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INTERNAL FACTORS OF RAIL FREIGHT TRANSPORTATION

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Abstract: *The aim of this study is to analyse the reason why the rail freight has a competitive disadvantage in comparison with the road transportation and to identify possibilities for further improvement. Both external and internal actions are needed to improve the competitive position. The influence of the external factors has been analysed in a previous study, so this study concentrates on the internal factors. One of the most effective tools to achieve these desperately needed improvements is the digitalisation of the Freight Transportation Industry.*

Key words: *rail, transportation, competitive advantage, customer analysis, digitalisation.*

1. Introduction

Despite all the efforts, in the past decades the role of rail freight transportation has significantly decreased, whereas the ratio of road transportations has continuously increased, as shown in Figure 1.

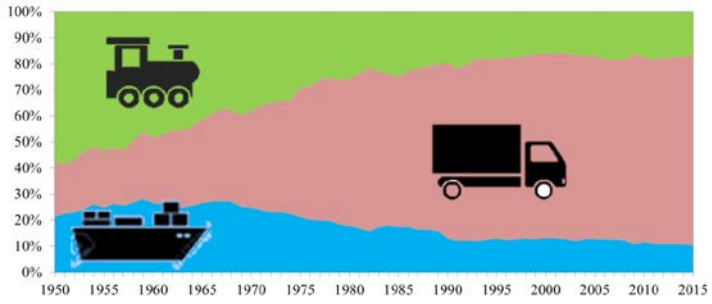

Fig. 1. *Development of the Modal Split in Europe [tons x km]*
(the author's own presentation, based on Eurostat\Database\Transport)

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These trends are in sharp contrast to the EU policy objectives, which include a target shift of 30% from road freight to rail freight for journeys over 300km by 2030, and a shift of over 50% by 2050, as set out in the 2011 White Paper (*European Commission, White Paper, 2011*) on transport.

2. Objectives

There are both external and internal factors which this unfavourable competitive position of the rail freight in comparison with the road transportation. The external factors have been already analysed in a previous study (Hegedüs at. al, "External Factors of the Rail Freight Transportation", 2017).

The aim of this study is to analyse the internal factors and identify possibilities for further improvement.

3. Methods

3.1. Customer Analysis

Some types of goods are intrinsically better transported by certain modes. For example, heavy bulk goods (such as coal) are predominantly transported by rail and perishable foodstuffs that are subject to a short production-to-outlet window can generally only be transported by road.

In between these extremes, the choice between road and intermodal transport is affected by a number of factors.

The choice between road and intermodal transport is affected by a number of factors, categorised as:

- **micro-level factors** affecting individual decision-making in the short term;
- **macro-level factors** which influence long-term trends at a more aggregate level.

Based on this observation, it is possible to describe a simple model of modal choice in which the shipper determines the appropriate carrier according to a number of attributes. A graphic representation of this environment is shown in Figure 2.

The main attributes are:

- **Shipper attributes** include firm size, accessibility – in particular the ability to directly access the rail network – and custom and practice among decision-makers in shipping companies.
- **Shipment attributes** include the type of goods, density (in terms of weight per unit of volume) and value per unit of product transported, degree of perishability, and package characteristics.
- **Carrier attributes** include total shipment costs, total delivery time, infrastructure capacity, service reliability, degree of safety, service flexibility, service frequency, availability of special equipment (e.g. refrigerated wagons, location trackers etc.).

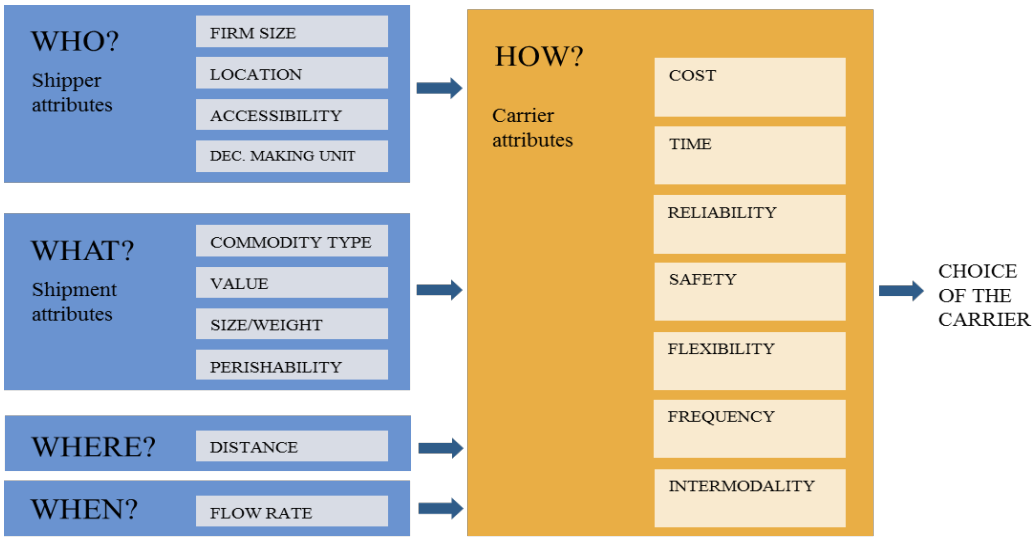

Fig. 2. *Decision factors when choosing between road and intermodal transport (Gleave at a.l 2015, 26)*

- **Distance covered** for all distances below around 300 km, road transport is markedly superior to rail transport in terms of cost and feasibility, see Figure 3.

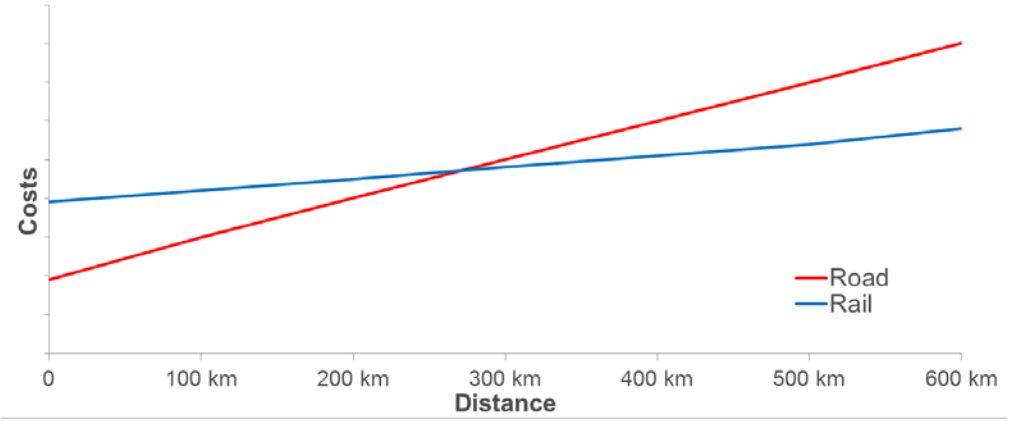

Fig. 3. *Cost comparison road and rail (the author's own presentation, based on Wittenbrink 2012, 17)*

- **Flow rate** at which shipments are carried out. Rail flow rates are less competitive due to the lack of flexibility on timetabled routes sharing both passenger and freight flows.

Obviously, some criteria are more important than others. Table 1 shows the relative importance of the criteria when making decisions regarding the transport mode.

Table 1

Shipper's selection criteria

	Important	Less important	Unimportant
Transport costs	43	0	1
Transport time	38	6	0
Suitability of transport capacity	36	7	1
Performance of additional service	7	25	12
Reliability of transport time	44	0	0
Extent of delay	37	7	0
Flexibility to individual requirements	31	13	0
Risk of damage	37	6	1
Announcement of scheduling problems	43	1	0

(European Commission, Eufranet 2001, 14)

3.2. Technology Level

As regards the quality perceived by the customer, the biggest gap between the rail and road transportation is in areas like delivery times, reliability/punctuality, proactive information etc. Although there certainly is room for internal improvements, one of the main handicaps of the rail is that it simply lacks the needed technology. Real time tracking & tracing, expected time of arrival etc. are basics for the truck but not for the rail transportation.

Even the basic function of all digital activities, tracking&tracing, is practically not available for the international Single Wagonload (SWL) (*Guglielminetti 2014, 10*). The extremely long-life cycle of the assets, the different national regulations and the numerous stakeholders make the introduction of new technologies even more complicated.

3.3. Competitor Analysis

The fact that the road transportation has an approximately five times higher market share in comparison to the rail transportation is not incidental. The comparison shown in Figure 4 explains the huge disadvantage of the rail transportation to the road.

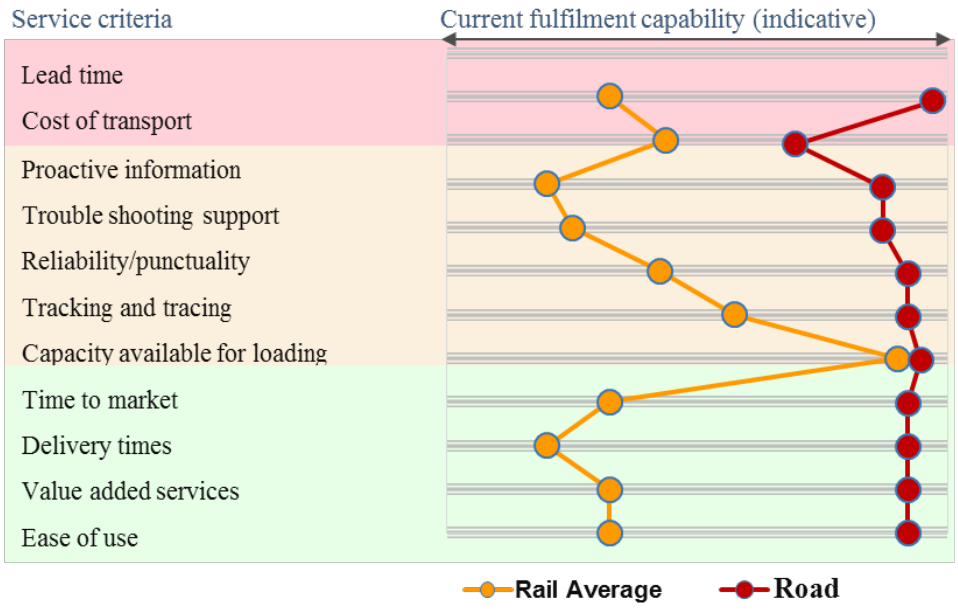

Fig. 4. *Severe gaps between rail and road*
(the author's own presentation, based on D'Incà 2016, 3)

3.4. Future Challenges

There are upcoming innovations both in the vehicle technology and in the process optimization, as shown in Fig. 5. It is easy to notice that urgent changes are needed in order to ensure the survival of the rail freight transportation.

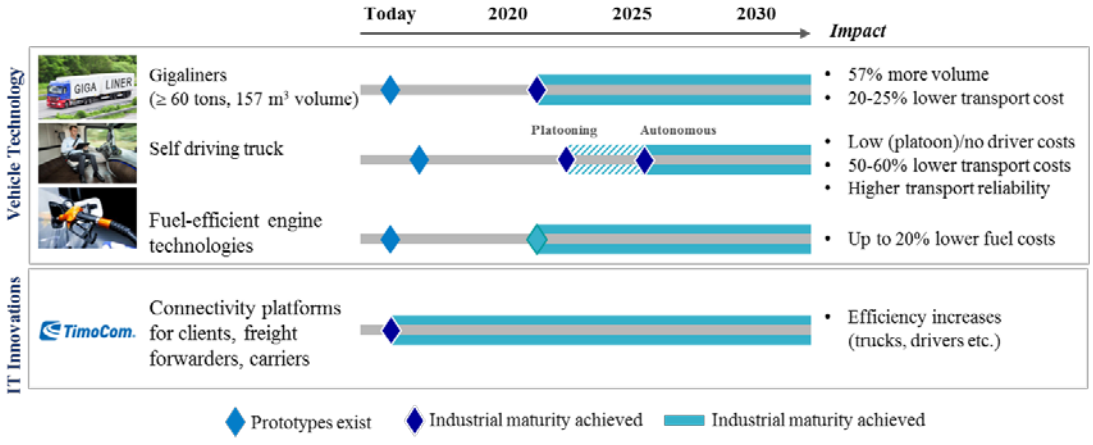

Fig. 5. *Disruptive productivity increase of the road transportation*
(*the author's own presentation, based on Steffens 2016, 4-7; D'Incà 2016, 3)*

3.5. The Structure of the Rail Freight Industry

There are numerous stakeholders in the rail freight industry, almost all of them with different objectives, see Figure 6.

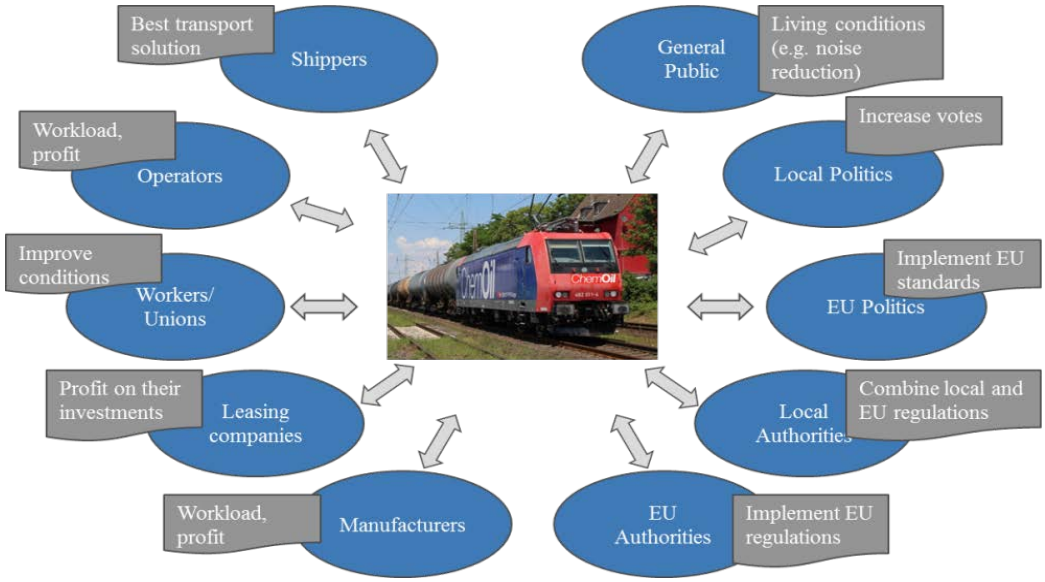

Fig. 6. *Rail Freight Transportation: Stakeholders and their objectives (the author's own presentation)*

3.6. Equipment Efficiency

The competitive (dis)advantage of the rail freight industry can be best seen in Fig. 7, showing the equipment efficiency of a train transporting chemicals between two locations (Germany and Austria) regularly.

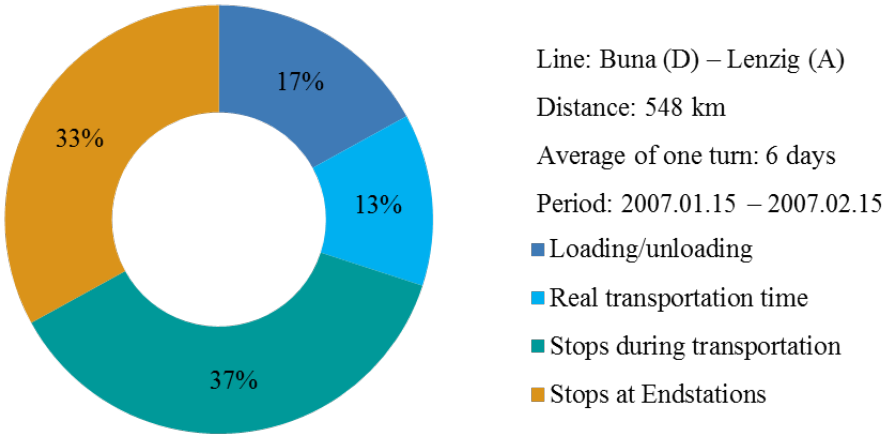

Fig. 7. *Time structure from a rail freight transport (König et al.2012, 38)*

4. Main Findings

The main difficulties faced by the rail transport:

1) Increased competition by road freight transport
   a. Road transport increases its competitiveness continuously;
   b. Road transport can react faster to changing conditions;
   c. Road transport is highly rated by shippers in terms of flexibility.
2) The quality perceived by customers is not sufficient
   a. International transportation is the worst;
   b. Poor service quality;
   c. Tracking and tracing is practically not available for the international Single Wagonload (SWL).
3) Low productivity and profitability, especially of the Single Wagonload
   a. Liberalization of the rail had limited effects on the SWL. New entrants focused on the intermodal and full train markets;
   b. Technological innovations are hard to be introduced, especially in the SWL, due to the need of interoperability;
   c. Large parts of the rail transportation are still operated according to traditional production and business models.
4) Hard to change and introduce innovation
   a. The rail industry is asset and resource intensive, which requires a careful long-term investment planning;
   b. The rail transport faces an increasingly volatile demand, resulting in short-term commercial and operational challenges; thus, there are no resources for long-term investments;
   c. Interoperability is needed, which makes the introduction of technical innovation difficult, especially in the case of SWL;
   d. Numerous stakeholders, difficult to set up a business case.

5. Discussions

In the already mentioned White Paper, the European Commission set the target to increase the modal share in Europe to 30% by 2030 and 50% by 2050. Taking into consideration the status and the analysis completed in the previous chapters, it can be stated that major changes are needed to be able to achieve the mentioned targets.
The needed actions can be grouped in external and internal factors.

5.1. Internal Factors (improving its own operations)

The rail freight industry has also to improve internally. The needed actions can be grouped as follows:

a) Improve competitiveness

- Faster and cheaper
- Improve service level
- Performance benchmarking, especially with the truck

b) Improve investment strategy
- Modularize investment, to obtain synergies
- Prepare for Industry 4.0
- Prepare for driverless scenarios

c) Build position in intermodal and driverless
- Develop intermodal solutions for train with driverless truck

5.2. Digitalisation as a Competitive Advantage

One of the most effective tools to achieve these desperately needed improvements is the digitalisation of the Freight Transportation Industry. The examples from the road transportation or industry show that there are huge short and long-term opportunities in the digitalization of key commercial/operations processes.

Some of the most obvious improvements which should be adapted from the already functioning models from the road or the general industry are:

a) Improve transport operations
- GPS based Tracking & Tracing
- Real-time optimization of transport operations
- Fully automated control of transport activities

b) Reduce costs
- Predictive maintenance
- Automation
- Energy-efficient driving

c) Improve customer satisfaction
- Real time information regarding the shipment
- Increase flexibility and improve information flow

d) Planning and capacity management
- Digital booking platforms and e-commerce platforms for capacity marketing
- Dynamic demand forecasting

6. Conclusions

6.1. The Status

Europe's railways have started to struggle from the late 1960s, with rail freight transport finding it difficult to compete with the increasing popularity of road and to adapt to new customer requirements.

At the same time, due to the increase of the road traffic in the last years, the road infrastructure has reached its limits in the urban spaces and busy traffic nodes *(Bretzke, 2014, 81).* A good sign in this respect is the increase of traffic jam messages between 2010 and 2016 by 275% *(ADAC, 2017).* In 2017 there was a total of almost 1.5 million kilometres traffic jam only in Germany *(ADAC, 2017).*

The European and national findings of the recent years have only been enough to stop the further decline of the market share of the rail freight.

Does rail freight have a chance to survive or even develop further? Internal and external changes are indispensable conditions to the success of the rail.

6.2. Needed Internal Changes

In order to satisfy its customers, it has to become faster and to improve its service level dramatically. The rail freight companies will have to build position in intermodal facilities or even road transportation to be able to offer complete solutions to their customers. The consequent digitalisation will probably be one of the key success factors for the rail freight industry.

6.3. Outlook

Summarising all the facts presented above, it can be stated that the rail freight industry already faces big challenges and will have to face even bigger ones in order to survive and further develop. External support is needed to create a competitive environment, but this alone will not solve all the problems. Customer orientation, improved investment strategy and a clever mixture of road and rail transportation is the key for future success.

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