Logistic Chain

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Abstract: The ever increasing demands of beneficiaries have led to the development of the transport system and automatically to an increase in the volume of freight transported. The increased performance of the transport system is one of the objectives of the decision makers, who seek to make efficient use of the modes of transport but also to increase the level of cooperation between them. Service quality is an attribute describing the performance of the transport system. Thus, flexibility, reliability, journey duration or security are criteria that allow for quality assessment for all transport modes. The process of choosing transport modes in a logistic chain depends on the particular interests of the decision maker, but also on the complexity of the chain. In a transport process, there are several partners who carry out activities that require careful planning to meet all the logistical requirements, tasks and related responsibilities. The decision for the modal choice as well as the selection of the carrier is an important part of the decision making process in the transport activity. Within our study we have tried to highlight and analyse some important factors that influence the process of choosing transport modes.

Keywords: *Logistic chain; transport mode; decision maker; modal choice.*

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1. Introduction-Decision Makers in the Modal Choice

The process of choosing transport modes in a logistic chain depends on the particular interests of the decision maker, but also on the complexity of the chain. In a transport process, there are several partners who carry out activities that require careful planning to meet all the logistical requirements, tasks and related responsibilities.

The table below highlights the levels of influence of the partners that are able to plan a transport, to organize and to choose the modes of transport, from the sender which determines the transport demand and can even plan the whole transport process, until the shipping houses, that ensures the transport to the destination in time.

Table 1. The levels of influence of the partners in the process of choosing transport modes in a logistic chain

No.	The level of influence	Participant
1.	Possibly decider at the level of the entire logistics chain	- The shipper - The shipping company
2.	Possibly decider at the level of the entire logistics chain or on certain components thereof	- Dispatch houses - The road transport operator from the importing country
3.	Possibly decider on certain components of the logistics chain	- The logistics services provider - The multimodal transport operator
4.	It does not take part in the decision-making process of transport planning and organization	- The multimodal transport operator - The river transport operator - The road transport operator - The transport terminals operators

The dispatch houses offer a complete and varied range of services such as transportation planning, but also of the related documents, internal or external transport tracking, storage/ consolidation/handling/insurance of goods or negotiation of transport tariffs. Depending on the carriers to which the shipping companies belong, most of the time they choose the modes of transport that will be used to carry out the transport.

Performed studies (SPIN, 2002) have shown that most of the time the decision to choose a mode of transport belongs to the shipper, who is the main decision maker. However, at the level of a logistics chain, there are cases where other participants can play a key role in making decisions, whereas dispatch houses stand on the second place after the shippers.

2. Criteria of Decision in the Modal Choice

At the logistics chain level, one of the key decisions of the process is the choice of the mode or modes of transport and essentially the carrier. Although most of the main attributes taken into consideration in modal choice are cost and transport time, studies have shown that the decision criteria in modal choice are multiple.

The scientific literature presents numerous models that aim to determine the decision criteria in the modal choice. The most important ones highlighted through the models are: classic economic models (based on transport distances), trade-off models (which add up the transport costs and the rest of the associated costs- non-transportation costs), inventory-theoretic models (which take into account not only transportation costs but also orders and inventory costs) and constrained optimization models (McGinnis, 1989).

The decision for the modal choice as well as the selection of the carrier is an important part of the decision making process in the transport activity. These decisions include a series of variables that aim at transport performance such as: the levels of services provided, negotiation rates, or carrier performance assessments (Meixell & Norbis, 2008).

In terms of supply chain management, the complexity of the activities and processes that take place at its level seek to obtain added value for both customers and participants within the supply chain. Thus the decision of modal choice intervenes in several points of the supply chain, a decision that at this level seeks to achieve economies of scale or scope (Cooper, Lambert, & Pagh, 1997).

Before choosing the modes of transport that will be used in the logistics chain, it is necessary to establish some essential conditions that must be satisfied during the transport process. These conditions are established according to two important elements:

- the requests of the beneficiaries regarding the delivery period of the goods or the general preferences related to the technical and organizational aspects of the transport process;

- the general characteristics of the goods that offer information related to: their size, perishability, fragility, sensitivity to certain temperatures, humidity, etc.

- Factors influencing the choice of transport modes at logistics level were highlighted by Pedersen and Gray (1998) based on an analysis of the scientific literature. They divided the modal selection criteria into four factors as follows:

- the factors that target the price by taking into account the lowest freight rates, the transport offers related to quantity or distance or the relation between the actual and the estimated costs;

- the time factors that take into account the frequency of transport, the transit time, the direction of transport or the reliability during the time related to the collection and delivery of the goods;

- factors regarding security and control that take into account the reduced damage of the goods, the frequency of losses, the ability to monitor the goods in transit or the control regarding the delivery time;

- the factors related to the services that concern the flexibility of the carrier, the ability to handle special transports, the ability/willingness to handle urgent deliveries or the coordination with the carrier.

Taking into account the modal choice criteria specific to the sender, we can specify that they depend on (Costescu, 2010):

- the geographic location of the sender which influence the decision of modal choice by the location towards the points of production or the distance to the points of delivery of the goods, but also by the accessibility to the transport terminals;

- the size of the company that influences the process of outsourcing the transport to various dispatch houses, the volume of shipments or their frequency.

Meixell and Norbis (2008) have identified in their paper five challenges that influence the logistic process of modal choice as follows:

- the lack of transport capacity: the limitations of the transport capacities affect to a greater or lesser extent the carriers that offer transport services of a certain way, this having a decisive role at the level of the modal competition;

- the international growth: the international freight flow influences the modal choice process, increasing the volume of freight automatically attracting higher transport needs (the more transport possibilities and the greater the volume of cargo is, the more difficult the modal choice decision is);

- the scope and scale economies: these make up an area that is often overlooked in carrier selection, although economies of this kind can influence the overall efficiency of transportation;
- the security issues: taking into account global security phenomena, carriers seek to choose safe modes of transport, secure terminals or meet packaging security requirements;
- the environmental and energy concerns: taking into account the attention paid to the problems related to environmental protection and energy consumption, but also to the fact that transport is the main source of pollution. These concerns are currently influencing the decision of modal choice to a large extent.

3. Analysis Regarding two Factors that Influence the Process of Choosing Transport Modes

After we highlighted the most important factors that influence the process of choosing transport modes, within our study we have analysed the factors that target the price and the environmental and energy concerns.

Figure 1. Infrastructure costs and taxes (bn. €)
Source: processing by EUROSTAT (n.d.); UIRR (2019)

The transport price is the most easily influenced by the applied tax system which in turn depends on the political factor, so the economists were interested in investigating the effect of these decisions on the transport modes offering feedback to support the political decision-making process.

Figure 2. Coverage of average cost - freight transport modes (€-cent per pkm)
Source: processing by EUROSTAT (n.d.); UIRR (2019)

As shown in figures 1 and 2, the mix of taxes levied on the four modes of land transport in the EU shows a unilateral image: the tonnage-kilometer truck subsidies are almost double compared to those received by trains and barges, the advantage of road transport annual level being 40%. This can easily be explained by the increasingly frequent use of trucks in European logistics chains and also the relatively low profitability of other modes of road freight.

Figure 3. Total costs and Taxes (bn €)
Source: processing by EUROSTAT (n.d.); UIRR (2019)

At EU level, the volume of freight and passenger transport has registered a steady increase in recent years, but growth is still expected at a slower pace (the target for 2050 being 40% for passenger transport and 60% for domestic freight). Thus, these increases can create capacity problems for some modes of transport, traffic congestion already drawing attention to economic and ecological problems, generating annual costs at EU level of over 150 billion euros which are expected to record 40% returns by 2050 (European Court of Auditors, 2018).

Figure 4. External costs from Accidents (Billion € per year)

Source: processing by EUROSTAT (n.d.); UIRR (2019)

There are numerous studies at the European Union that indicate that the main component of external costs is caused by accidents (over 30%) followed by congestion, air pollution, climate, noise, well-to-tank, habitat damage etc. (Van Essen, 2018).

Figure 5. Average External costs from Accidents (€ -ct/tonne-km)
Source: processing by EUROSTAT (n.d.); UIRR (2019)

As can be seen from Figures 4 and 5, in terms of transport modes, the most affected by these external costs due to accidents are land transport.

Figure 6. Modal split of inland freight transport, EU-28
(% share in tonne-kilometres)
Source: processing by EUROSTAT (n.d.)

As seen in the figures above, the road transport holds over 60% of the total volume of inland freight transported in 2018.

4. Conclusions

Our study has shown that even if the external costs and the price for road transport are higher than for any other mode of transport, it is a mode of transport that is highly choose. This show the fact that, when choosing the transport modes at logistics level there are a lot of factors that need to be taken into consideration.

Thus we can conclude that an important role in determining the requirements on which the decision to choose the mode/modes of transport is based on the structure of the loading units. The requirements for the formation of the cargo units follow the particularities of the goods that determine the specialization of the means of transport, the development of the means of handling or the special conditions of storage and transfer.

In order to overcome the challenges presented above and to meet the listed criteria, it is necessary to correctly determine the structure of the loading unit, taking into account at the same time the frequency, volume and allocation of goods on transport directions, these being the ones that directly determine the overall size of a freight shipment and planning and organizing the transport at the logistics chain level.

Thus, the decision criteria in the modal choice are divided into two categories: main criteria that take into account the economic calculations necessary to satisfy the cost/quality ratio and secondary criteria that show the subjective preferences of the parties involved (decision makers, operators, shipping companies, etc.). But, in the end, the decision of a well-founded choice is strictly related to efficiency, reliability and to the specific organizational aspects.

References

- Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *The International Journal of Logistics Management*, 8(1), 1-14. doi:10.1108/09574099710805556
- Costescu, D. (2010). *Cercetări privind rețeaua transporturilor multimodale la distanțe medii. Modele matematice și de simulare pentru amplasarea și dezvoltarea terminalelor* [Research on the network of multimodal transports at medium distances. Mathematical and simulation models for the location and development of terminals]. PhD Thesis. Bucharest, Romania.

- European Court of Auditors. (2018). Landscape review towards a successful transport sector in the EU: Challenges to be addressed. Retrieved from <https://op.europa.eu/webpub/eca/landscape-review-transport/en/>
- EUROSTAT. (n.d.). Homepage. Retrieved from <https://ec.europa.eu/eurostat>
- International Union for Rail-Road Combined Transport (UIRR). (2019). UIRR Report - European Road-Rail Combined Transport. Brussels, Belgium: UIRR.
- McGinnis, M. A. (1989). A comparative evaluation of freight transportation choice models. *Transportation Journal*, 29(2), 36-46.
- Meixell, M. J., & Norbis, M. (2008). A review of the transportation mode choice and carrier selection literature. *The International Journal of Logistics Management*, 19(2), 183-211. doi:10.1108/09574090810895951
- Pedersen, E. L., & Gray, R. (1998). The transport selection criteria of Norwegian exporters. *International Journal of Physical Distribution & Logistics Management*, 28(2), 108-120. doi:10.1108/09600039810221676
- Project SPIN - Scanning the Potential of Intermodal Transport. (2002). Deliverable 1: Actors and factors in transport mode decision in supply chain, European Commission 5th FP. Retrieved from <https://trimis.ec.europa.eu/project/scanning-potential-intermodal-transport>
- Van Essen, H. (2018). Sustainable transport infrastructure charging and internalization of transport externalities committed to the environment. Retrieved from <https://ec.europa.eu/transport/sites/transport/files/2018-year-multimodality-external-costs-ce-delft-preliminary-results.pdf>