

Sustainable development: Innovations in business

Robert Romanowski
Editor



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INNOVATIONS ON RAIL FREIGHT MARKET



Dora Naletina

University of Zagreb



Mate Damić

University of Zagreb

Abstract: Ten years ago, the European Union recognized the importance of stopping further development of road freight transportation and the need for making rail freight a more prominent branch of industry. Rail transportation used to hold a more relevant position, but because of slow response to changes on the market and no investments in modernization, it now occupies only around 10% of the share in freight transportation in most EU member states. Most members have initiated the implementation of the restructuring and liberalization of rail market, with the aim of establishing a multimodal transportation network and reducing negative impact of road freight on the environment. The Croatian market is no exception, of course. It has liberalized the rail freight market since the Accession to the EU, while the rail passenger traffic is still monopolized by a company owned by the state. The Croatian national carrier HŽ Cargo has decided to face the competition by restructuring the current business and giving a sharper focus on innovation (intermodal terminals, RO-LA, and digitalization of business operations). The above-mentioned topics are analysed in the following chapter.

Keywords: Croatia, European Union, HŽ Cargo, innovation, intermodal terminals, rail freight transportation.

7.1. Introduction

All countries benefit from freight transportation. It increases the value of goods by relocating them to the points where their value is increased. Freight transportation also broadens the area for the labour market and pushes the production and competition to expand outside their usual operational zones. Furthermore, freight transportation provides work for millions of people and boosts demand for goods and services. This leads to the conclusion that freight transportation plays a crucial role in the productive capacity of the country (U.S. Department of Transportation Federal Highway Administration, 2020). In 2017, the EU-28 transportation industry employed 11.28 million of people (European Commission, 2020). Freight transportation is the major component of all supply-chain and logistics systems (Ranaiefar & Regan, 2011).

Over the last ten years, the European Union has been working on expanding the multimodal transportation network, with the primary aim of reducing the extremely negative influence road transport exerts on the environment. The most promising plan for reducing negative influence on the environment mandates that freight gets relocated from the roads onto the network of the hinterland waterways and railways. In line with that, even back in 2008, the European Union highlighted the importance of creating the preconditions for the establishment of a modern and competitive railroad network, which would enable this type of transportation to become the engine of European integration. In 1970, the share of railroad transportation in the total land freight transportation in the EU area was 32.6% (European Communities, 2008). This fact should not pass unnoticed, as well as the figure of 17.83% in 2018 (European Commission, 2020). While the volume of the transported goods by rail declined in this period, the volume of the freight transported by the road continually increased, so the share of road freight in the entire land freight transportation in the European Union for the year 2018 was 71.95%. The drop in the volume of rail freight transportation would be even more substantial if the EU had not been putting considerable efforts in complete opening of the rail market services and their modernization. Supporting this, the volume of the goods transported by rail has been growing continuously since 2012. The White Paper on Transport (European Union, 2011) supports the idea that, even though rail is seen as not such an attractive mode of transport, it can provide a very good service. Ensuring conditions for fair competition of the rail market is crucial, so that this type of transport can take on more of the medium and long-distance freight (European Union, 2011). Rail freight transport has been very slow in accepting the changes, while containerised and door to door transport service have become widely accepted since the 1970s (Islam & Blinge, 2017).

The Republic of Croatia joined the unique market of the EU on 1 July 2013, which had significant impact on the rail freight market because the national

transportation operator that had previously enjoyed the monopolistic role was now forced to begin competing for the jobs with the competitive firms from the EU member states.

Bearing in mind the previously mentioned need for strengthening the role of rail freight transportation, as well as the fact of changing market situation after joining the UE, the need for analysing the characteristics of this market arises, with special emphasis on the analysis of the strategy implemented by the national HŽ Cargo operator, used as the answer to the pressure exerted by the competition. The main practitioners of the European transportation policy, as well as most member states have recognized the need for a more prominent role of rail in freight transportation. They see the key to success in the establishment of an open market and in the development and acceptance of innovations. It is innovations that are the key to achieving the goals on the rail market. These innovations can help bring all participants together in cooperation and they can play a significant role in promoting more sustainable business attitudes (European Union, 2011).

7.2. Literature review

The literature has devoted considerable number of pages to rail freight transportation and recognized it as important even more than 50 years ago. We can find many authors from the 1980s that focus on rail freight transportation, such as the research on algorithm for routing freight over a rail network whose tracks are controlled by several carriers, conducted by Lansdowne (1981). Crainic, Ferland and Rousseau (1984) dealt with the problem of routing freight traffic and tried to propose an optimal planning model for rail freight transportation. Haghani (1987) conducted extended research on the issues in rail transportation and focused on presenting recent optimization models for rail routing, etc.

Railway is one of the best options if one is to consider the optimization of the costs. It is the most cost-effective mode of transport, although being slow and less reliable than its main competitor—road. However, there are some advantages to rail transportation when compared to road: it can transport bulkier and heavier commodities (Rajabi, 2011; Shinghal, 2005) at lower external costs to community (The World Bank, 2009). In addition, the prices are usually uniform throughout the year, and are not strongly market driven. Road transportation, on the other hand, is greatly influenced by the market and seasonality, and the prices fluctuate from day to day (Shinghal, 2005). There are many papers on heavy traffic congestion and how serious issue it is. Some of the other disadvantages of land freight transportation include air, noise and water pollution, together with the endangerment of vegetation and wildlife, and the increased number of road accidents (Ranaiefar & Regan, 2011; Ongkittikul & Geerlings, 2005).

The European Union has recognized the negative effects road freight transportation has on the environment. One of the initiatives is to shift at least 30% of road freight to rail and inland transportation by the year 2030, and to complete high-speed rail network by the year 2050. This all aims at reducing the GHG emission from road transportation (European Union, 2011). The main reason for focusing on railway development in the European Union is reflected in the fact that in 2018, rail transportation had only 0.39%, while road transportation had 71.75% of the entire GHG emission. The CO₂ emissions were almost the same for both (European Commission, 2020). Therefore, rail transport is considered to be an eco-friendlier mode of transport (Siciliano et al., 2016). Rail freight transportation services usually share their infrastructure (primarily rail lines) with the passenger traffic (Teodorović & Janić, 2017). The situation is no different in Croatia. In only a few countries, including the United Kingdom, the Netherlands, Sweden, Romania and Poland, the national railway network is managed by a company that is independent of the train operations and is not the property of the state (The World Bank, 2009).

It takes better planning, adequate ICT systems and an integrated supply chain to improve the quality of the rail freight service (Islam, Ricci, & Nelldal, 2016). Duffin (2020) suggests that if companies on the rail market aim at improving and modernising the quality of their services, they have to implement innovation(s). This is supported by Yianni (2020), who concludes that this should also be done if they want to survive in the challenging environment. Duffin (2020) also gives an example of the German rail systems that, in 2019, started using 3D laser scanners to measure tracks accurately and to effectively plan routes. Wiegmans, Hekkert and Langstraat (2007) dove into the question of innovations and asked whether they could be successful in rail freight transportation. The results suggest that innovation in rail terminal transshipment is mostly not adopted because there are limited (or no) improvements in product characteristics and limited (or no) improvements in user requirements, followed by high costs. Restructuring is the mandatory condition for making rail transport more attractive. For most European countries, one of the ways to do so is to implement rolling stock innovation as an essential part in operating railway (Ongkittikul & Geerlings, 2005). It is very important to consider the costs and the benefits of the innovations we are planning to implement in our business (Johnson, 2012).

The efficiency of rail transportation has been improving due to digitalization and automatization. Still, there are barriers companies are facing: the process of introducing new technologies demands time and cultural changes, along with the changes in organization and reconsidering success indicators. These obstacles are serious, and it is crucial to identify them so they could be removed and no longer hinder the commercialization of innovation on the rail market. There is a huge problem in many countries of not implementing innovation on operational level (United Nations Economic Commission for Europe, 2019). In recent years, more

and more railway companies on the European market are engaging and implementing solutions from a new form of supplier: the tech start-up. This results in the railway-supplier relationship being changed, and in the industry's wider approach to innovation (Smith, 2019).

7.3. Analysis of Croatian rail freight market

7.3.1. Characteristics of rail freight in the Republic of Croatia

In 2018, the European Union realised the total of 3,353 bn tonne-kilometres. If we observe the transportation in total, including maritime transportation, the highest share went to road freight (50.96) %, while air transport had the lowest percentage ($< 0.0001\%$). In the same year, the share of rail freight was 12.6%, while its average annual growth rate for the period from 1995 to 2018 was 0.5%. Besides the fact that the share of rail freight has had a slight drop in the last two years (12.9% in 2016), the positive side to this is that the number of tonne-kilometres has been growing. In 2018, rail freight realised 423,3 bn tonne-kilometres, i.e., 10.10% more than in 2013. In the period from 2013 to 2018, the number of tonne-kilometres in rail freight was increasing, but in the same period, the kilometres realised by the hinterland waterways was declining (European Commission, 2020). A very similar situation is observed on the Croatian transportation market, where, as evident in Figure 7.1, the dominant role is taken by road transport with the share of 63,04%, and rail transport occupying the third position with 11,23%. The share of rail transport grows to 13,09% if only land transport is considered.

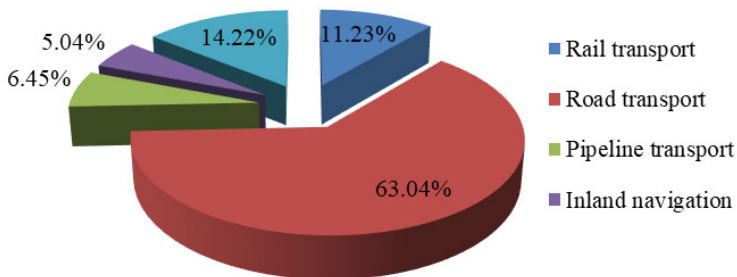


Figure 7.1. Transport structure in the Republic of Croatia in 2019

Source: Authors compiled according to (Croatian Bureau of Statistics, 2020, pp. 68–70).

Since the accession of the Republic of Croatia to the EU on 1 July 2013, we notice that the number of tonne-kilometres has been on the rise. In 2013, 2,1 bn

of tonne-km was realised, while the number of tonne-km in 2018 was 2,7 bn. It should be noted that Croatia achieved growth of 5.8% in rail freight in 2018, while the growth in the EU was 2.1%.

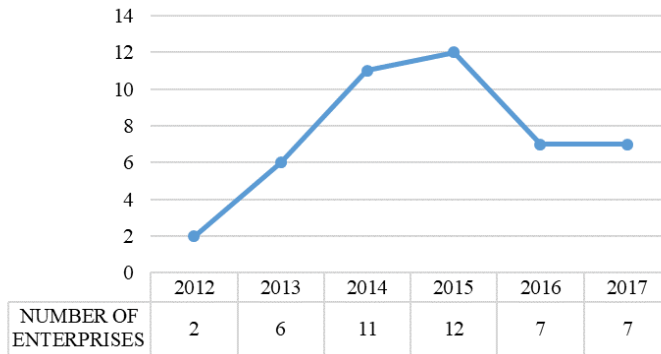


Figure 7.2. Number of enterprises on Croatian Railway market

Source: Authors adjusted according to data from (European Commission, 2015-2020; Statistical pocketbook 2015-2020).

Figure 7.2 clearly shows how the Croatian accession to the European Union has had a positive impact on creating competitiveness on the rail freight service market. The competition in the sector of rail transport can be boosted with these new endeavours. The measures for encouraging the restructuring that also considers social aspects and work conditions should accompany these endeavours (Ongkittikul & Geerlings, 2005).

In 2012, there were only two firms on the market, HŽ Putnički prijevoz (cro. Croatian Railways Passenger Traffic), that held a monopolistic position in the transport of the passengers, and HŽ Cargo that held the same monopolistic position in rail freight transportation. Still, the firm that is owned by the government manages the railway network in Croatia. This fact represented a problem in many other member states, and they have been trying to resolve this with market restructuring and with providing the possibility for other firms to take over railway management. Most rail freight companies in Europe are state-owned. This hinders the companies from developing fast and efficient transportation throughout Europe. There are many problems these companies face: train electrification is incompatible, track gauges are not uniform, long border checks (Wiegman, Hekkert, & Langstraat, 2007). It is also of great importance that governments stop financing inefficient business endeavours of the companies they own through different subsidies and state aids. This is primarily important if they want to ensure equal conditions for all those who operate on this market (European Communities, 2008). Becoming competitive is the first step towards building an efficient market. With the Croatian accession to

the EU, changes in the rail freight transportation occur. This market finally becomes competitive, which positively influences the quality and price of the final service. In 2020, the rail freight services are provided by HŽ Cargo and some other, privately-owned firms: ENNA Transport d.o.o., Rail Cargo Carrier-Croatia d.o.o., Rail & Sea d.o.o., SŽ Tovorni promet d.o.o., Train Hungary and Transagent Špedicija d.o.o.

7.3.2. Case study on the example of the Croatian national rail freight operator

HŽ Cargo was founded and is owned by the Republic of Croatia. It offers the services in regional centres: Centre (Zagreb), West (Rijeka), South (Split) and East (Vinkovci). HŽ Cargo provides the following services (HŽ Cargo, 2020):

- conventional transport, intermodal transport and transport of dangerous goods;
- storage space rental;
- license holder for EUR pallets with the right of their assignment to third parties in the Republic of Croatia;
- rolling stock maintenance (mainly wagon rolling stock).

The realization of the goals set by the EU regarding the freight will largely depend on the rail sector as a strategic sector, and its efforts to shift the balance (Ongkitikul & Geerlings, 2005). System complexity, expensive infrastructure development, lack of resources, increasing cost pressure, decarbonization, and interconnected ICT services are only some of the challenges the railway systems are facing (United Nations Economic Commission for Europe, 2019). HŽ Cargo, being the leading company in this sector, is facing all these challenges as well.

When it comes to rail freight and terminal markets, innovations are important, but it is very difficult to introduce innovations to freight terminals (Wiegman, Hekkert & Langstraat, 2007). An innovation can be seen from two different perspectives: it is something that is newly implemented or something that is new to (Dinges & Pieriegud, 2016):

- the implementing organization—even though the competition is already using this innovation (e.g., selling tickets online);
- a given sector/industry, albeit employed in other sectors/industries (e.g., hybrid vehicles or usage-based billing for traction power);
- a geographic area, e.g., in a country (although known and utilized in other countries, e.g., ERTMS (European Rail Traffic Management System)).

Wiegman, Hekkert and Langstraat (2007) distinguish three categories of innovations on the rail freight market:

1. **“New generation terminals” concepts.** Those terminals have fully automated transshipment techniques and more space-intensive terminal areas. The higher

the level of automatization, the lower the costs of freight manipulation and physical workers.

2. **Trailers on train.** The trailers are built in different forms; however, they all have transporting trailers or swap-bodies on rail wagons. They vary in terms of automation, speed, complexity, and land use. The concepts range from an improvement in 'putting the trailer on the train' to complete new terminal layouts.
3. **Transshipment techniques.** The transshipment techniques can be separated between horizontal and vertical (cranes, reach stackers, and forklift trucks). The innovative vertical concepts in transshipment aim at the increased use of automation to supervise the transshipment material; improvement of the transshipment speed; increasing weight-lifting capacities; transshipment in the presence of an electric overhead line; and a reduction in the used terminal surface. The horizontal transshipment innovations enable the transshipment without lifting the intermodal transshipment unit.

Since 2001, the United Kingdom has been implementing innovations on the rail market with the hope of restoring it to its former glory. Between 2000 and 2020, the innovations brought about many good results: the percentage of the trains that run on time increased to 94% and the number of the broken rails was reduced from almost 1000 to 152. This, in turn, resulted in more passengers using the trains, and more companies transporting more freight by train, which resulted in 30 bn GBP worth of freight transported annually. If companies wish to advance and further develop their business, they should introduce new mechanisation, better automation, automated monitoring systems and innovative thinking (Yianni, 2010). Switzerland has adopted the Swiss split concept which ensures that containers are distributed via conventional shunting yards directly from intermodal terminals to the final recipients' sidings by rail (Islam & Blinge, 2017). All the parties involved in the implementation of innovations should be aware of the fact that this process is difficult and a long-term effort. The same is true about HŽ Cargo and others involved in the process. HŽ Cargo can benefit from the examples of other member states, which have majority of the investments carried out with the support from the EU. Poland is an excellent example: it has modernized its railway infrastructure, repaired railway stations and stops and conducted many other investments on this market thanks to the EU funds (Kozłowski, Pawełczyk, & Piotrowska-Piątek, 2020).

Further development of HŽ Cargo deeply depends on its awareness of that fact, because, for the survival on the market and the establishment of the competitive role, timely implementation of the innovations is of critical importance. Implementation of innovations will not be an easy process for HŽ Cargo. HŽ Cargo management indicate that their strategy for further development firstly focuses on **intermodal**

traffic. This is supported by the fact that in the period from April 2018 to July 2019, the increase of 40% in TEU in the Port of Rijeka was achieved (HŽ Cargo, 2020). Although HŽ Cargo has already undertaken certain steps in upgrading the existing terminals, it is planning to continue with the investments in intermodal terminals. These include the inland intermodal chains with which rail terminals are linked to port terminals (The Geography of Transport Systems, N/A). That is, the focus is placed on building intermodal terminals that link the branches for long-distance transport and then steer towards the branches that operate on shorter distances. To paint the picture, the freight is first transported by sea, then, in the Port of Rijeka, it is transhipped onto the rail and transported to Zagreb or some other destination and then transported by the road (i.e., trucks) to its final destination. In order for the investment of HŽ Cargo to be cost-effective, it is crucial for the new Zagreb-Rijeka railroad to be built in the following years. This would open the possibility for the Port of Rijeka to fully exploit its resources (the 18-meter draught), and to be able to manipulate great amounts of freight it could receive if it had the support of an adequate rail infrastructure. The existing railroad, besides lacking the capacities, has many steep parts, making it dangerous and demanding for a bulk of freight to be transported. This has negative consequences on the duration of the transporting process. Bearing in mind the definition posed by Dinges and Pieriegued (2016), who suggest that product innovation can include rolling stock and /or the infrastructure, the conclusion can be drawn that intermodal terminals fall under this category. The previously-mentioned growth has also been reflected in the growth of the transported goods on the rail market in the Republic of Croatia, so, in 2019, the total of 14,449 thousand tonnes was transported, representing the growth of 18.65% in relation to the year 2017. Moreover, a significant increase in business profits was recorded: on July 30, 2019, they amounted to 250,94 m HRK, which is the increase of 20.46% in relation to January 1, 2019 (HŽ Cargo, 2019).

It is important to note that HŽ Cargo has been operating with **RO-LA trains** it is currently renting, but its business plan highlights the importance of investing in the terminals with the huckepack technology, so HŽ Cargo would then stop renting the RO-LO trains and begin using their own. In case where trucks are transported piggybacked on the Rolling Road (ROLA), the roads are kept clear and the influence on the environment is reduced; this also suggests some safety regulations to be taken into consideration (Rail Cargo Group, N/A). To reap the benefits, the investments HŽ Cargo is making will not be enough; it is necessary for the government to subsidize the RO-LO trains. With no subsidies, it is highly unlikely that the road freight carriers will replace the roads with the rail.

HŽ Cargo is persistent in the idea of **advancing its operations**. Therefore, it issued the 'Call for presentation of IT solutions for operational business in railway freight transport' (HŽ Cargo, 2010).

Questions / tasks

1. Do you think that, without the implementation of innovation, the survival of HŽ Cargo would be possible? Where do you see main innovations being implemented?
2. Considering the options of innovations on the rail freight market, do you consider that HŽ Cargo has chosen the appropriate ones?
3. Can you describe the process of innovation (steps taken, results gained)?
4. Where do you see other potential innovation possibilities for HŽ Cargo?
5. Was the innovation, that HŽ Cargo listed, sustaining or disruptive? Explain your standpoint.
6. Describe main characteristics of rail freight market in your country.
7. List innovations that have been implemented on rail freight market in your country. Are there similarities with Croatian market?

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