

## Study of the Multimodal Freight Transport Sector in Romania: Analysis of the External and Internal Environment

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**Abstract:** *The paper studies the current situation of the multimodal freight transport sector in Romania, using the analysis of its external and internal environment. The goal is to find out what are the pluses and minuses of this sector and what strategies must be adopted so that the targets set by the European Green Deal can be reached. This EU strategy emphasizes that, in order to reduce pollution, emphasis must be placed on multimodal transport, with an emphasis on rail transport.*

*Thus, the general external environment is defined by the following factors: demographic, economic, technological, ecological, etc. While the labor force crisis in the road transport of goods deepens, and the average age of the staff in the railway sector is getting higher, the policy of the EU and, implicitly, of the EU member states stimulates multimodal transport, in order to reduce CO2 emissions. The Porter model shows that, despite the forces acting in a negative direction, the multimodal freight transport market is attractive. At the same time, from the strategic group belong both multinational corporations and enterprises with domestic capital, which underlines the attractiveness of the market. Thus, it is necessary to apply the strategy that involves a reduction of costs, but not by decreasing the quality of the services offered. On the other hand, the SWOT analysis indicates that multimodal freight transport in Romania is in the ideal/ maximum situation. Therefore, it is necessary to apply an aggressive strategy. Thus a net competitive advantage will be ensured. The strategy consists in stimulating rail freight transport, which will contribute to reducing pollution.*

**Keywords:** *multimodal freight transport; rail freight transport; external analysis; internal analysis; EU Green Strategy; environmentally friendly transport.*

**How to cite:** Scarișoreanu, D.I., & Ghiculescu, L.D. (2023). Study of the Multimodal Freight Transport Sector in Romania: Analysis of the External and Internal Environment. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 14(4), 571-595. <https://doi.org/10.18662/brain/14.1/436>

## 1. Introduction

The transport sector, as a whole, represents more than 5% of the EU's GVA, with more than 10.5 million employees involved, which means more than 5.4% of the total EU workforce, as stated in Statistical Pocketbook 2021, EU Transport in Figures (European Commission, 2021b).

At the same time, according to Sustainable and Smart Mobility Strategy – putting European transport on track for the future (European Commission, 2020) “Uninterrupted land, waterborne and air cargo services are of crucial importance for the transport of goods and inputs to manufacturing industries, the functioning of the EU's single market, and the EU's effective response to the current and future crises. Efforts to ensure multimodality and interoperability between different modes should be stepped up, and the completion of the Single European Transport Area must be accelerated”.

Also, in the Treaty on the functioning of the European Union it is stipulated that: “The internal market shall comprise an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured in accordance with the provisions of the Treaties”.

All other economic sectors, including the competitiveness of European enterprises, in a post-industrial society, depend on how transport services work.

However, the transport sector in the EU is responsible for a good part of the total amount of greenhouse gas emissions.

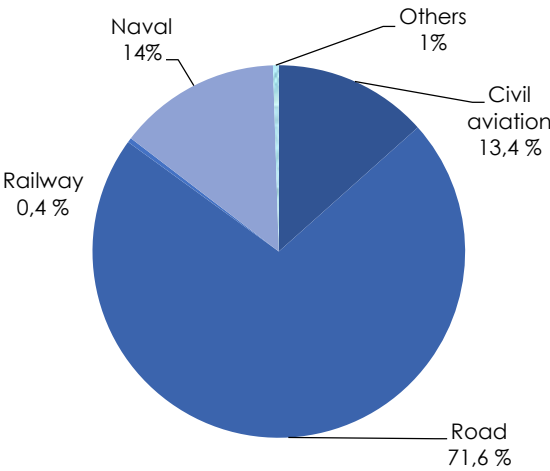
Road transport is estimated to be responsible for 72% of total CO<sub>2</sub> emissions from transport activities.

As stated by Action plan for the implementation of intelligent transport systems in Europe “road traffic congestion is estimated to affect 10 % of the road network, and yearly costs amount to 0.9-1.5 % of the EU GDP”.

Rail transport is considered to be the least polluting mode of transport.

Thus, while road transport generates about 72% of the total CO<sub>2</sub> emissions, naval transport is responsible for 14% of the total emissions generated by the transport sector, civil aviation for 13.4%, and rail transport for only 0.4% (see Figure 1).

At the European level, efforts are being made to replace road transport with rail, with an emphasis on multimodal transport, which would lead to the reduction of CO<sub>2</sub> emissions.



**Figure 1.** The level of CO2 emissions, depending on the mode of transport, in the EU 27, in 2019

**Source:** Statistical pocketbook 2021, European Commission (EC) (2021b)

The EU strategy envisages that the “rail freight traffic will increase by 50% by 2030 and double by 2050, compared to 2015”. The goal is “to have zero emissions and zero road deaths”.

For example, in the EU, goods are mainly transported on the road system. The modal share of road transport of goods in the EU is 52%, and in Romania 68%. The rail transport of goods in the EU has a share of 12% in total modes of transport, it is gradually losing to the road transport of goods (see Table 1).

**Table 1.**Modal share of road and railway freight transport in EU

| Year | Road transport (%) | Railway transport (%) |
|------|--------------------|-----------------------|
| 1995 | 47                 | 15,6                  |
| 2000 | 48,8               | 14,1                  |
| 2005 | 51,3               | 12,8                  |
| 2010 | 51,3               | 12,4                  |
| 2011 | 50,6               | 13,2                  |
| 2012 | 50                 | 13                    |
| 2013 | 50,4               | 12,8                  |
| 2014 | 50,2               | 12,8                  |

|      |      |      |
|------|------|------|
| 2015 | 50,8 | 12,9 |
| 2016 | 50,9 | 12,7 |
| 2017 | 52   | 12,4 |
| 2018 | 51,1 | 12,5 |
| 2019 | 52   | 12   |

**Source:** Statistical pocketbook 2021, EC (2021b)

The purpose of developing methods for analyzing the external and internal environment of multimodal freight transport in Romania is to identify the forces acting on multimodal freight transport, its weaknesses and strengths, as well as solutions to stimulate rail freight transport, in accordance with the provisions European Green Deal.

The external environment was analyzed, using the model of the five forces - the Porter Method and strategic groups were researched. Thus, the external environment of multimodal freight transport in Romania was analyzed.

Subsequently, the internal environment was researched, taking into account elements of the analysis of the internal environment and the design of the SWOT analysis of multimodal freight transport.

The strategic management process involves, among other things, the analysis of the external and internal environment of the sector, in the case of multimodal freight transport (Ghiculescu & Vulturescu, 2015). And there is a connection between strategic management and knowledge economy.

Information and know-how are more important than capital and physical assets for a company to be competitive, in the current economic conditions. Thus, the skills and knowledge of the company's management and its employees, which are considered intellectual capital, ensure the possibility that an organization can compete on the market. In today's business environment, knowledge is evolving rapidly and the useful life of organizational skills is shrinking, meaning that an organization's survival and competitiveness is linked to its ability to learn and incorporate findings into its strategic management process (Nedelea & Păun, 2009).

In the condition of the Fourth Industrial Revolution, when the knowledge economy and advanced technology are important to compete on a globalized market, countries seek to capitalize on their human resources as best as possible. Therefore, not only the economic effects produced by the Fourth Industrial Revolution, but also the impact on social, cultural, political and security systems should be taken into account. (United Nations Development Programme Regional Bureau for Arab States & Mohammed Bin Rashid Al Maktoum Knowledge Foundation, 2021).

Thus, the main pillars of the knowledge economy are: education & training, information infrastructure, economic incentive&institutional regime and innovation systems (World Bank, n.d.). Investments in education, stimulating innovation capacity, renewing the informational infrastructure and creating a favorable economic environment are necessary conditions for the transition to the knowledge economy. The emphasis is on the skills and knowledge of the human resource and less on the material resources of the organizations. The knowledge economy represents the engine of sustainable economic growth (Mohamed et al., 2022).

According to the Global Knowledge Index 2021 "Romania is a strong performer in terms of its knowledge infrastructure". It ranks 50th out of 154 countries in the Global Knowledge Index 2021 and 47th out of the 61 countries with very high human development (United Nations Development Programme Regional Bureau for Arab States & Mohammed Bin Rashid Al Maktoum Knowledge Foundation, 2021).

However, in order to increase its performance, with a view to sustainable economic development, Romania must fit into the European trend of encouraging multimodal transport, with an emphasis on rail transport. Currently, Romania does not have a strategy for the development of multimodal transport.

This paper is a starting point for the detailed elaboration of such a strategy, which starts from the analysis of the external and internal environment of the multimodal transport of goods in Romania.

It should be emphasized that the railway system in Romania is integrated into the single European railway space. At the same time, EU legislation in the field is transposed into national legislation. Thus, the railway network in Romania must be considered as part of the European railway system.

For example, two of the European freight corridors cross Romania. It is about the "Orient/East-Mediterranean" railway freight corridor, which starts from the German ports on the North Sea and reaches Greece, Romania being crossed on the Curtici-Brasov-Bucharest-Constanta route. The other corridor is "Rhine-Danube", which crosses France-Germany-Czech Republic-Slovakia-Austria-Hungary and Romania. In other words, the development of the European railway network depends on the development of the railway systems in the EU member states.

## **2. Analysis of the external environment of multimodal freight transport**

Transport is a strategic sector for the economy, whether it is the movement of goods or people. The global economy has progressed through transportation. The demand for the optimized transport of goods, fast and cheap, which generates low CO<sub>2</sub> emissions, is increasing more and more, due to the doubling of the volume of transported goods, as well as of the distances covered in the last ten years (Matei et al., 2021). Therefore, an in-depth analysis of freight transport, especially multimodal freight transport, is needed. The analysis of the external environment involves both the research of the general external environment and that of the competitive external environment, as well as of the strategic groups (Ghiclescu & Vulturescu, 2015).

### ***2.1. Analysis of the general external environment***

The general external environment is defined by:•

- Demographic factors:
  - Aged railway workforce and reduced training capacity as mentioned by the Romanian National Railway Supervisory Council on Railway monitor 2019/2020 (Romanian National Railway Supervisory Council, 2021a);
  - The crisis of professional drivers (Podaru, 2021);
- Economic factors:
  - The sustained pace of economic development, prior to the health crisis;
- Management and politico-legal factors:
  - EU policy to encourage multimodal transport;
  - 2021 Action Program for the Development of Railway Infrastructure and the Modal Transfer to Railways of Passenger and Freight Transport Flows (Romanian Government, 2021). Thus, rail freight operators could receive compensation under a public service provided by them, following the model of rail passenger transport;
  - EU funding through the Transport Operational Program 2021-2027, according to Transport Operational Program (Ministry of European Funds, 2020) and the Connecting Europe Facility (European Commission, 2021a);
  - The state finances modes of transport differently, creating a competitive advantage for road transport over rail transport (the non-internalisation of external costs generated by road transport allows road

transport operators to offer much better prices for the services provided, as a large part of the costs actual operation of road transport services is distributed to other actors in the national economy through the system of taxes and duties). In Romania, land transport generates in the national economy total external costs of 21.66 billion euros per year, which represents 6.5% of GDP. Among them: rail transport generates external costs of 0.46 billion euros per year, and road transport generates external costs of 21.2 billion euros per year, according to Romanian Railway infrastructure development strategy 2021-2025 (Ministry of Transport and Infrastructure, 2020);

On the other hand, the companies, which call on carriers, can request them to meet certain environmental conditions related to CO2 emissions, the source of energy production used for the transport of goods, etc. (Cichosz et al., 2019). In this regard, the state could provide tax incentives to encourage companies to take such steps.

For example, many provinces in China currently offer subsidies for rail containers, amid growing demand for containerized goods. At the same time, this is an attempt to ensure the modal transfer from road to rail in order to reduce CO2 emissions (Yang et al., 2020).

However, while most freight organizations in emerging economies face difficulties in adopting environmentally responsible transport practices in their business processes (Kumar, 2021), those in developed economies are under institutional pressure to adopt such practices (Evangelista et al., 2017);

- Socio-cultural factors:
  - Skilled labor force;
- Technological factors:
  - Improving transshipment technologies;
  - Integrated freight IT systems to ensure live tracking and monitoring of the condition and position of goods, providing information and data in the supply chain (implementation of TAF TSI - telematics applications for rail freight and GPS system for monitoring freight road transport);

“TAF TSI telematics applications include: information systems (real-time monitoring of goods and trains), sorting and allocation systems, reservation, payment and invoicing systems, management of connections with other modes of transport, development of electronic accompanying documents and so on”, pursuant to EU Regulation no 1305/2014 (European Commission, 2014);

- Introduction of the European Train Control System (ERTMS) on certain parts of the Pan-European Corridor IV, which crosses Romania, on

the route: Nădlac - Arad - Timișoara - Lugoj - Deva - Orăștie - Sebeș - Sibiu - Pitești - Bucharest - Drajna - Cernavoda – Constanța, in accordance with Action Program for the Development of Railway Infrastructure and the Modal Transfer to Railways of Passenger Transport Flows and cargo 2021-2026;

ERTMS aims to guarantee a common standard that allows trains to run continuously between different countries and to stimulate the growth of the competitiveness of the railway sector. Railway signaling is used to control rail traffic and to ensure that collisions or derailments are avoided, while at the same time increasing the speed of trains, as stated in the Study on railway transport infrastructure;

- Ecological factors:

- Romania has a geo-strategic position, which integrates it into international trade, having access to the Black Sea;

- Capitalizing on the potential of the Danube River to attract freight traffic in containers from/to Romania;

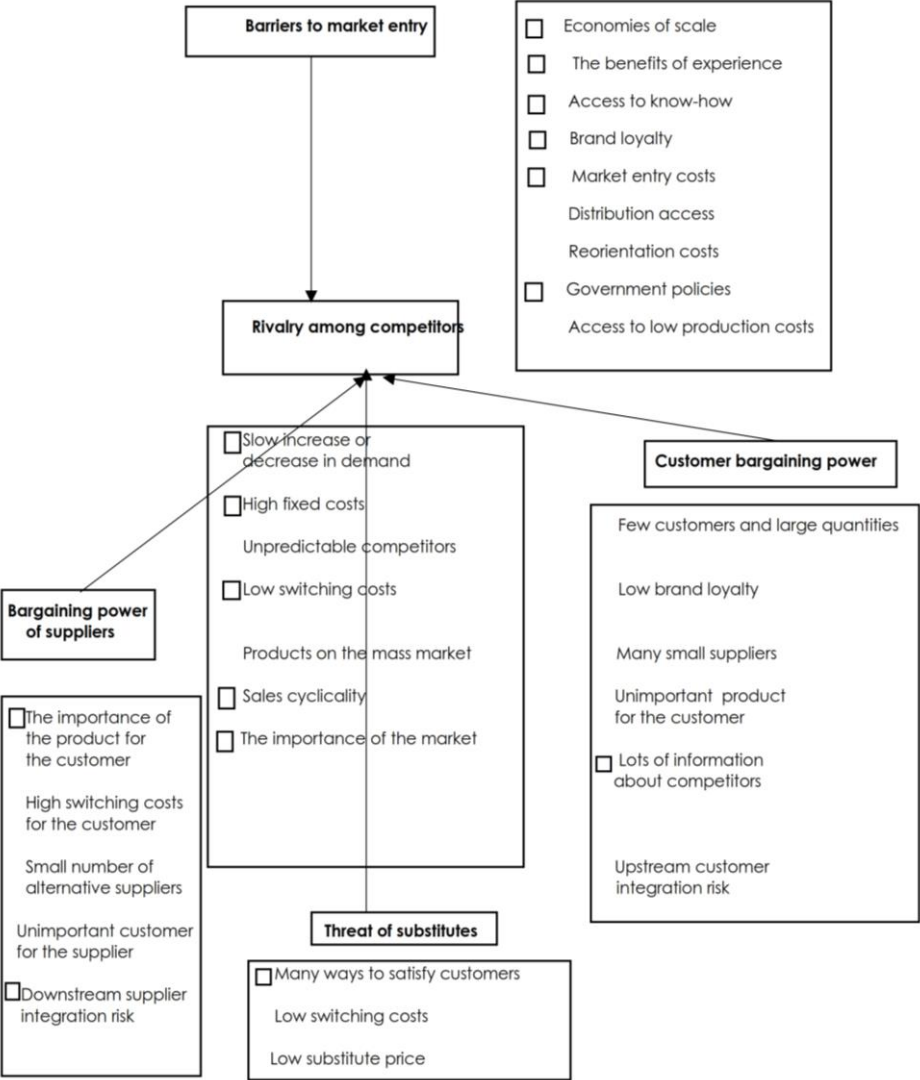
- Globalization factors:

- On the multimodal freight transport market in Romania, it operates, together with companies with local capital, such as Rofersped SA or Rocombi SA, and multinational companies, such as DB Schenker Logistics Romania (member of Deutsche Bahn, Germany), Rail Cargo Logistics Rail Cargo Group, member of OBB Austria), DHL Logistics SRL etc.

## ***2.2. Analysis of the external competitive environment***

The external competitive environment is more restricted than the general external environment. The five forces model was developed by Michael Porter. They act in the competitive external environment (see Figure 2) (Ghiculescu & Vulturescu, 2015):

- rivalry between competitors;
- the risk of new competitors entering the market;
- bargaining power of customers;
- bargaining power of suppliers;
- the threat of substitution products.



**Figure 2.** Existing elements in the case of the freight market  
(model of the five forces - Porter)

Source: Authors' own conception

The analysis of the external competitive environment involves the examination of the following factors:

F1. Barriers to entry:

- Economies of scale: Transport of a larger quantity of goods loaded in the same train (several wagons), truck (truck with trailer / mega-trailer) or

ship; it involves a large volume of goods transported to cover costs (it becomes profitable only after exceeding a profitability threshold) (Ghiculescu & Vulturescu, 2015).

- Benefits of the experience: The experience gained can lead to a competitive advantage. Activity requires experience, which is why it is a barrier to entry into this market.

- Access to know-how: Franchise/partnerships with large logistics companies or multinational companies (examples: multinational companies, such as DB Schenker Logistics, Gefco Romania or partnership with DHL Freight, one of the largest logistics providers in the world).

- Brand loyalty: Contracts with the multimodal transport service provider are usually extended in the long term (example: GEFCO, global multimodal supply chain expert and leading automotive logistics provider in Europe, has signed an agreement with the Renault Group and Dacia for expanding logistics cooperation in Romania, started in 2005).

- Costs at market entry: Costs of acquisition / rental / leasing of rolling stock, trucks, ships, planes; cost of transport licenses etc.

- Distribution access: N/A.

- Reorientation costs: N/A (transport companies are usually specialized in certain types of freight transport, because the goods are transported with certain types of wagons/trucks, such as: petrol tank wagons, diesel, fuel oil, crude oil, specialized wagons for coal transport, fuel tank trucks, etc.). Switching to other modes of transport would require additional costs.

- Government policies: The EU stimulates multimodal freight transport through funds allocated to the creation of green freight transport, a policy found in the National Recovery and Resilience Plan (PNRR). In Romania, in previous years there was the RO-LA Program, which was carried out by the Environment Fund Administration. Through this program, the railway undertakings obtained financing in the amount of 60% of the VAT-free amount of the invoice issued by the railway undertaking to the road transport company for the activities financed under the program. Also, Action program for the development of railway infrastructure and the modal shift to rail of the passenger and freight transport flows mentions the EC's recommendation to establish public service obligations for rail transport for rail freight as well and compensation from public funds of the difference in costs and revenues. Basically, it is about the implementation in the rail freight transport of some instruments similar to those provided in Regulation (EC) no. 1370/2007. Provided that such instruments are designed to ensure the modal shift to the railways of current transport flows

by other modes of transport (for example by promoting combined transport or transport in isolated wagons), compatibility with the provisions of the Treaty on the Functioning of the European Union (TFEU) is ensured of the respective state aid schemes. At the same time, at the international level, the creation of an international multimodal transport corridor, the improvement of management, as well as the elimination of institutional obstacles to the evolution of multimodal transport are being discussed. It is also desirable to encourage the use of information technology in businesses related to international multimodal transport (Zang, 2011). The use of information technology (ICT) can also have an important role in mitigating the damaging environmental effects of freight transport. Thus, from an empirical point of view, a 10% increase in the use of new technologies in freight transport can cause a 1.3-3% decrease in its impact on the environment. The new technologies could be used for the management and planning of the transport of goods (Chatti, 2021).

- Access to reduced production costs: N / A (salaries in the field do not differ depending on the region / county of the country).

## F2. Rivalry of competitors

- Slow increase or decrease in demand: freight transport registered slow growth in 2018-2019, later being affected by the pandemic.

- High fixed costs: transport operators have high fixed costs (salaries, taxes, rents, authorization fees and licenses, etc.)

- Unpredictable competitors: The freight market is a liberalized, competitive, stabilized one, with market entry costs so that the competitors know each other.

- Low forwarding costs: Switching the transport provider does not, in principle, involve high forwarding costs if it is the same mode of transport. If the mode of transport is changed, the redirection may have lower costs (switching from air to river or sea transport) or higher costs (switching from river to air transport).

- Mass Products: Companies specialize in certain types of transportation requires certain types of rolling stock / trucks. In other words, although there are many transport companies on the market, in reality, for the transport by categories of goods, their number is reduced depending on the type of goods transported because it is expensive to buy / rent a certain type of rolling stock / trucks. There are exceptions: multinational companies.

- Cyclical sales: The quantity of goods transported depends on the evolution of industrial / agricultural production in that year. A special situation is the pandemic.

- Importance of the market: Transport is a key sector of the economy and very important for it, as it comprises a complex network of private and public companies that provide goods and services to citizens and businesses in the EU and its trading partners.

#### F3. Bargaining power of suppliers

- Importance of the product for the customer: transport companies are usually large companies with high bargaining power; The exception is for infrastructure providers (the state), but, for example, in the case of rail transport, the railway infrastructure manager provides certain facilities for complete trains in intermodal traffic (33% of the Infrastructure Access Charge).

- High forwarding costs for the customer: In all cases, except for the infrastructure provider, competition between providers is high, resulting in low forwarding costs for the customer.

- Low number of alternative providers: There are a significant number of alternative providers on the market, except for infrastructure providers.

- Non-important customer for the supplier: Transport companies are usually large companies, which means that they are important for suppliers.

- Risk of downstream integration of the supplier: For example, the fuel supplier may have its own fleet of trucks for transporting fuel.

#### F4. Customer bargaining power

- Few customers and large quantities: On the transport market there are many customers and many transport operators, but they are specialize in transport by category of goods.

- Low brand loyalty: contracts with the multimodal transport service provider are usually extended in the long term (example: GEFCO, a global multimodal supply chain expert and leading automotive logistics provider in Europe, has signed an agreement with the Group Renault and Dacia for the extension of logistics cooperation in Romania, started in 2005).

- Many small suppliers: although there are many transport operators on the freight market, they specialize in transporting certain categories of goods, for which they have a certain type of rolling stock / trucks. The main transport operators, in terms of revenues from rail freight transport, are: Grup Feroviar Român, CFR Marfă, Deutsche Bahn Cargo and Unicom

Tranzit, according to the Study on rail freight transport (Romanian National Railway Supervisory Council, 2021b), namely there are few large suppliers.

- Unimportant product for the customer: the transport of raw materials and finished products are essential for the customer.
- A lot of information about competitors: there is information on the market about freight operators, companies that compete with each other. Sources of information are very numerous in the information age - the economy based on knowledge / knowledge;
- Upstream customer integration risk: N / A.

#### F5. Threat of substitutes

- Many ways to satisfy customers: The same goods (depending on the type of goods) can be transported by train, truck, ship or plane.
- Low costs when switching to a substitute: switching to a substitute involves low or high costs, depending on the mode of transport chosen: road, rail, sea or air.
- Low substitute price: depends on the mode of transport chosen. For example, the cost of transporting goods by water is much lower than by air.

### ***2.2.1. Evaluation of the five forces***

Grades are given for each of the five forces in Porter's model on a scale of 1 to 5. The high values obtained correspond to the strong forces on the market, which indicates unfavorable conditions of the business environment.  $NFi$  grades given to a  $Fi$  force can be evaluated using the formula:

$$NFi = ncp \div nct \times 5$$

$ncp$  represents the number of components established as being present within the force  $Fi$ ;

$nct$  - the total number of components within the force  $Fi$  (Ghiclescu & Vulturescu, 2015)

Analyzing the five forces acting in the case of the freight market, the following result is obtained:

#### 1. Barriers to entry

$$NF1 = 6 \div 9 \times 5 = 3,33$$

2. Rivalry of competitors

$$NF2 = 5 \div 7 \times 5 = 3,57$$

3. Bargaining power of suppliers

$$NF3 = 2 \div 5 \times 5 = 2$$

4. Customer bargaining power

$$NF4 = 1 \div 6 \times 5 = 0,83$$

5. Threat of substitutes

$$NF5 = 1 \div 3 \times 5 = 1,67$$

Total:  $\sum NF5 = 11,4$

Summarizing the grades given for each force, a total of 11.4 is obtained, this value indicating the attractiveness of the market.

### ***2.3. Strategic groups***

According to Michael Porter, "the strategic group consists of all competing companies in a market whose behavior is similar." Regarding the multimodal freight transport, the strategic group includes both multinational companies, such as DB Schenker Logistics Romania, Gefco Romania, Gebruder Weiss SRL, etc., but also companies with Romanian capital, such as Rofersped SA or Rocombi. Thus, the cost leader strategy is used. This means reducing costs for research and development by using technological solutions in order to reduce costs, but without improving the performance of the product (Ghiculescu & Vulturescu, 2015).

## **3. Analysis of the internal environment of multimodal freight transport**

The analysis of the internal environment aims to study the following elements: resources, capabilities and fundamental competencies.

### ***3.1. Elements of the analysis of the internal environment***

a) Resources

- Tangible resources:

Financial resources: investments in public railway infrastructure in the Port of Constanța and in the adjacent area of the port (which ensures the connection of the Port of Constanța with the hinterland), which is to enter

into an extensive program of systematization, reconfiguration and modernization works; lack of funds to invest in freight terminals; underfunding of railway maintenance and repair works;

Material resources: the existence of a network of intermodal freight terminals, which is under conservation, which can be reopened with small investments; extended railway and road network; the existence of port infrastructure, which can be upgraded with relatively low investment; the existence of an airport infrastructure that ensures the connection between the main areas of the country;

Human resources: an aging workforce in the railway system and reduced training capacity; skilled labor force; the crisis of professional drivers.

- Intangible resources:

Technological resources - franchise / partnerships concluded with large logistics companies or multinational companies;

Innovation resources: integrated IT systems for goods to ensure live tracking and monitoring of the status and position of goods, providing information and data in the supply chain (implementation of Technical Specification for Interoperability relating to Telematics Applications for Freight / Passenger Services) - telematics applications for rail freight transport and GPS system for monitoring road freight transport); According to Regulation (EU) 1305/2014 "TAF TSI include: information systems (real-time monitoring of goods and trains), sorting and allocation systems, reservation, payment and billing systems, management of links with other modes of transport, preparation of electronic accompanying documents, etc<sup>1</sup>."; also, creative solutions, creativity for technical and managerial innovation, know-how (highly personalized ability to find solutions for various work tasks) on the relational system with suppliers and customers, etc.

#### b) Capabilities

Multimodal freight transport is the sector that channels efforts at European level in terms of innovation and identification of the most practical solutions to ensure transferal modal from road to rail. The innovations used for the transport of goods determine a decrease in costs (Ferrari, 2018).

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<sup>1</sup> According to point 2.1 of the Annex to Regulation (EU) 1305/2014 on the technical specification for interoperability relating to the "telematics applications for freight applications" subsystem of the European Union rail system and repealing Regulation (EC) No 62/2006

c) Basic skills

Pursuant to Smart Mobility Strategy “Multimodality takes advantage of the strengths of the different modes, such as convenience, speed, cost, reliability, predictability, and in combination, can offer more efficient transport solutions for people and goods”; reduces carbon emissions; decongests road traffic; decreases the number of road accidents; ensures connection with remote / isolated areas.

### ***3.2. SWOT analysis of multimodal freight transport***

To get the most realistic results, it is necessary to combine the two types of analysis of the external and internal environment, as shown in Table 2:

- analysis of the external environment provides opportunities and threats;
- the analysis of the internal environment indicates strengths and weaknesses represented by the fundamental resources, capabilities and competencies.

**Table 2.** SWOT analysis elements for multimodal freight transport in Romania

| Strong points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Weaknesses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Reduces carbon emissions;</li> <li>• Skilled labor force;</li> <li>• Decongests road traffic;</li> <li>• Decreases the number of road accidents;</li> <li>• „Takes advantage of the strengths of the different modes, such as convenience, speed, cost, reliability, predictability, and in combination, can offer more efficient transport solutions for people and goods”, according to point 28 of the Smart Mobility Strategy – putting European transport on track for the future;</li> <li>• Ensures connection with remote / isolated areas;</li> <li>• Extended rail (Romanian National Railway Supervisory Council, 2019), and road network (Romanian National</li> </ul> | <ul style="list-style-type: none"> <li>• Costs in addition to unimodal transport, generated by the extra work required to organize multimodal transport, longer transit time, which leads to an additional cost and the lack of a harmonized documented procedure, which leads to losses (European Economic and Social Committee, 2021); Currently, intermodal freight transfer costs are difficult to reduce due to container handling and storage costs. This is because the process of automating the handling of containers is slow, and the direct transfer to/from the truck/train needs synchronization (Bharadwaj, 2019);</li> <li>• Less reliable (punctual) than unimodal transport (European</li> </ul> |

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| <p>Institute of Statistics, 2021);</p> <ul style="list-style-type: none"> <li>• Existence of a conserved network of intermodal freight terminals, according to Study on rail freight transport, which can be reopened with small investments;</li> <li>• Existence of a port infrastructure, which can be modernized with relatively low investment;</li> <li>• investments in public railway infrastructure in the Port of Constanța and in the adjacent area of the port (which ensures the connection of the Port of Constanța with the hinterland), which is to enter into an extensive program of systematization, reconfiguration and modernization works;</li> <li>• integrated IT systems for goods to ensure live tracking and monitoring of the status and position of goods (implementation of Technical Specification for Interoperability relating to Telematics Applications for Freight / Passenger Services) - telematics applications for rail freight transport and GPS system for monitoring road freight transport); „TAF TSIs include: information systems (real-time monitoring of goods and trains), sorting and allocation systems, reservation, payment and billing systems, management of links with other modes of transport, preparation of electronic accompanying documents, etc.”, according to Regulation (EU) 1305/2014;</li> <li>• The existence of an airport infrastructure that ensures the connection between the main areas of the country.</li> </ul> | <p>Economic and Social Committee, 2021);</p> <ul style="list-style-type: none"> <li>• Slower than unimodal transport (European Economic and Social Committee, 2021); However, there are also situations in which multimodal transport can be faster than unimodal transport, an example of this being presented by Wang et al. (Wang et al., 2020). The authors point out that by using the China-Europe rail network for freight transport, transport time is reduced by more than 60%, while reducing carbon emissions by 40%, compared to traditional, unimodal, water transport.</li> <li>• The low speed of freight trains imposed by the state of the railway infrastructure, which does not require state-of-the-art rolling stock (average commercial speed around 16 km / h) (Romanian National Railway Supervisory Council, 2019);</li> <li>• Underfunding of railway maintenance and repair works (Romanian National Railway Company "CFR" – SA 2020, 2021);</li> <li>• Lack of funds needed to invest in freight terminals;</li> <li>• Limited infrastructure capacity for rail freight transport;</li> <li>• There are a relatively small number of freight terminals;</li> <li>• Few ferry ships are used <sup>2</sup>;</li> <li>• Railway rolling stock older than 30 years (over 60% of total rolling stock) (Romanian National Railway</li> </ul> |
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<sup>2</sup> CFR Marfă owns two ferry-type ships, specialized mainly in the transport of freight wagons, containers and cars which, at the moment, are in conservation and which provided the transport of goods to Turkey and Georgia.

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Opportunities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Threats                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li>• EU policy to encourage multimodal transport;</li> <li>• Romania has a geo-strategic position, which integrates it into international trade, having access to the Black Sea;</li> <li>• Action program for the development of railway infrastructure and the modal shift to rail of the passenger and freight transport flows mentions the EC's recommendation to establish public service obligations for rail transport for rail freight as well and compensation from public funds of the difference in costs and revenues. Basically, it is about the implementation in the rail freight transport of some instruments similar to those provided in Regulation (EC) no. 1370/2007. Provided that such instruments are designed to ensure the modal shift to the railways of current transport flows by other modes of transport (for example by promoting combined transport or transport in isolated wagons), compatibility with the provisions of the TFEU is ensured. of the respective state aid schemes;</li> <li>• Introduction of the ERTMS system on certain parts of the Pan-European Corridor IV, which crosses Romania;</li> <li>• EU funding through the Transport Operational Program 2021-2027 and the Connecting Europe Facility;</li> <li>• Take advantage of the potential of the Danube river to attract containerized goods traffic to / from Romania;</li> <li>• Take advantage of the potential of the port of Constanta, a port located on the</li> </ul> | <ul style="list-style-type: none"> <li>• Extending the EU Emissions Trading Scheme (EU ETS) to the maritime transport sector, which may lead to the rise of the maritime transport costs;</li> <li>• Aged railway workforce and reduced training capacity;</li> <li>• The crisis of professional drivers;</li> <li>• With regard to the aviation sector, the EC will make a revision proposal of the EU ETS Directive, in particular to reduce ETS certificates allocated free of charge to airlines, which may lead to the rise of air transport costs;</li> <li>• Poor quality of transport infrastructure compared to other Member States and neighboring countries, which could lead to the re-routing of freight through those states;</li> <li>• The state finances modes of transport differently, creating a competitive advantage for road transport over rail transport (the non-internalization of external costs generated by road transport allows road transport operators to offer much lower prices for the services provided, because a large part of the real costs operation of road transport services is distributed to other actors in the national economy through the system of taxes and duties);</li> <li>• Lack of an updated national strategy for multimodal transport.</li> </ul> |

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| <p>TEN-T network, to become a hub (center) for the South-East of Europe;</p> <ul style="list-style-type: none"><li>• Encouraging the industrial sector to locate production centers in the vicinity of intermodal terminals;</li><li>• Resumption of the RO-LA Program, which was carried out by the Environment Fund Administration, through which the railway transport undertakings obtained a financing in the amount of 60% of the VAT-free value of the invoice issued by the railway undertaking to the road transport company for the activities financed in within the program;</li><li>• Implementation by December 2024 of the Timetable Redesign (TTR) project, which determines the increase of infrastructure capacity on the rail freight transport corridors;</li><li>• Improving transshipment technologies.</li></ul> |  |
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Source: Authors' own conception

Using the SWOT analysis, the SWOT matrix is designed (see Figure 3.).

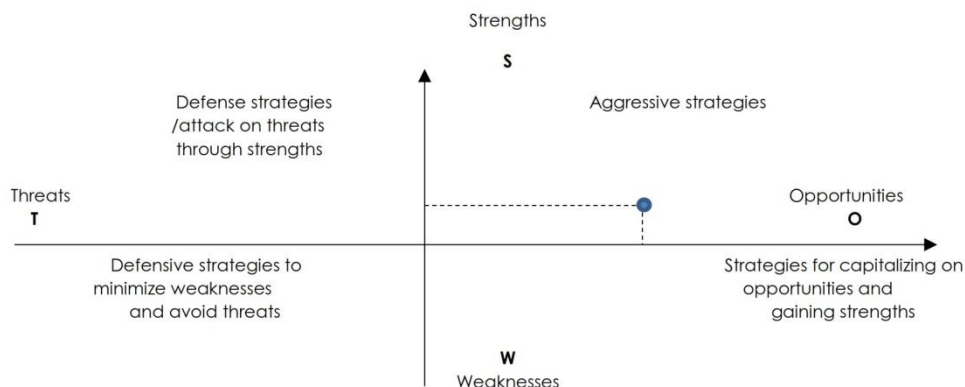
| Multimodal freight transport<br>External environment | Strong points (S)         | Weaknesses (W)                  |
|------------------------------------------------------|---------------------------|---------------------------------|
|                                                      | 12                        | 10                              |
| Threats (T) 7                                        | speculative situation     | unfavorable situation / danger  |
| Opportunities (O) 11                                 | ideal / maximum situation | contrasting situation / dilemma |

**Figure 3.** SWOT matrix for multimodal freight transport in Romania

Source: Authors' own conception

Based on the information presented in the matrix, it results that the multimodal transport in Romania is in the ideal/maximum situation, the

strong points being more than the weak points. Also, the external environment offers more opportunities than threats (see Figure 4.)



**Figure 4.** Graphical representation of the SWOT matrix for transport multimodal freight in Romania

Source: Authors' own conception

In the analyzed case, an aggressive strategy should be applied, which would provide a net competitive advantage. The strategy is linked to the stimulation of rail freight transport to reduce pollution.

The transport sector influences economic growth and the evolution of business and rail transport logistics chains. Companies such as Dacia, Ford and the Romanian subsidiary Daimler, Star Assembly, have urged decision makers to invest in railway modernization.

Thus, in order to increase the railway traffic speed, it is required, on the one hand, a proper financial allocation from the state budget and the efficient use of European funds, in order to carry out repair, maintenance and modernization works to lift the speed restrictions on certain sections of the railway network, and, on the other hand, the extension of the introduction of the ERTMS system on the Pan-European Corridor IV, which crosses Romania.

It is also necessary to expand the electrified railway network which will lead to the reduction of pollution, as well as the introduction of a modern railway traffic management system, such that to increase the degree of automation. At the same time, the rapid implementation of the European project called TTR is useful. Its aim is to increase the capacity of rail freight infrastructure at EU level. The deadline is December 2024. Pilot projects are currently underway on several freight corridors. TTR is a project carried out in collaboration with the Association of European Railway Infrastructure

Managers - RailNet Europe and European Association of Railway Operators - Forum Train Europe, with the support of the EC and the Ministries of Transport and Regulatory European countries.

The development of the network of intermodal cargo terminals is also required.

#### 4. Conclusions

- The use of multimodal transport helps to reduce carbon emissions and road accidents;

- Multimodal transport has additional costs compared to unimodal transport, generated by the additional work required to organize multimodal transport, longer transit time, etc., it is less reliable (punctual) and slower than unimodal transport. However, multimodal transport provides connection to remote or isolated areas;

- Technological progress has led to the improvement of freight forwarding technologies, the use of telematics applications for rail freight transport, real-time monitoring of transported goods and trains, ensuring links between modes of transport, etc., but also the introduction of European Train Control System to avoid collisions or derailments;

- One of the key results from the research is that in Romania, multimodal transport is in the ideal/maximum situation, with strengths being more than weaknesses, and the external environment offering more opportunities than threats. Therefore, it is necessary to apply an aggressive strategy. Thus a net competitive advantage will be ensured. The strategy consists in stimulating rail freight transport, which will contribute to reducing pollution, thus achieving the objectives set by the EU through the Green Deal. In this situation, it is appropriate to ensure the appropriate financial allocation so that the provisions of the Railway Infrastructure Development Strategy 2021-2025 are fully implemented;

- Another key result from the research is that in Romania, rail freight transport is in the ideal/maximum situation, where the weak points are fewer than the strong points, the external environment offering fewer threats and more opportunities. Thus, it is recommended to adopt an aggressive strategy to create a net competitive advantage:

- a proper financial allocation from the state budget and the efficient use of European funds, in order to carry out repair, maintenance and modernization of the railway infrastructure;

- expanding the introduction of European Train Control System on the rail network;

- introducing a modern rail traffic management system;

- increasing the electrification of the rail network;
- implementing the Timetable Redesign project as soon as possible;
- expanding the network of intermodal freight terminals, promoting measures to internalize - external costs generated by road transport so that this mode of transport is not advantageous over rail transport;

- Another key result is that the use of all modes of transport requires skilled labor, and there is currently a labor crisis in the freight transport market, whether it is the reduced training capacity and the aging workforce in the rail system or the driver crisis. Thus, it is necessary to stimulate young graduates to go to these jobs, the state granting, on the one hand, scholarships for these young people, and on the other hand, fiscal incentives for companies in the field, which employ these young graduates.

One of the future research directions aims to present a case study. The external and internal environment of a company that offers a wide range of multimodal solutions, from conventional rail transport to intermodal transport, will be analyzed. Quantitative and qualitative forecasting methods will also be used for rail freight transport, like: Relevance Tree Method, Scenarios Method and Content Analysis Method. Thus, it will be possible to establish the strategy to be applied in order to achieve the proposed targets.

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