



## Master Thesis

# Coordination of Information Flows in International Road Transport Enterprises

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## Master Thesis Assignment Form

# Coordination of Information Flows in International Road Transport Enterprises

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2. Principles of managing information systems
3. Description of the current state of information processes in the selected enterprises
4. Evaluation of the current state of information flows
5. Optimization or design of a new information strategy with regard to the international context of the selected enterprises

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- DOHNAL, Jan a Jan POUR, 2016. *IT v řízení podniku: MBI*. Praha: Professional Publishing. ISBN 978-80-7431-160-4.
- GÁLA, Libor, Jan POUR a Zuzana ŠEDIVÁ, 2015. *Podniková informatika: počítačové aplikace v podnikové a mezipodnikové praxi*. 3., aktualizované vydání. Praha: Grada Publishing. Expert. ISBN 978-80-247-5457-4.
- GALLIERS, Robert, Dorothy LEIDNER, 2014. *Strategic information management: challenges and strategies in managing information systems*. London: Routledge. ISBN 978-04-159-964-71.
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- PROQUEST, 2021. *Databáze článků ProQuest* [online]. Ann Arbor, MI, USA: ProQuest. [cit. 2021-09-26]. Dostupné z: <http://knihovna.tul.cz>

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## **Anotace**

Diplomová práce se zaměřuje na analýzu procesů a informačních toků ve dvou malých podnicích silniční nákladní dopravy, jejich efektivitu a následnou optimalizaci. V úvodu práce jsou představeny pojmy související s odvětvím logistiky, její vztah k dodavatelskému řetězci a řízení dodavatelského řetězce a k dopravě. Spolu s logistickými informačními systémy jsou představeny také principy informačního managementu a znalostního managementu.

V druhé části práce jsou představeny dva konkrétní malé sesterské podniky silniční nákladní dopravy se sídlem v České republice a Rumunsku. Jsou popsány jejich procesy, které jsou následně analyzovány a vyhodnoceny z hlediska efektivnosti. V závěru jsou navržena optimalizační řešení těchto neefektivních procesů a návrh budoucího rozvoje těchto podniků.

## **Klíčová slova**

Data, Dodavatelský řetězec, Doprava, Efektivita, Informace, Informační management, Informační systém, Komunikace, Logistika, Malý podnik, Mezinárodní kontext, Moudrost, Nákladní doprava, Optimalizace, Proces, Řízení dodavatelského řetězce, SWOT analýza, Znalost

# **Coordination of Information Flows in International Road Transport Enterprises**

## **Annotation**

The diploma thesis focuses on the topic of process and information flows analysis their effectiveness and subsequent optimization in two small road freight transportation enterprises. The introduction of the thesis presents the concepts of Logistics, its relation to supply chain and supply chain management as well as transportation. Principles of information management and knowledge management alongside with the logistics information systems are also introduced.

In the second part of the thesis, two specific small road freight transportation sister enterprises based in Czech Republic and Romania are presented. Their processes are described, and subsequently analysed and evaluated in terms of efficiency. In the final section, optimization solutions for process inefficiencies and bottlenecks are proposed as well as suggestions for future development of the studied enterprises.

## **Key Words**

Communication, Data, Efficiency, Freight Transportation, Information, Information management, Information system, International Context, Knowledge, Logistics, Optimization, Process, Small Enterprise, Supply Chain, Supply Chain Management, SWOT analysis, Transportation, Wisdom



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## List of Abbreviations

1PL	First-party Logistics
2PL	Second-party Logistics
3PL	Third-party Logistics
4PL	Fourth-party Logistics
5PL	Fifth-party Logistics
ADR	Accord Dangereux Routier ( <i>Carriage of Dangerous Goods by Road</i> )
AI	Artificial Intelligence
B2B	Business to Business
CAO	Chief Administration Officer
CEO	Chief Executive Officer
COO	Chief Operating Officer
CZK	Czech Crown (currency)
EU	European Union
EUR	Euro (currency)
IT	Information Technology
Ltd	Limited Company
ORION	On-road Integrated Optimization and Navigation
RF	Radio Frequency
RON	Romanian New Leu (currency)
SC	Supply Chain
SCM	Supply Chain Management
SME	Small and Medium-sized Enterprises
SRL	Societate cu Raspundere Limitata ( <i>Private Limited Company in Romanian</i> )
s. r. o.	Společnost s Ručením Omezeným ( <i>Private Limited Company in Czech</i> )

## Introduction

We are living in the period of globalism where the world is getting increasingly smaller as the possibilities of transportation of people and especially freight are advancing. Such an environment provides many opportunities as well as challenges. After the pandemic of COVID-19, when freight transportation was subdued meanwhile health logistics went full speed ahead, another challenge in form of inflation and increase of costs of fuel caused by Russian aggression in Ukraine occurred.

Road transportation represents 77,3 % of total inland freight transportation in European Union. (Statista 2023) It is a highly competitive market with emphasis on speed and precision and is entirely dependent on market developments, as proven in recent years. The current economic situation has been the reason for constant search for costs reductions and means for increasing efficiency. Management of processes and information flows has been playing a significant role in these endeavours.

The aim of the thesis is to identify weaknesses in the management of information flows and processes within two selected enterprises and between them with regard to the international context, and to suggest an adequate solution suitable for each of the companies, which would contribute to the optimization of found inefficiencies. Information management in such enterprises is not given enough importance, although a proper management can make many of the processes more efficient and save unnecessary costs.

The thesis introduces these concepts and specifics of the market segment. It analyses the information environment of the given enterprises and efficiency of their information flows and processes. For this purpose, internationally standardized tools such as information flow diagrams, process diagrams, SWOT analyses and cost comparisons were used.



# 1. Basic Concepts from Logistics

Logistics is often interpreted differently depending on the field of business. In addition, throughout the time, the concept of logistics has been undergoing many transformations and involved different subjects. The concept's flexibility is reflected also in the academic sources which include distinct elements in the definition (Pernica 1991, Pernica 1998, Pieters and Ntenje 2012, Zimová 2015, Gros et al. 2016). Nevertheless, despite the differences, the multiple definitions are nowadays perceived as complimentary.

Logistics, as a discipline known today, consists of many different activities following in logical order in a time covering the entire supply chain. The activities according to Pieters and Ntenje (2012) as well as Longshore and Cheatham (2022) are:

- Material Handling
- Stock control
- Order handling and processing
- Customer service
- Demand prediction
- Sourcing, vendoring and purchasing
- Internal and external distribution
- Location of warehouses and production facilities
- Handling reversed flows of goods, rejects and packaging material
- Spare parts, repairs and customer services
- Production planning

All of the mentioned above is part of the so-called forward flow of the logistics. That means the flow from the supplier to consumer. Longshore and Cheatham (2022) also present the reverse flow of the logistics. That is a flow of items from the consumer back to the original suppliers or another processor of disposal. These activities occur when material, packaging or products are retired, disposed or recycled. Both of the flows, forward flow and reverse flow of the logistics, are represented in the figure below followed by table of activities in the processes.

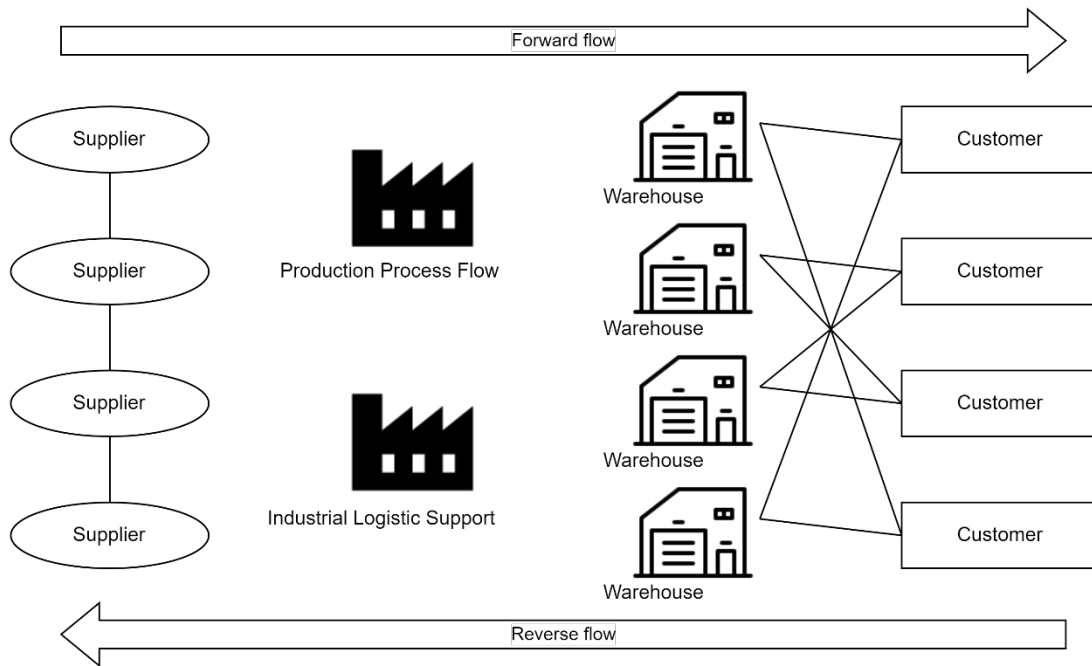


Figure 1: Logistics Flows During the Production Process

Source: own processing according to Longshore and Cheatham (2022, p. 2)

Table 1: Activities of the Logistics Flows During the Production Process

Physical Supply	Manufacturing	Physical Distribution
Demand Forecasting	Production Planning	Demand Forecasting
Order Processing	Purchasing	Order Processing
Procurement	Material Handling	Inventory Management
Inventory Management	Packaging and Shipping	Transportation and Traffic
Transportation	Information Flow	Customer Service
Information Flow	-	Information Flow

Source: own processing according to Longshore and Cheatham (2022, p. 2)

## 1.1 Brief History of Logistics

The origin of the logistics as a discipline or term is uneasy to track. According to Zimová (2015), Pieters and Ntenje (2012) and Dolan (2018), the concept originated from the need to manage military supplies. Even antic army generals knew that campaign success didn't rely exclusively on being a good tactical officer, but also included being a good logistics organizer. In that time, the purpose of logistics was to get people and material to the right location, within the given time constraints

and also while preventing the opponents from having the same material and equipment.

After the World War II, the situation on the market was different. There was an excess of demand over supply which created an environment where customers were motivated to find the products themselves while reducing the pressure on companies to reach their customers. Between the years 1950 to 1970, also known as the "*preparation and start of logistics*" (Dolan 2018, p. 6), economy logistics starts to appear. However, in that time, logistics was considered as a dead-end job for employees who could not keep up with the changes in production, mostly before retirement. It was seen as an easy discipline accessible to all individuals without the need for any in depth training or education. (Dolan 2018, Pieters and Ntenje 2012)

The period after the 1970 is being referred to as "*success of logistics*", according to Dolan (2018, p. 6). In this period, the market situation, as mentioned above, changed leading to a majority market saturation. Logistics had to evolve and adapt to the new trends appearing in marketing, planning or to the need for more flexible management reflecting the customer's requirements, etc. Processes started to be more coordinated and by the new millennium, logistics was considered as a complex discipline and a "*servant to the whole organization and should help each and everyone in the organization to achieve the overall goal of the company.*" (Pieters and Ntenje 2012, p. 18, Dolan 2018, Zimová 2015)

## **1.2 Definitions of Logistics**

Military roots of logistics are reflected in the definition provided by the The New Lexicon Webster's Dictionary of the English Language (1990, p. 582): "*The branch of military science concerned with troop movements and supplies.*" While not being incorrect, this definition is not sufficient for business purposes.

As mentioned above, definition of logistics is ambiguous and is treated differently by many authors. Logistics is understood as strategic management of the Supply Chain in order to gain set goals. Each definition in literature is adjusted according to the purpose of the topic. According to Dolan (2018), European logistics association

analysed 14 definitions formulated between 1960 to 1990 and in the year 1990 presented the logistics as:

*“organizace, plánování, řízení a výkon toků zboží vývojem a nákupem počínaje, výrobou a distribucí podle objednávky finálního zákazníka konče tak, aby byly splněny všechny požadavky trhu při minimálních kapitálových výdajích. (the organization, planning, management and execution of product flows from development and purchasing, to production and distribution according to the order of the final customer, so that all market requirements are met with minimum capital expenditure.)”* ([Gros et al. 2016, own translation](#))

The changing understanding of logistics may be also observed in publications produced by one author in different years. For instance, [Pernica](#) describes logistics differently in his two books. First as a discipline *“which deals with the management of the flow of material in time and space, in a complexity with related information flows and in a concept including both the physical and the value side of the movement of material”* ([Pernica 1991, p. 8](#)), and as a discipline *“which deals with the overall optimization, coordination and synchronization of all activities within self-organizing systems, the chaining of which is necessary to achieve a given final (synergistic) effect flexibly and economically”* ([Pernica 1998, p. 80](#)).

These two definitions, while evolving, still didn't encompass all factors entering the process of logistics. There are more appropriate and exact definitions for business purposes nowadays below. The most commonly used definition is known as the **7Rs** and is described by [Pieters and Ntenje \(2012, p. 30\)](#) as follows:

*“Logistics ensures the availability of the **Right** product, in the **Right** quantity and the **Right** conditions, at the **Right** place, at the **Right** time, for the **Right** customer, at the **Right** cost.”*

Another generally accepted definition has been developed by the Council of Logistics Management and is mentioned by both [Zimová \(2015\)](#) and [Pieters and Ntenje \(2012, p. 30\)](#):

*“Logistics is the process of planning, implementing and controlling the efficient, effective flow and storage of raw materials, in-process inventory, finished goods,*

*service and related information from point of origin to point of consumption (including inbound, outbound, and external movements) for the purpose of conforming to customer requirements.”*

Overall, as Gros et al. (2016) supports, that the definition of logistics can be summarized as that part of supply chain management that plans, implements and effectively and efficiently manages the forward and backward flows of products, services and related information from the point of origin to the point of consumption and storage of goods so that the requirements of the end customer are met. Typical managed activities include transportation, fleet management, warehousing, material handling, order fulfilment, logistics network design, inventory management, supply and demand planning, and management of logistics service providers. To varying extents, logistics functions also include sourcing and purchasing, production planning and scheduling, packaging, assembly and customer service. It is involved in all levels of planning and implementation – strategic, operational and tactical. Logistics management is an integrating function that coordinates and optimizes all logistics activities, as well as being involved in linking logistics activities with other functions, including marketing, production, sales, finance and information technology.

Jenkins (2022) states that Logistics includes numerous methods of transportation used to move inventory from one location to another. This component is responsible for figuring out where to keep goods at each stage until they're needed elsewhere. Logistics coordinates facilities, people, equipment and other resources to ensure that products are moved at the right time, when they are supposed to and that there is space and demand for them at the next stop.

According to Adam Smith, as he mentions in his classical book published in 1776 *An inquiry into the cause of the wealth of nations* (Smith 2017), free trade of material and goods, therefore logistics connected to obtaining these, can provide goods for the lowest prices possible. That is possible e.g. due to the greater availability of the material in some other regions than in the place of the manufacturer and has to be shipped, of course for the most efficient costs. Also import of the products can be cheaper than manufacturing because of the labour costs. For example, manufacturing clothes in Asia instead of Europe. On the other hand, lower costs,

especially labour cost are often connected to unethical practices, child labour and other problems.

Judging based on the development of the aforementioned definitions, we may observe a significant trend of increasing importance of logistics within the management during integration of material flows not only within companies, but also in the conditions of extensive supply systems and its development from the operational to the strategic level. It is unambiguous that modern organizations cannot overcome their competitors without efficient logistics management and logistics chains, but it also requires consideration of ethics in specific cases.

### **1.3 Supply Chain and Supply Chain Management**

In the beginning of year 2000, new terms such as *Supply Chain (SC)* and *Supply Chain Management (SCM)* started to occur. As Jirsák et al. (2012), as well as Longshore and Cheatham (2022), point out, there is a difference between the terms supply chain, supply chain management and logistics. Nevertheless, literature often uses these terms as synonymes. However, similarly to the concept of logistics itself, the definitions of supply chain, supply chain management and logistics, eventually logistic chain, when differentiated, vary. (Jirsák et al. 2012, Gros et al. 2016)

#### **1.3.1 Supply Chain**

In a broad sense, supply chain refers to a sequence of value-adding transformations, movements or placements which satisfy a need. Pieters and Ntenje (2012, p. 25) describe the supply chain as: “*a network of connected and interdependent organizations mutually and cooperatively working together to control, manage and improve the flow of materials and information from suppliers to end users.*”

Longshore and Cheatham (2022, p. 3) state that “*supply chain includes all those activities associated with inbound logistics, the flow of material flows within the factory, and the outbound logistics, flow of materials, products, and services from the factory to the customer.*”

Gros et al. (2016) describes, that the supply chain includes all the steps that need to be carried out directly or indirectly to meet the end customer's requirements. The supply chain includes not only manufacturers and suppliers, but also transporters, warehouses, sellers and customers. Through all the organizations involved, such as manufacturers, the supply chain contains all the components that are necessary to meet customer requirements. These components include, for example, new product development, marketing, distribution, financing and customer service. Gros et al. (2016) also mention another several definitions and descriptions of supply chain, however most of them are like those already mentioned above.

As Gros et al. (2016) point out that some descriptions perceive supply chain as a network and a set of organizations that carry the functions necessary to fulfil customer demands, some as a sequence of steps, events, activities and processes.

### **Logistic Chain**

In some literature sources, there is a possibility to come across a term of Logistic Chain or even Logistic. Supply Chain is often interchangeable with these terms. Gros et al. (2016, p. 27) describes the term using the ČSN EN 14943 standard, which says: *“Logistický řetězec je pořadí událostí, které mohou obsahovat přeměnu, pohyb nebo umístění, jež přidávají hodnotu. (A logistic chain is a sequence of events that may include transformation, movement or location, that add value.)”* (Own translation)

MSU (2023) perceives logistics and its chain as activities such as transportation, warehousing and packaging, which are responsible for moving and positioning inventory and acknowledging its role in the supply chain.

In general according to the literature (Gros et al. 2016, MSU 2023) Logistic Chain can be described as a subset of supply chain and consists of a list of individual points and activities necessary for the successful delivery of the material, goods, etc.

### 1.3.2 Supply Chain Management

Term Supply Chain Management started to occur at the end of 20<sup>th</sup> century. Gros et al. (2016) mentions several definitions ranging from 1996 to 2008 indicating development in the perception of the importance of the topic and its complexity.

For example, author Harlandová in 1996 stated that Supply Chain Management is *“řízení sítě vzájemně propojených podniků zapojených do poskytování balíku výrobků a služeb požadovaného konečným zákazníkem. (managing a network of interconnected businesses involved in providing the package of products and services required by the end customer.)”* Gros et al. (2016, p. 415 own translation)

In 2008, Lamberta described Supply Chain Management as *“integraci základních obchodních (podnikatelských) procesů napříč dodavatelským řetězcem tak, aby došlo k růstu hodnoty pro zákazníky a stakeholdery. (the integration of basic business processes across the supply chain in order to increase value for customers and stakeholders.)”* Gros et al. (2016, p. 416, own translation)

Nowadays, Supply Chain Management is described as a system of joint planning involving all parts of the supply chain within and outside the company in one system in order to satisfy the needs of the market while spending costs effectively. Individual stages of the supply chain involve planning, organizing, material acquisition, including acquisition of material suppliers as well, and other individuals involved in the system, development, production and the distribution to the final customers. (Jirsák et al. 2012, Zimová 2015)

Standard EN 14943 describes Supply Chain Management as *“organizování, plánování, řízení a realizace toku produktů od vývoje a opatřování přes výrobu a distribuci k finálnímu zákazníkovi za účelem uspokojení požadavků trhu nákladově efektivním způsobem. (organizing, planning, managing and realization the flow of products from development and procurement through production and distribution to the final customer in order to meet market demand in a cost-effective manner.)”* (Gros et al. 2016, p. 416, own translation)

Longshore and Cheatham (2022) state that Supply Chain Management integrates supply and demand management within and across companies and includes all



logistics management activities, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance, and information technology. Following their Supply Chain definition (1.3.1 Supply Chain), the authors add that SCM is the management of those Supply Chains or groups of them, efficiently and effectively with the overall objective being to accomplish those activities shown in Figure 1: Logistics Flows During the Production Process, with a global business perspective in mind.

Gros et al. (2016) provide probable the most exact definition claiming that Supply Chain Management is a set of rules, principles and methods, includes the planning and management of all activities that require sourcing and purchasing, transformation of resources and implementation of other logistics activities. Most significant being the fact that the definition involves flexible coordination and cooperation between partners in the chain, such as suppliers, intermediaries, logistics service providers and customers.

Essentially, the Supply Chain integrates supply and demand management within and between organizations. Supply Chain Management has an integrative function and is responsible for connecting business processes in a cohesive and high-performance model environment in such way to ensure permanent and efficient growth of added value for the customers and other stakeholders. It includes all the logistics activities mentioned above, including production, and manages the coordination of processes with marketing, sales, product design, financing and information technology. (MSU 2023, Gros et al. 2016, Jenkins 2022)

### **1.3.3 Logistics versus Supply Chain Management**

MSU (2023) mentions, that Logistics and Supply chain management are almost the same terms, however the term logistics is commonly used in Europe, while SCM is mostly used in United states. Despite the similarities, there are differences not just geographical.

Definitions of both the concepts are stated in the previous chapters of this thesis. Based on them, it is possible to estimate the differences. Both of the concepts

do supplement each other the synergy between them is necessary for achieving process effectiveness.

Aspects which do have logistics and supply chain management in common are:

- Focus on goods, services and information,
- Supporting the company's success,
- Focus on customers satisfaction,
- Revolve around the same flow of goods and services from supplier to customer.

MSU (2023) and Jenkins (2022) state that logistics focuses on meeting customers' requirements and refers to movement, storage and flow of goods, services and information (these are items in the Supply Chain, as Jenkins (2022) reminds), while Supply Chain focuses on a competitive advantage and SCM is more comprehensive. It is a way to link major business processes within and across companies, coordinate partners that have a role in the network in order to ensure a smooth efficient flow in a high-performance business model, that drives the competitive advantage.

*"Supply Chain Management is an overarching concept that links together multiple processes to achieve competitive advantage, while logistics refers to the movement, storage, and flow of goods, services and information within the overall supply chain."*

(MSU 2023)

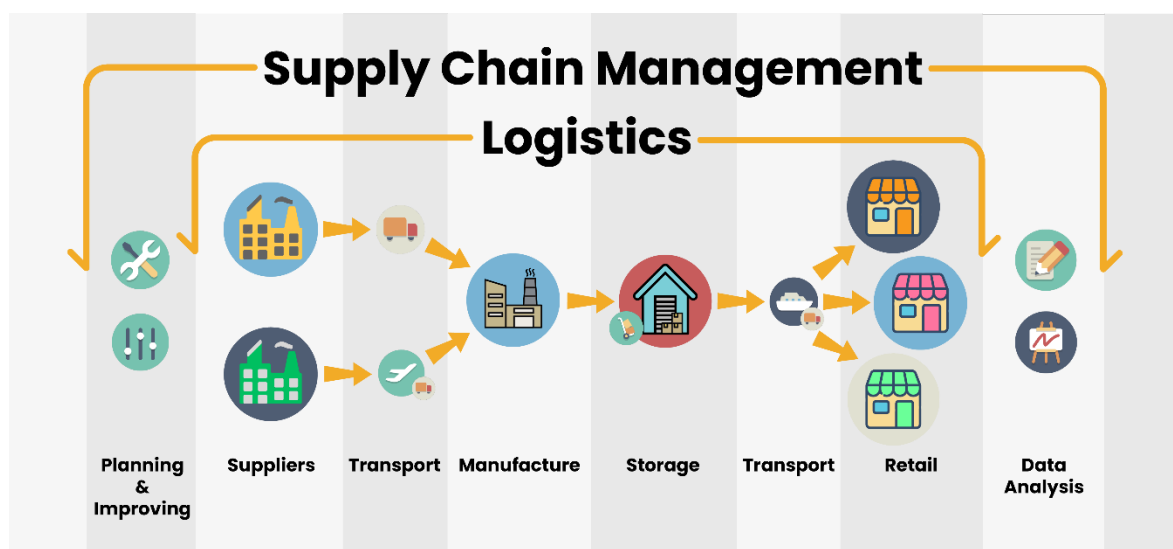


Figure 2: Supply Chain Management vs Logistics

Source: WTA (2022)

That statement confirms [Jenkins \(2022\)](#): *“In Supply Chain Management, Logistics are responsible for the movement and storage of goods and services, along with the documents and reports that record those movements throughout an item’s journey to the customer.”*

An easy-to-understand description is provided by the [WTA \(2022\)](#) which describes Supply Chain Management as: *“planning and continually analysing processes for inefficiencies. Key decisions around the sourcing of raw materials, labour and facilities falls under SCM. Ensuring the business has the resources to handle all these raw materials, turn them into products and distribute them.”* Whilst Logistics *“only covers the movement and storage of goods between set points. Points which have already been agreed by the supply chain management.”*

According to these descriptions it is possible to mark Logistics as a subset of Supply Chain Management which is evidenced by [Gros et al. \(2016, p. 415\)](#), who marks Logistics of today and near future as a significant subset of the Supply Chain Management. [Jenkins \(2022\)](#) offered a summarization of the differences between the terms and it can be seen in the table below.

*Table 2: Differences between Logistics and Supply Chain Management*

Logistics	Supply Chain Management
Logistics is one activity in supply chain management.	Supply chain management covers a wide range of activities, including planning, sourcing materials, labour and facilities management, producing and delivering those goods and services.
Logistics focuses on the efficient and cost-effective delivery of goods to the customer.	Supply chain management targets higher operational performance that will give the business a competitive advantage.
Logistics started with the military. Many say Alexander the Great, born 356 B.C., as a logistics master.	The modern practice of supply chain management started in the 20th century. The Ford Motor Company production lines perfected the concept. Many credit logistician Keith Oliver as the person who coined the term in the early 1980s.
Logistics is centered on the movement and transport of goods within a company	SCM oversees the development of raw materials into finished goods that move from the producer to the manufacturer. Those goods get distributed to retailers or directly to consumers.
Logistics is one activity in the supply chain management.	Supply chain management covers a wide range of activities, including planning, sourcing materials, labour and facilities management, producing and delivering those goods and services.

Source: own processing according to [Jenkins \(2022\)](#)

In general, with a bit of exaggeration there is a possibility to say that Logistics focus and answer the questions *Where? When? How Many?* whilst Supply Chain Management focuses on all mentioned above and even *What? How?*

## 1.4 Outsourcing of the Logistics

Outsourcing, according to the standard EN 14943 is *“Proces, ve kterém dodavatelé poskytují zboží a služby, které byly původně zajišťovány interně. (a process in which suppliers provide goods and services that were originally provided in-house.)”* (Gros et al. 2016, p. 449, own translation)

Logistics is not a privilege to only large enterprises and corporates, but also to small and medium-sized enterprises (SME). SMEs often suffer of lack of resources, finance and technologies and are more forced to manage the costs even more effectively. Nevertheless, principles of lean production methodology are applied across all businesses. One of the approaches of Lean Production is to focus on the key activities of the company, on the primary product, and to secure other supporting processes as much as possible by suppliers, that means to outsource them. Most often, various levels of logistics are outsourced. (Jirsák et al. 2012, Veber a Srpová 2012, Gros et al. 2016)

Gros et al. (2016, p. 449) even provides some definitions of Logistics. A few examples are given for illustration:

Outsourcing is *“vyřazení funkcí nebo činností tradičně vykonávaných ve firmě a jejich převedení smluvnímu výrobcí nebo poskytovateli služeb. (eliminating functions or activities traditionally performed in the company and transferring them to a contract manufacturer or service provider.)”* (own translation)

Outsourcing is *“orientací na hlavní aktivity firmy a přesun ostatních činností na třetí partnery. (focusing on the company's main activities and transferring other activities to third partners)”* (own translation)

Gros et al. (2016) emphasize the importance of outsourcing, which, in addition to the aforementioned definitions, also consists of changing the cost structure so that it is maximally variable and minimally fixed.

Reasons for logistics outsourcing could be several. According to Gros et al. (2016), the main reasons are **operational**, **tactical** and **strategic**. This division is described below together with Jirsák's et al. (2012) classification. According to him, the reasons for the outsourcing can be divided as follows:

- Costs
- Capacity
- Quality
- Capital

High costs can be several kinds. There can be initial costs for technologies or vehicles as well as costs of missed opportunity caused by inefficient or untapped potential of facilities or vehicles or human labour costs. The last two are, according to Jirsák et al. (2012), main reasons mostly in western European countries. According to the Gros et al. (2016) these are the tactical reasons.

The use of outsourcing, in addition to what has already been mentioned, brings an improvement in the cash flow of the company. The company is not forced to make a one-time and expensive investment, but by using subcontracted services it spends less funds, which it can use for other purposes or investments.

Capacity reasons are either personnel capacity, storage capacity or capacity of logistic facilities. Also demand fluctuations due to seasonality can cause additional capacity requirements which the company is not able to comply with. According to the Gros et al. (2016) these are the operational reasons for outsourcing.

Outsourcing customer, for example manufacturing company, is focused in its field of business instead of logistics and is not able to provide such a quality of services, therefore quality is also an important factor for choosing outsourcing. Improving quality within the business would need to be supported with enough capital, which would cause additional costs, etc. Jirsák et al. (2012) also mentions know-how as one of the aspects for outsourcing, but that is most likely a thing in production outsourcing

that logistics. According to Gros et al. (2016), these are the strategic reasons for outsourcing. (Jirsák et al. 2012, Veber a Srpová 2012, Gros et al. 2016)

#### **1.4.1 1PL, 2PL, 3PL, 4PL and 5PL**

The classic approach for outsourcing consisted of a subordinate supplier relationship (the supplier is subordinate to the client), in which the supplier focused on fulfilling contractual obligations, with no further motivation towards the company. Nowadays it is replaced by a partnership of companies based on teamwork, motivation and the joint search for the most effective solutions. Logistics service providers can be divided into groups according to the range of offered services and the way in which they are implemented. (Jirsák et al. 2012, Gros et al. 2016, WTA 2023)

##### **1PL**

A First-party logistics consists of two parties, the supplier and the retailer/customer. A 1PL logistics “provider” transports items from the manufacturer to the seller. In this type of relationship, the supplier manages its own inventory, storage, and delivery without the outsourcing.

##### **2PL**

A Second-party logistics is the most basic service a company can outsource. 2PL providers focus exclusively on the transportation sector of the business. Examples of 2PL include airlines, shipping lines, and trucking companies that operate the vehicles. 2PL transports inventory between warehouses of the fulfilment journey.

##### **3PL**

A Third-party logistics consists of Second-party logistics, that means outsourcing of the transportation, but also 3PL providers manage other details of the supply. Third-party providers secure necessary secondary services like warehousing, packing, customs, and freight forwarding. However, the manufacturer defines the form of a logistics chain and ensures the correct execution of the process and defines what it is they want.

Third-party logistics providers usually have their own logistics infrastructure, that consists of warehouses, fleet of vehicles or employees. Using these services can significantly reduce costs, especially for SMEs. This is the most used solution of logistics outsourcing. (Jirsák et al. 2012, Pieters and Ntenje 2012, Gros et al. 2016, WTA 2023)

#### **4PL**

In a Fourth-party logistics the manufacturer outsources both the organisation and supervision of the supply chain. This model consists of 4PL provider partnership with several established 3PL and 2PL companies and carriers sharing infrastructure or do ensure even this infrastructure by its own. The Fourth-party logistics provider takes care of every aspect of the supply chain without inputs from client. On top of 3PL, this model can provide logistics strategy, project management, carrier performance analysis, freight sourcing strategies, and other services.

Fourth-party logistics providers function as consultants who manage the flows of logistics using 3PL partners, but also can efficiently improve supply chain. 4PL is used mostly in complex far-reaching supply chains. As 4PL providers often outsource 3PL assets like vehicles or warehouses, it allows them to be more flexible than a 3PL or a manufacturer with their assets and find the most appropriate supplier for the clients. An orientation towards creating value for the customer in the entire chain is typical. (Pieters and Ntenje 2012, Gros et al. 2016, WTA 2023)

#### **5PL**

Fifth-party logistics is most recent concept and according to WTA its interpretations vary. According to the Gros et al. (2016), 5PL providers are virtual suppliers providing know-how and using extraneous sources. That comply with the WTA stating that 5PL providers focuses on the wider supply networks using its expertise to oversee all the organisations' supply chains, organise them and put the client's logistics solutions in place, taking on all supply chain management elements.

Fifth-party logistics services are most valuable to e-commerce businesses. 5PL providers takes advantage of new technologies, robotics or AI (artificial intelligence). Some literature with the phenomenon of AI also mention 6PL concept as a fully

automated artificial intelligence driven supply chain management, however the literature sources agree that this concept is still rather theoretical. Table and figure below represent the differences between each of the logistics concepts. (Gros et al. 2016, WTA 2023)

Table 3: Differences between each of the Logistics Concepts

1PL	2PL	3PL	4PL	5PL
A manufacturer delivers its product to a store to sell	A courier delivers the product to a store	A fulfilment company with fleet of trucks transport the product to a store	A logistics company that manages a 3PL on behalf of the manufacturer to package and deliver the product to a store	A logistics company manages the manufacturer's supply chain from production to delivery

Source: own representation according to WTA (2023)

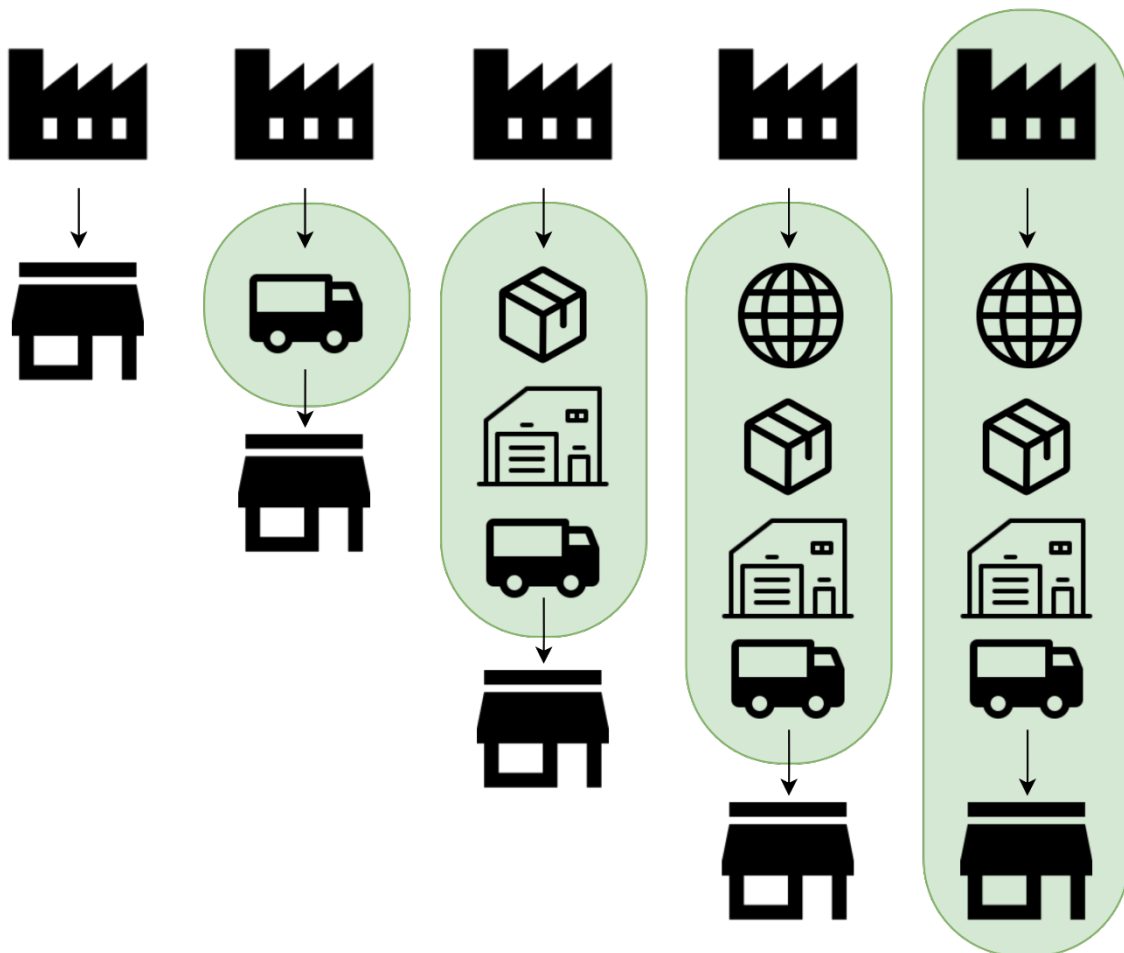


Figure 3: Visualisation of the Differences of each of the Logistics Concept

Source: own representation according to WTA (2023)



## 2. Transportation as a part of Logistics

*„Transportation systems are a fundamental part of our supply chain and logistics system.“ (Longshore and Cheatham 2022, p. 155)*

As Longshore and Cheatham (2022) state, the term *transportation system* is used to refer to all of the equipment and logistics used for transporting passengers and goods and it covers movement by all forms of transportation from bicycles and cars to boats, aircrafts or even space ships.

Transport infrastructure is part of the logistics and communication infrastructure, consisting of energy, communication and distribution networks. Its development is very uneven. For example, road transportation development increases more rapidly than inland waterway transportation. The reasons for this could be found in financial demands, but also with universality of the transportation networks. Road networks, such as highways or motorways, are used not only for freight transportation but also for civil transportation. Also, it is simpler and more profitable to build a multipurpose road than a water canal.

### 2.1 Types of Transportation Systems

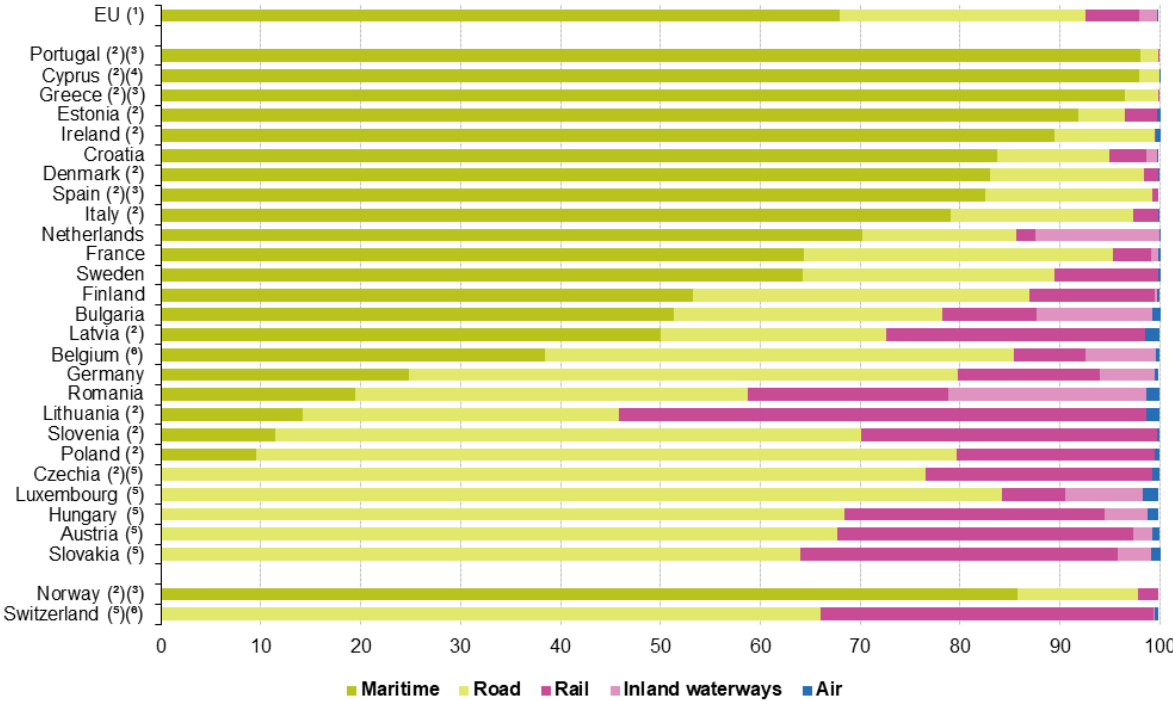
As Gros et al. (2016) states, transportation infrastructure can be divided into two basic parts:

- Network of transportation routes
- Means of transport

Network of transportation routes can be more divided according to the used technology. Eurostat (2023) considers in the European context the Maritime, Road, Rail, Inland waterways and Air transportations whilst Gros et al. (2016) adds even pipelines and cableways.

Whilst the pipelines and sometimes cableways (except for cableways for passenger transport) are in freight transportation used only for delivering commodities, such as oil, gas or ore, the other transportation systems are more multipurpose and can

deliver a wide range of goods, materials, etc. Pipelines are the least universal type of transportation system, but on the other hand it allows to deliver huge amounts of the transported commodity continuously and without any fluctuations caused by the bad weather for example. It is the least expensive transportation system per volume of delivered commodity. Cableways are used mostly in the mines and they are not relevant in the transportation systems of goods within the EU or its member states. (Gros et al. 2016)



Note: no data for Malta. Countries are ranked based on the share of maritime transport.  
 (\*) Includes Eurostat estimates for rail transport for Belgium but does not include road freight transport for Malta and road international transport of Cyprus (negligible).  
 (2) No inland waterway freight transport or negligible (less than 0.1 % in the total freight transport of the country).  
 (3) Air transport is negligible (less than 0.1 % in the total freight transport of the country).  
 (4) No rail transport.  
 (5) No maritime transport.  
 (6) Eurostat estimates.

Figure 4: Modal Split of Freight Transport in 2021 based on tonne-kilometres  
 Source: EUROSTAT (2023)

Figure 4: Modal Split of Freight Transport in 2021 based on tonne-kilometres above represents the transportation situation in European Union. The split is based on the tonne-kilometres. As displayed in the figure, the highest share is represented by maritime transportation. As Longshore and Cheatham (2022) states, up to ninety percent of all international trade is accomplished through maritime transportation. This predominance may be accounted to the capacity of the carriers and to the fact that nearly any commodity or goods can be transported for low costs. On the other

hand, the expediency of the delivery is the slowest by far and has to be combined with other methods of transportation in order to deliver goods to the destination out of the port. Ecological footprint of maritime transport is also significant. Carbon emissions produced by one cargo ship are equivalent to the emissions produced by 50 million cars. Strengths and shortcomings of the freight transport means are summarized in the Table 4: Pros and Cons of Individual Means of Transport below. (Longshore and Cheatham 2022, Gros et al. 2016)

Maritime transportation's share varies considerably at country levels and obviously depends on the availability of the given mode of transportation. Landlocked member states of European Union without a coastline are obviously not relevant for maritime transportation.

It is important to note that the modal split as analysed before consists not only of the transportation within the European Union but also of the import and export out of the member states of the EU. If only inland freight transportation and road transportation are considered, according to Statista (2023), they represent 77,3 % of total in the European Union (EU-28) in 2021.

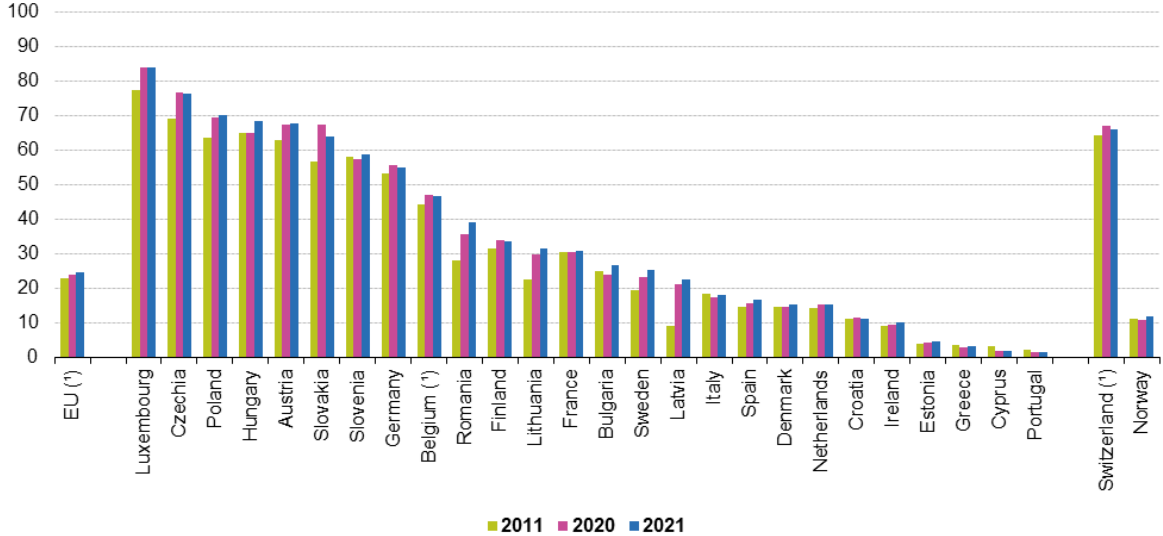
*Table 4: Strengths and shortcomings of Individual Means of Transport*

	<b>Maritime freight</b>	<b>Air freight</b>	<b>Rail freight</b>	<b>Road freight</b>
<b>Pros</b>	<ul style="list-style-type: none"> <li>• Cheapest</li> <li>• Largest volumes</li> <li>• Most sustainable</li> </ul>	<ul style="list-style-type: none"> <li>• Fastest</li> <li>• Most secured</li> <li>• least susceptible to delays</li> </ul>	<ul style="list-style-type: none"> <li>• Cheaper than air freight</li> <li>• High sustainability</li> <li>• High security and safety</li> </ul>	<ul style="list-style-type: none"> <li>• Cheap for short distance</li> <li>• High flexibility</li> <li>• Can reach anywhere</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Other transport necessary</li> <li>• Slow</li> <li>• Inflexible</li> </ul>	<ul style="list-style-type: none"> <li>• Most expensive</li> <li>• Volume limitations</li> <li>• Worst ecological burden</li> </ul>	<ul style="list-style-type: none"> <li>• More expensive than maritime freight</li> <li>• Less flexible</li> <li>• Slow</li> </ul>	<ul style="list-style-type: none"> <li>• Impossible for intercontinental routes</li> <li>• Capacity limitations</li> <li>• Most accidents</li> </ul>

Source: own representation according to information of Longshore and Cheatham (2022) and Gros et al. (2016)

## 2.2 Road Transportation

The share of freight transport by road in the European Union, according to [Eurostat \(2023\)](#), including the import and export as mentioned above, measured in tonne-kilometres, is represented by 24,6 %. Its share also varies considerably at country levels. As can be seen in the [Figure 5: Share of road in total freight transport based on tonne-kilometres](#) below, in Czech Republic the share of road transportation reaches more that 70 % of total freight transport. In comparison with the year 2011, there is an increase of 7,5 %. According to [Statista \(2023\)](#), Czech Republic is nearly in the average of the European Union in inland road transportation share. The inland freight transportation share of road transport according to [Statista \(2023\)](#) as mentioned above represented 77,3 % of total in the European Union in 2021. In the same period of time, Romania recorded an increase of 11,1 % leading to almost 40 % share which also makes the road transportation the most used method in this country.



Note: Malta not available. Countries are ranked based on 2021 data.  
 (\*) 2020-2021: Eurostat estimates.

Figure 5: Share of road in total freight transport based on tonne-kilometres  
 Source: [EUROSTAT \(2023\)](#)

### 2.2.1 Strengths and Shortcomings of Road Transportation

The biggest and undisputed strength of road transportation is high availability, which allows to provide “door-to-door” service (delivery to everywhere where the road is).

This aspect is also the reason for combined transportation methods, as mentioned above, for fuel, grain, etc. This characteristic is one of the main reasons of rapid growth of its share in the total of the transportation methods. Its growth depends also on the density and development of road networks, especially highways and motorways, within the individual states and its connection to the European network. (Gros et al. 2016)

On the other hand, the cost of the road transportation fluctuates accordingly to the fuel prices and in recent times it caused massive increase of costs in the industry. The expediency of the delivery over a long distance in comparison to air or railroad transportation can be perceived as another negative aspect. The average speed is approximately 60 km per hour. (Gros et al. 2016)

### **2.2.2 Combined Transportation**

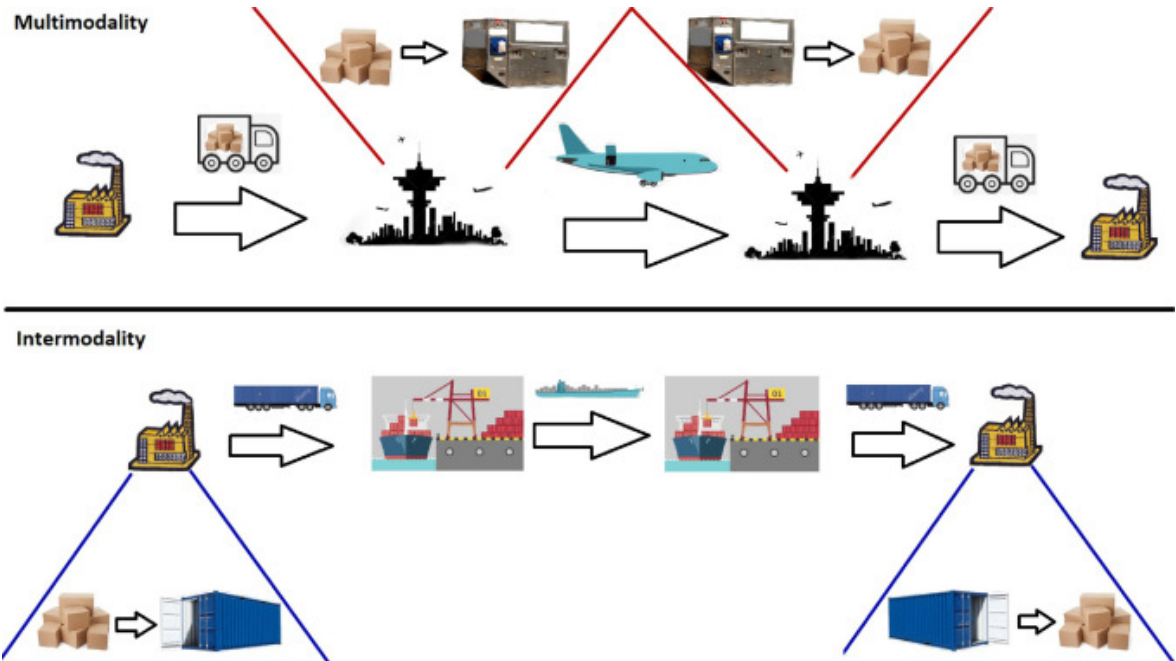
Combined transportation is, accordingly to (Gros et al. 2016, p. 260), characterized by using more methods of transportation without transshipment. Its growth had been caused with implementation of the cargo containers into operation in the middle of the 20<sup>th</sup> century. Nevertheless, transport units can be not only containers but also trailers, semi-trailers or whole trucks. According to the number of used methods, we distinguish bimodal system of combined transportation which consists of two methods, and multimodal system including three or more methods combined together. The common element is combination with road transportation on the first or last part of the route because of its highest availability. (Longshore and Cheatham 2022, Gros et al. 2016)

Archetti et al. (2022) further divides the above-described multimodal system on multimodal and intermodal systems. Multimodal is defined as *“the transportation of goods carried out by a sequence of at least two different modalities”*. Intermodal freight transportation is according to them defined *“the transportation of goods by a sequence of at least two different modalities without changing the load unit during the transport chain.”*

Furthermore Archetti et al. (2022) explained that in intermodal transportation goods are loaded at the place of origin, manufacturer of shipper warehouse, inside the load

unit, mostly the cargo container. The transportation unit is then moved between modalities until it reaches the final delivery location, where goods are unloaded. Which brings an issue with return logistics. Some countries are mainly importers thus the need for empty transport units to be moved from import areas back to export areas rises. Visualisation of the differences between Intermodality and Multimodality can be seen in the Figure 6: Difference between Multimodality and Intermodality below.

Archetti et al. (2022) thereby contradicts in the interpretation of multimodality the description of combined transportation given by (Gros et al. 2016, p. 260) above as transportation without transshipment.



*Figure 6: Difference between Multimodality and Intermodality*  
 Source: Archetti et al. (2022)

Combined transport can be also divided into accompanied and unaccompanied transport according to the driver, if he travels all the way with the loaded truck, or if the truck is sent without driver and in final destination another driver is assigned to it. Accompanied combined transport is suitable for short and medium routes between 200 km to 500 km. Drivers are able to accomplish mandatory breaks whilst the transport is still on the way and also it helps to reduce costs and even the ecological burden. (Longshore and Cheatham 2022, Gros et al. 2016)

### 2.2.3 Types of Road Transportation Vehicles

According to the transported goods or material there are different types of vehicles which can be used for the transportation. (Teleroute 2023)

**Rigid trucks** are those where the driver's cabin and the trailer with transported goods are combined into a single, indivisible unit. These trucks mostly operate in urban areas as parcel delivery vehicles, because they typically have smaller dimensions than the others.

**Articulated trucks** combine a tractor unit with semi-trailer. The parts that make up this type of truck are a motor vehicle together with a semi-trailer connected together by the pivot joint, so it can be separated.

**Trailers** are commonly visible on the roads not with connection to the freight transportation but also towed by cars. They cannot be moved by their own means but will require a cab or a tractor-trailer to tow it.

**Tautliner truck** is the most common on European roads. Its semi-trailer is covered by the tarpaulin on the sides and top of it. These tarpaulins can be partially or totally removed, so that loading and unloading process can be more expeditious and more convenient.

**Closed trucks** are the opposite of Tautliner. It can be loaded only from the rear and the structure of the semi-truck is rigid.

**Open platforms** trucks have its load placed totally or partially uncovered. In some cases, the sides can be covered. They are usually used to transport heavy and large-volume goods, such as construction materials.

**Refrigerated trucks** are used to transport food, medical supplies, cold drinks and other perishable cargo. Within this category of trucks, it is possible to distinguish between refrigerated or isothermal, depending on whether it has cold generation systems or if they only have a temperature insulation.

**Tanker trucks** transport liquids and gases in a cylindrical tank mounted on a semi-trailer. They are used to transport fuel, milk, chemical fluids, etc. Depending on the liquid, the tank can be refrigerated or insulated or pressurized.

**Road trains** are not used in Europe due to the legislation of maximum length of the freight set. They are trucks with one or more semi-trailers attached.



## **3. Information Systems in Logistics and Transportation**

Logistics is a very complex discipline consisting of many different activities, as demonstrated in chapter 1 Basic Concepts from Logistics. To achieve competitive advantage and optimize the business processes, organizations must implement and utilize information technologies such as information systems, as well as principles of information management. Furthermore, efficient use of information technologies allows companies to reduce costs and improve customer experience.

### **3.1 Principles of Information Management**

Information management as a discipline focuses not only on information systems, but also on other information processes and information flows which are handled outside the IT systems.

*„The general goal of the Information Management is to assure data for satisfying manager’s information need as well as to realize so called data logistics – to transport relevant data to relevant persons in the right time.“ (Doucek 2015, p. 5)*

Information Management focuses on the management of information, its collection, generation, processing, storage, communication, and dissemination of information for the purpose of systematic organizing and planning processes and especially its use in decision-making and management processes of the company. The management of information is a complex discipline, which, to facilitate data processing, it is closely connected with information systems. (Doucek 2010)

### **3.2 Knowledge Management**

Data is a fundamental part of any information technology. For further information systems description it is necessary to understand the difference between data and information, as well as knowledge and wisdom, as they are sometimes interchanged. These terms are usually united under the discipline of Knowledge Management, which

is sometimes mistaken for Information Management. Its basic definitions are described below in this chapter.

Knowledge Management is the process by which an organization generates value from its intellectual and knowledge assets. Novotný and Mikulecký (2011, p. 103) describe knowledge management as „*systematický proces vyhledávání, výběru, organizace, koncentrace a prezentace poznatků (znalostí) způsobem, který pomáhá v podnicích zvyšovat úroveň, na jaké zaměstnanci rozumí konkrétním oblastem.*“ (“*a systematic process of searching, selecting, organizing, concentrating and presenting findings (knowledge) in a way that helps companies to increase the level at which employees understand specific areas.*”)(own translation) Drahokoupil (2017) further points out that Knowledge Management is a key activity for achieving competitive advantage.

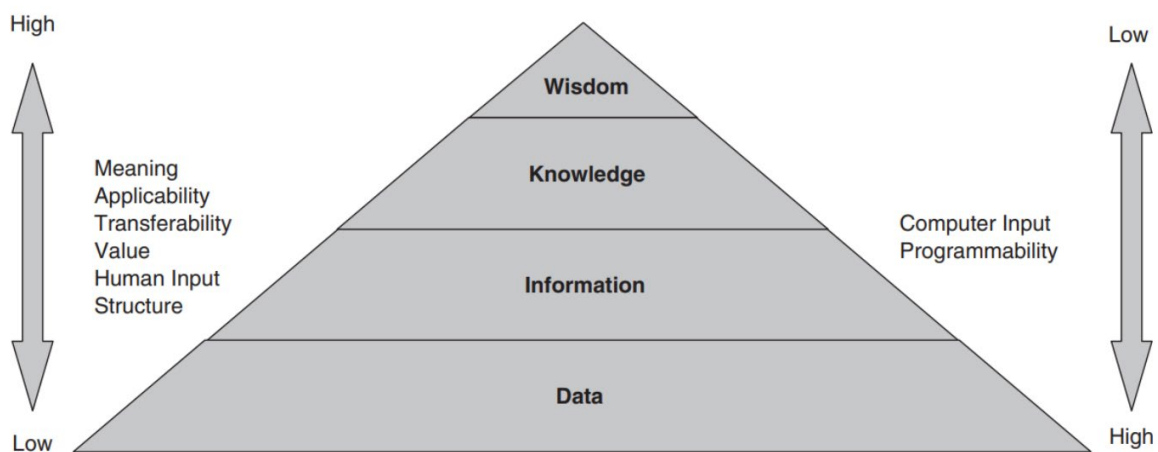


Figure 7: Knowledge Management Hierarchy Pyramid  
Source: Rowley (2007)

### 3.2.1 Data & Information

As mentioned above, **Data** is fundamental part of any system and any information. Data is described as a record represented by characters suitably formalized for communication, processing and interpretation by other human or automatic systems. Švarcová and Rain (2011, p. 24) states that purpose of data is to „*přenášet a zpracovávat obraz skutečnosti*“ (“*transmit and process the image of reality*”) (own translation).

Rowley (2007) points out an important feature of data. Data has no meaning on its own, until it is interpreted, processed and information is extracted.

On the other hand, **Information** is purpose-processed data that has been assigned subjective meaning through interpretation and reduces the degree of uncertainty of a system. It is important to note that interpretation of data is always subjective as it has a different meaning for each subject, person or organisation. However, information is a wide term and it does not have a specific definition which would be broadly accepted across the literature and science disciplines. (Švarcová and Rain 2011, Rowley 2007, Truneček 2004)

### **3.2.2 Knowledge & Wisdom**

Knowledge and Wisdom are terms placed on top of the hypothetical pyramid of Knowledge Management depicted in Figure 7. Similarly to data and information, neither the knowledge nor wisdom have a specific definition.

According to Rowley (2007, p. 172) *“Knowledge builds on information that is extracted from data.”* This statement only describes the hierarchy in pyramid but nothing more.

Truneček (2004, p. 13) knowledge describes as *„schopnost využít své vzdělání, zkušenosti, hodnoty a odbornost jako rámec pro vyhodnocení dat, informací a jiných zkušeností k výběru odpovědi na danou situaci“* (“the ability to use one's education, experience, values and expertise as a framework for evaluating data, information and other experiences to select a response to a given situation” (own translation).

Knowledge is always subjective based on one's information and previous experience. It is a way people organise information into pattern understandable by themselves and others. (Rowley 2007, Truneček 2004)

Knowledge can be divided into three basic categories according to its nature (Rowley 2007, Truneček 2004):

- Explicit – formalizable, recordable and representable with data.

- Implicit – individual based on previous experience, hard to communicate.
- Tacit – based on subconscious and intuition, unable to formalize.

**Wisdom** is in some definitions neglected. According to Rowley (2007, p. 174), it can be described as accumulated knowledge that enables to understand the application of knowledge from one discipline or field to new situations, to anticipate and act critically or practically depending on the individual's ethical judgment and convictions.

### 3.3 Logistics Information Systems

Managing of information flows, and of course material and other flows in logistic systems nowadays is not possible without efficient information system. In order for the organisation to effectively manage them, it is absolutely necessary to implement a logistics information system, whose functions adequately correspond to the requirements of the organisation. The task of the logistics information system is to provide accurate information about all costs that arise in connection with the processes taking place in the logistics chain. (Longshore and Cheatham 2022, Gros et al. 2016, Zimová 2015)

Zimová (2015) presents four individual systems together creating a logistical information system. These systems are **Material**, **Managing**, **Informational** and **Communicational**.

According to Zimová (2015), **material system** ensures and is responsible for raw material preparation before production processes and its transference between individual production processes up to finished production and departure from production. **Managing system** consists of planning, organizing, coordinating, transference of information, decision making and controlling of all of the logistics processes in the organization. **Information system** consists of data collection, analysis, evaluation, controlling of the information and its transference to responsible recipients in the organization in specific time and form. **Communication system** ensures communication between the organization and external subjects and stakeholders like suppliers or customers.

Gros et al. (2016) presents a cumulative but simplified logistics information system consisting of several subsystems each responsible for individual logistics activity. The system can be seen in the Figure 8: Logistics Information System below. Such a system can be modified for individual purposes of individual organisations engaged in fifth-party logistics (see chapter 1.4.1 1PL, 2PL, 3PL, 4PL and 5PL) or those organisations dealing with all of the logistics activities on their own.

Comparing the both presented systems it is possible to notice key similarities between the systems presented by Zimová (2015) and Gros et al. (2016). **Subsystem of Orders Processing** ensures communication between the organisation and a customer and it can be compared to the Communicational system presented by Zimová (2015). Activities of the subsystem can be seen in the Figure 8: Logistics Information System below. This subsystem requires adequate quality and velocity of processes as it needs to process the orders in cooperation with the **Supply Management Subsystem**. That is responsible not only for evidence of the inventory in the exact place, time, quantity and structure and to carry out a regular inventory, but also for completion of production requirements based on customer orders or forecasted demand according to **Subsystem of Demand Forecast**. According to Zimová (2015), demand forecasting is one of the basic skills an organisation should have. Forecasts are created by organisations primarily based on analysis of the past, experience, market developments and customer requirements. Gros et al. (2016, p. 391) these demand forecasts describe as „*systematický postup vedoucí k odhadu velikosti poptávky na zvolené období opírající se o využití intuitivních, metodických, matematických a statistických metod,*“ (“*a systematic procedure leading to the estimation of the size of demand for the selected period of time based on the usage of intuitive, methodical, mathematical and statistical methods*”) (*own translation*).

**Subsystem of Logistics Planning**, which is responsible for complex logistics plan for whole organization and its supply chain, is the most important in terms of strategical management of an organization. Its purpose is to fulfil the strategic goals of the organisation in accordance with the customers' demands. It should be stable providing a constant environment for efficient management and dynamic for internal and external conditions. All of the partial plans of the complex logistics plan can be seen in the Figure 8: Logistics Information System below and are

summarized in the Table 5: Partial Plans of Complex Logistics Planning. The plan considers received and approved customers' orders and forecasted demand as well as inventory status and capacities. Production plan directly controls **Subsystem of Production Management**, as well as supply plan which further affects the **Subsystem of Supply**. (Gros et al. 2016, Zimová 2015)

Table 5: Partial Plans of Complex Logistics Planning

Step	Input Information	Output Information	Outcome
1	<ul style="list-style-type: none"> <li>Accepted orders, forecasted orders</li> </ul>	<ul style="list-style-type: none"> <li>How many? Where? When? Which quality?</li> </ul>	<ul style="list-style-type: none"> <li>Distribution Requirements Plan (Distribution Plan)</li> </ul>
2	<ul style="list-style-type: none"> <li>Product inventory status in the supply system</li> </ul>	<ul style="list-style-type: none"> <li>How many? Where? When? Which quality?</li> </ul>	<ul style="list-style-type: none"> <li>Master Production Plan (Production Plan)</li> </ul>
3	<ul style="list-style-type: none"> <li>Consumption standards, technological regulations, workflow, work-in-process inventory status</li> </ul>	<ul style="list-style-type: none"> <li>How many? Where? When? Which quality? What to buy?</li> </ul>	<ul style="list-style-type: none"> <li>Master Requirements Plan (Supply Plan)</li> </ul>
4	<ul style="list-style-type: none"> <li>Performance standards, order fulfilments dates, repair plans</li> </ul>	<ul style="list-style-type: none"> <li>When? Where? How many? In which order?</li> </ul>	<ul style="list-style-type: none"> <li>Capacity Requirements Plan (Capacity Plan)</li> </ul>

Source: own representation according to Gros et al. (2016, p. 409)

Fundamental activities of every business organisation can be seen in the bottom part of the diagram in the Figure 8: Logistics Information System. These activities without the other subsystems can be presented as a first-party or second-party logistics (see chapter 1.4.1 1PL, 2PL, 3PL, 4PL and 5PL) and does not require any complex planning.

### 3.3.1 Big Data

Usage of appropriate system can provide logisticians an innumerable amount of data which can be used to make operational and even strategic decisions. As Longshore and Cheatham (2022) state, contemporary hardware and software allow logisticians to access a large amount of data collected through a variety of sources such as sensors, smartphones, RF tags and real-life data streams from operating systems. This is the phenomenon of 21<sup>st</sup> century called *Big Data*.

*Big Data* can be defined as datasets whose size or type exceeds the ability of traditional relational databases to capture, manage and process the data. Characteristics of Big Data include high volume, high velocity and high variety.

*Big Data* can be distilled into understandable information using the method called *Data Analytics*. Using this technology can provide organization with more accurate decision-making and predictions. According to Longshore and Cheatham (2022), in logistics and transportation enterprises, *Big Data* is already used for vehicle routing and scheduling. The authors provide as an example of how the analytics of *Big Data* improve a logistics process ORION (On-road Integrated Optimization and Navigation) which allows drivers to determine optimal routing.

With the advent of the Internet of Things, which means that even more devices are connected to the internet, gathering data on customer usage patterns and product performance become significantly easier and more accessible.

As literature implies, the methods of collecting *big data* have come far, but the ways of processing are rather at the beginning and mastering software solutions such as business intelligence, machine learning and algorithms can become a competitive advantage in a near future.

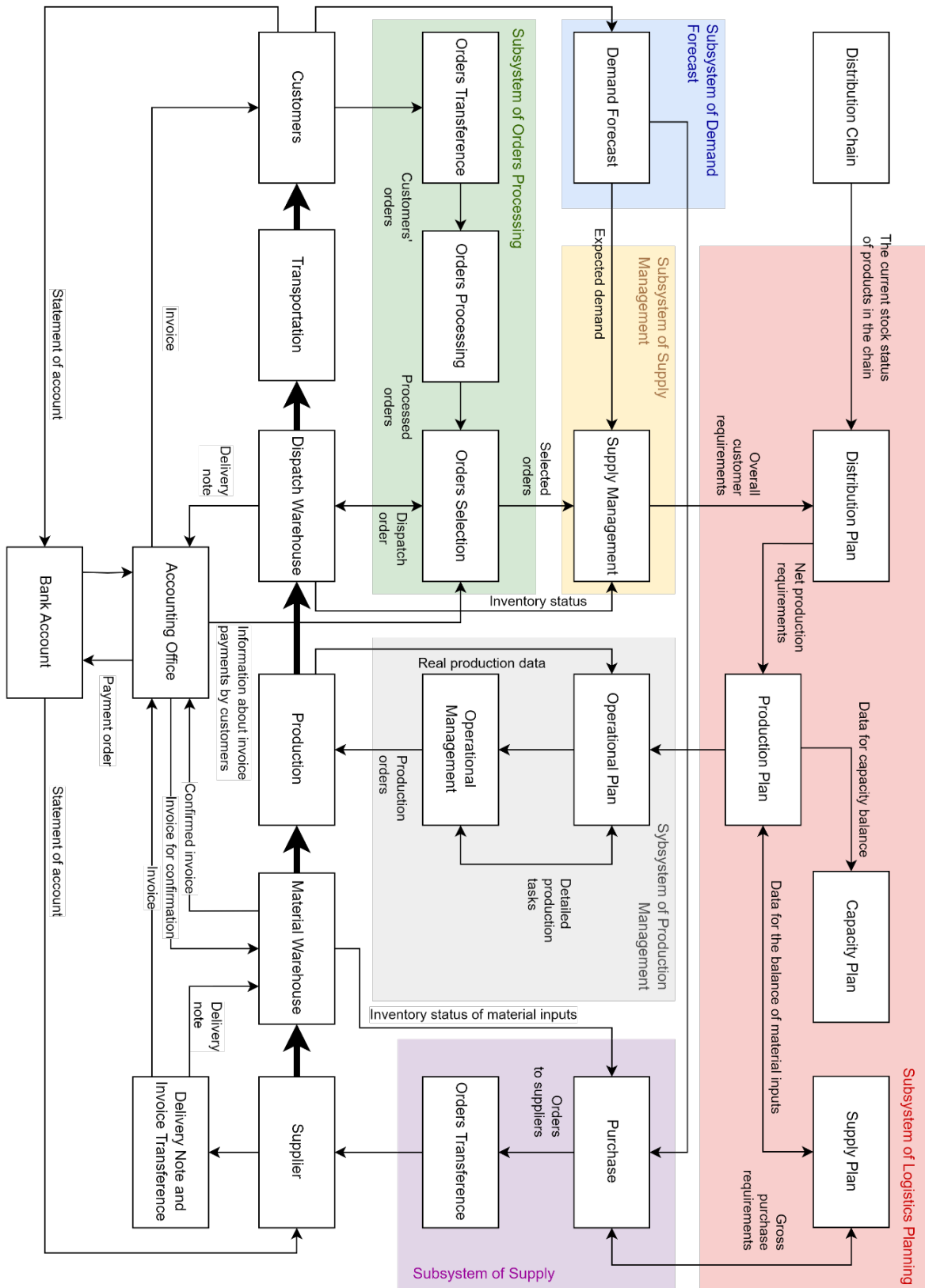


Figure 8: Logistics Information System

Source: own representation according to Gros et al. (2016, p. 390)



## 4. Processes in Selected Enterprises

Following the main objective of the thesis, two small enterprises operating in the same field of business were selected for analysis. Both of the companies have the same owner and chief executive officer, but both are operating in the different member states of European Union – Czech Republic and Romania. However, they are sister enterprises and both cooperate closely together.

In order to optimize information processes taking place within and between these enterprises, an initial analysis of information flows was performed. The analysis was carried out as a series of observations and structured interviews with the owner and chief executive officer, as well as dispatcher of EURIKA s. r. o. The analysis focused on the mapping of information flows in both of the companies as well as between them and on the mapping of the IT systems and technologies used by the companies.

Based on the analysis, diagrams of the information flows taking place in both of the enterprises were created and are listed below in the chapters related to the individual companies. The analysis also focused on the cooperation between the enterprises and based on the findings, a collaboration process diagram was designed as well.

### 4.1 EURIKA s. r. o.

The EURIKA s. r. o. (the English equivalent is Ltd.) is a small road transportation enterprise based in Frýdlant v Čechách in Czech Republic. The enterprise has been established in 1995 and since 2000 is engaged in the current filed of business. The Enterprise shareholders are husband and wife Ioan Paşcan and Dana Paşcan. Ioan Paşcan is as well chief executive officer of EURIKA s. r. o.

Company currently operates four Tautliner trucks with capacity of 90 cubic metres and/or maximum load weight capacity of 24,5 tons (see chapter [2.2.3 Types of Road Transportation Vehicles](#)). They are capable of transporting up to 33 Euro-pallets.

The semi-trailer length is 13,60 metres, width is 2,45 metres and height is 2,70 metres.

There are two basic and standardized types of pallets used in freight transport. Euro-pallet mentioned above has been standardized in 1961 by International Union of Railways in order to achieve easier manipulation and transportation within the Europe. They are adapted for better manipulation with forklifts. Its load capacity is approximately 1 ton. The dimensions are 1 200 mm x 800 mm and load should not exceed height of 160 mm. But that parameter depends on the weight of the load. Other commonly used pallets are ISO pallets with dimensions of 1 200 mm x 1 000 mm. (Gros et al. 2016)

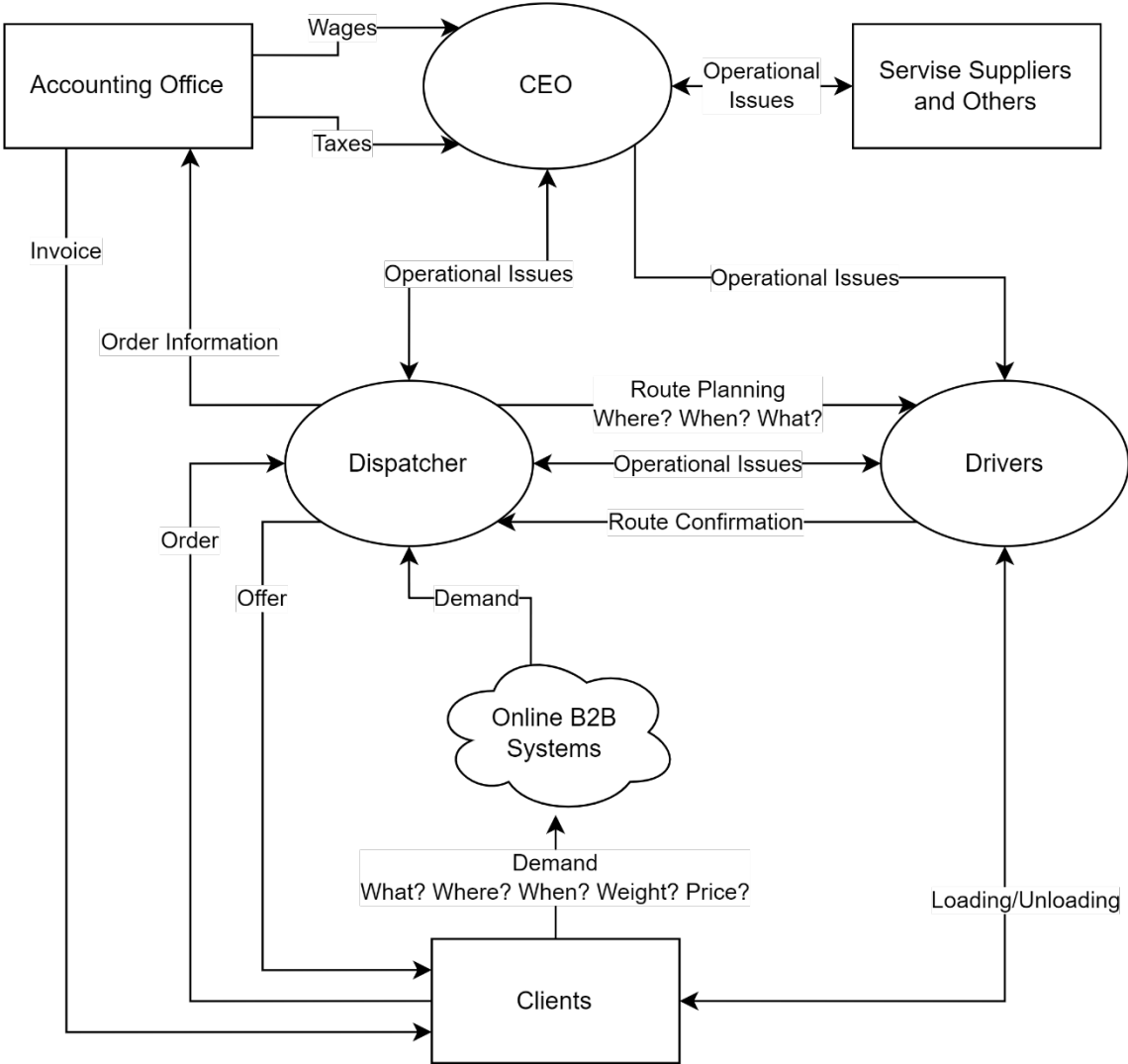


Figure 9: Information Flow Diagram of EURIKA s. r. o.  
Source: own representation

#### **4.1.1 Freight Transportation Business of EURIKA s. r. o.**

The company focuses on freight transportation mostly between Czech Republic and Romania. There are several reasons for that decision. The major reason is the market saturation of logistic services and freight transportation providers in the western Europe. According to chief executive officer most of the customers, often based in Germany or France, are demanding services for Just-In-Time deliveries, which requires precise route and time management. Non-fulfilment of those conditions results in enormous contractual penalty which are for a small enterprise as EURIKA s. r. o. devastating and also such a small enterprise is not capable of providing this type of service, for example, in case of complications with a truck.

Taking into account the reasons above and fact that chief executive officer is native Romanian, which provides a competitive advantage, the focus on the market segment is proper.

EURIKA s. r. o. also does not provide freight transportation marked as ADR, which means Carriage of Dangerous Goods, according by *Agreement concerning the International Carriage of Dangerous Goods by Road* done at Geneva on 30<sup>th</sup> of September 1957 under the auspices of the United Nations Economic Commission for Europe.

The company has a few regular clients for whom provides freight transportation services on regular basis. However, most of the contracts comes from online B2B servers specializing in freight transportation exchanges. These systems are more described in chapter 4.4 Information Systems Used in Enterprises.

EURIKA s. r. o. can be, according to chapter 1.4.1 1PL, 2PL, 3PL, 4PL and 5PL, characterized as second-party B2B logistic provider focusing only on transportation without any other logistics services.

#### **Business Principles of EURIKA s. r. o.**

As is illustrated in the Figure 9: Information Flow Diagram of EURIKA s. r. o., the company uses B2B systems in order to search for demands and collect orders

from customers, apart from the regular clients. These clients contact the dispatcher directly. Those B2B systems which are used by dispatcher in EURIKA s. r. o. for freight exchange are RAALTRANS and TIMOCOM. These systems are described in detail below in chapter 4.4 Information Systems Used in Enterprises. The dispatcher is in charge of route management of vehicles as well as negotiation of orders. According to the already planned routes, the dispatcher searches for further potential orders of freight to be delivered from the nearest of the place of last unloading. After outlining certain options, based on proximity to position, due date of delivery, weight of the load and other criteria, potential clients are contacted with offer by the dispatcher.

When negotiations are completed and most cost-effective order is approved, dispatcher plans a new route for the driver and sends him information about location and time of loading, what will be loaded, destination of the load and contact for responsible personnel of the client. This process is done for every vehicle and driver.

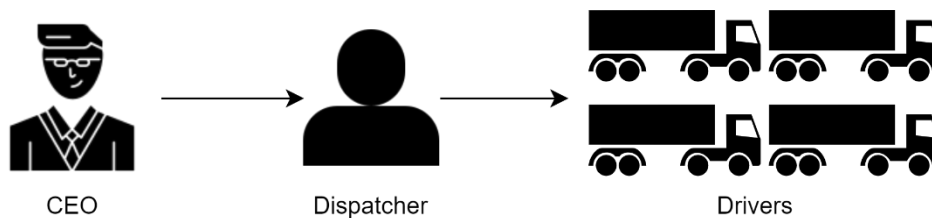
In case of any inconvenience with handling an already approved order, when it is not possible to secure a vehicle for any reason, dispatcher contacts a dispatcher of MANINA SRL. Cooperation between the enterprises in this regard consist of forwarding the order to the sister company. Further details of the processes are described below in chapter 4.3 Cooperation of the Enterprises. Accounting and Legal details of the transaction are further handled by accountant office of EURIKA s. r. o. and chief administration officer in MANINA SRL.

#### **4.1.2 Employees of EURIKA s. r. o.**

EURIKA s. r. o. currently employs five employees. Four of them are drivers of the trucks and one is dispatcher in the office. The owner and chief executive officer is not involved in operational business on daily basis and manages other strategical decisions, communication with state institutions, service of the vehicles or possibly other important operational issues.

Dispatcher is in particular responsible for sourcing orders using information systems described in the chapter 4.4 Information Systems Used in Enterprises below or based

on direct requests from potential clients and pricing. After that, in accordance with the demand of transportation services, dispatcher is responsible for coordination and communication with the drivers as well as the route planning. Employee who is in charge of the dispatcher position does not speak any language except Czech. That causes issues in communication especially with the sister company or its drivers who speak Romanian. They use online translators to communicate, which is not ideal and delays communication. Most of the clients speak Czech, so communication with them is smooth. Otherwise, the translator is used again. In case of any inconveniences in terms of communication and language barrier, chief executive officer intervenes and address the necessities.



*Figure 10: Hierarchy of EURIKA s. r. o. (horizontal view)*  
 Source: own representation

#### **4.1.3 Other Operations of EURIKA s. r. o.**

Small enterprises, due to their size and number of employees, usually do not have a personnel department, and EURIKA s. r. o. is not an exception. The chief executive officer takes care of all the HR agenda. The HR agenda in this company mainly includes rewarding employees, recruiting new employees, mostly drivers, and in case of illness or other unplanned complications covering the workload of the dispatcher.

The company uses the services of an external accounting office, which manages both the accounting agenda and the payroll agenda as well as invoicing and payments from the clients. There is no economic officer in EURIKA s. r. o. who is in charge of that agenda. Dispatcher regularly submits approved orders from the clients to the external accounting office and their further responsibility is to manage invoices for clients and monitor their payments. Due date of the invoice is usually 60 days, but it is not same for every client and is also negotiated. In return, chief executive

officer receives an information about wages payments and other taxes and legal necessities to be paid.

Communication within the company, that means mostly between the dispatcher and drivers, is held by mobile phones or communication applications for smartphones like WhatsApp. The communication between the enterprises is held also by this flow and e-mail. Communication with clients is initiated mostly by phone in the first place, after that it is continued by e-mail. As mentioned below in chapter 4.4 Information Systems Used in Enterprises, companies do not use any information systems that would function as a communication platform. Using these publicly available communication tools is therefore efficient with no additional costs.

## **4.2 MANINA SRL**

The MANINA SRL (the English equivalent is Ltd.) is a small road transportation enterprise based in Sighetu Marmaciei in Romania. The company has been estimated in year 1993. Its shareholder and chief executive officer is also Ioan Pașcan. It is sister company of EURIKA s. r. o.

Company currently operates two Mega trailer trucks with capacity of 100 cubic metres and/or maximum load weight capacity of 24 tons. The difference between Tautliner trucks owned by EURIKA s. r. o. is in the height of the semi-trailer, which is higher by 30 centimetres, which however cost 0,5 ton of its weight capacity. Other properties of the semi-trailers are same with accordance with European legislation. They are capable of transporting up to 33 Euro pallets too. The semi-truck length is 13,60 metres, width is 2,45 metres and the height is 3,00 metres. More details about types of vehicles are in chapter 2.2.3 Types of Road Transportation Vehicles.

The enterprise owns another three Tautliner trucks with capacity of 90 cubic metres and/or maximum load weight capacity of 24,5 tons, same as EURIKA s. r. o. operates. Company currently struggles with shortage of employees, drivers specifically, therefore only two of the trucks currently operate.

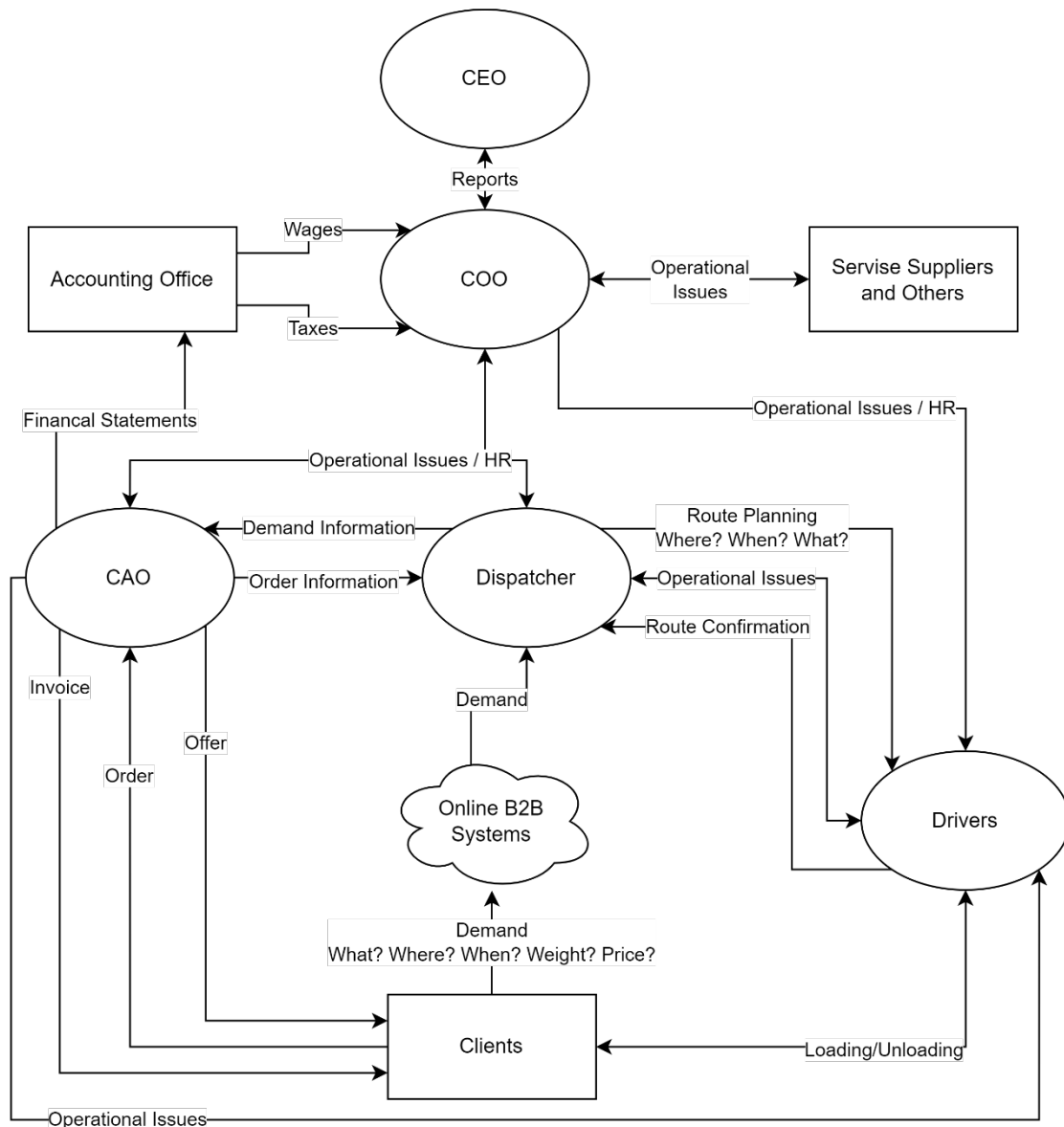


Figure 11: Information Flow Diagram of MANINA SRL  
 Source: own representation

#### 4.2.1 Freight Transportation Business of MANINA SRL

The company currently focuses on freight transportation mostly between Czech Republic and Romania as well as EURIKA s. r. o. Its former field of business focused predominantly on domestic freight transportation in Romania. With the arrival of the sister company EURIKA s. r. o. the focus gradually transformed into international freight transportation.

As well as EURIKA s. r. o., MANINA SRL does not provide Just-In-Time deliveries, which requires precise route and time management. The company also does not provide freight transportation marked as ADR, which means Carriage of Dangerous Goods, as also briefly described above in chapter [4.1.1 Freight Transportation Business of EURIKA s. r. o.](#)

The company currently does not have any regular clients for whom provides freight transportation services. MANINA SRL, like EURIKA s. r. o. most of the contracts secures online from B2B platforms specializing in freight transportation exchanges. The company uses the same online B2B portals as its sister company – RAALTRANS and TIMOCOM. These systems are more described in chapter [4.4 Information Systems Used in Enterprises](#). MANINA SRL unlike EURIKA s. r. o. also uses another online B2B portal for freight exchange called BursaTransport. This system is also more described in the chapter below.

MANINA SRL, according to chapter [1.4.1 1PL, 2PL, 3PL, 4PL and 5PL](#), can be also characterized as second-party B2B logistic provider focusing only on freight road transportation without any other logistics services.

### **Principle of Business of MANINA SRL**

As is illustrated in the [Figure 11: Information Flow Diagram of MANINA SRL](#), processes slightly differ from those in EURIKA s. r. o. The company also uses B2B systems in order to search for freight exchange demands and collect orders from customers. Those B2B systems are RAALTRANS, TIMOCOM but also BursaTransport, which is not used in EURIKA s. r. o. These systems are detailly described below in chapter [4.4 Information Systems Used in Enterprises](#).

Dispatcher's responsibilities and workload, along with other employees', are described in detail below in chapter [4.2.2 Employees of MANINA SRL](#). In contrast to EURIKA s. r. o., dispatcher is not responsible for contacting and negotiating with the potential clients after certain demands are identified via the B2B portals. After CAO completed and approved order, dispatcher plans a new route for driver as in sister enterprise.



Another dispatcher's responsibility in MANINA SRL is to deal with forwarded orders from EURIKA s. r. o. , as mentioned above in 4.1.1 Freight Transportation Business of EURIKA s. r. o. This process is further described below in chapter 4.3 Cooperation of the Enterprises.

#### **4.2.2 Employees of MANINA SRL**

MANINA SRL currently employs five employees too, but with different distribution of the positions. As mentioned above, the company operates only two vehicles, that means two of the employees are drivers of the trucks and three are responsible for running the company at administrative level.

The owner and chief executive officer is not based in Romania, therefore he is not involved in operational business at all. He manages strategical decisions on remote, but for operational issues, communication with state institutions, service of the vehicles or other operational issues is responsible chief operating officer acting by the CEO's power of attorney.

Chief operating officer is responsible for running the company on daily basis. Her responsibilities include communication with state institutions, communication with service providers and other suppliers of the company. She is responsible for meeting legal requirements and payment of taxes and other fees. HR agenda, wages and rewarding of employees is also responsibility of chief operating officer, instead of chief executive officer as is in case of EURIKA s. r. o. External accounting office, which is more described below in chapter 4.2.3 Other Operations of MANINA SRL, is also in direct contact with COO. For CEO, chief operating officer prepares reports about enterprise status, achieving of goals whether strategic, profit, earnings and costs, or others. Chief operating officer speaks fluently Romanian, English and Hungarian. This gives the company a competitive advantage, especially when any unexpected inconvenience occurs when transiting thru Hungary (most routes are Czech – Slovakia – Hungary – Romania).

Chief administration officer is in the company responsible for administrative tasks of the business. After the CAO receives a selected demand from the dispatcher, who selected it from the systems (this process is described in the paragraph below),

chief administration officer initiates a communication with the potential client. She is responsible for negotiation of terms and prices of the service. When negotiations are successful and clients sends an order, she is further responsible for invoicing and sending invoice to the client. Information of the negotiated order, chief administration officer transfers to the dispatcher. Financial statements related to the orders are then sent to the external accounting office for another processing. In exceptional circumstances, chief administrative officer can directly contact company drivers in order to solve any operational inconveniences, but this is predominantly a dispatcher's agenda.

Dispatcher's responsibility in MANINA SRL is to search for corresponding freight transportation demands in the online B2B systems used in company (see chapter 4.4 Information Systems Used in Enterprises) according to the schedule of routes and its plans. Selected demands are further transferred to chief administration officer for further negotiations (as mentioned in the paragraph above). After that dispatcher receives from CAO an information about negotiated and approved order for further route planning. Dispatcher is responsible for communication with drivers, delivering a route plan for them and dealing with operational issues with regard to the physical transportation with drivers as well as clients if necessary or if any inconvenience occurs.

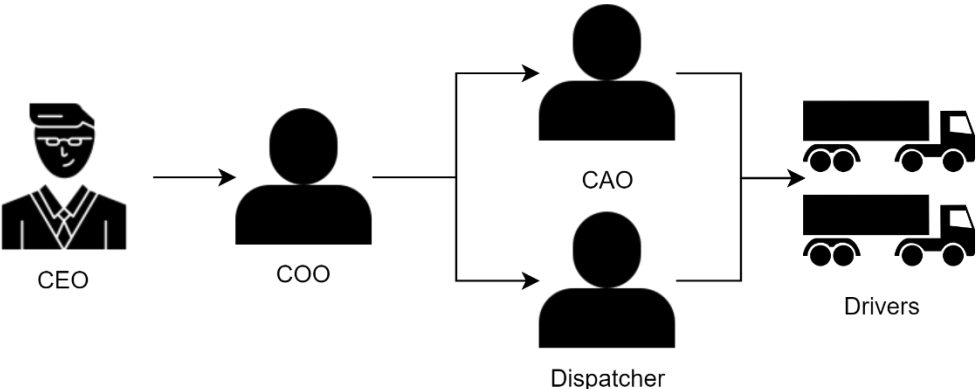


Figure 12: Hierarchy of MANINA SRL (horizontal view)  
 Source: own representation

The chief administration officer as well as the dispatcher are directly subordinated to the chief operating officer. CAO and the dispatcher are both on the same level in the hierarchy of the company as can be seen in the Figure 13: Hierarchy of MANINA SRL (horizontal view) below. Drivers are subordinate to the dispatcher, but chief

administration officer also does have the authority to deal with drivers, as well as chief executive officer has.

### **4.2.3 Other Operations of MANINA SRL**

As mentioned above, the company uses services of an external accounting office. Unlike the same process in EURIKA s. r. o., external accounting office in MANINA SRL does not have such a competence and its scope of work is limited. External accounting office is responsible only for accounting agenda, the payroll agenda and maintenance of financial statements, taxes and other legal necessities according to those financial reports delivered by chief administration officer. The office reports directly to the chief operating officer who is further responsible for payment of those transactions.

Communication within the company is same as is in EURIKA s. r. o., that means mostly is held by mobile phones or communication applications for smartphones like WhatsApp. Between the sister enterprises the communication is held also by these flows or using e-mail, mostly when sending any documents. Communication with potential clients based on the demands selected by dispatcher, as mentioned above, is initiated by phone and follow-up documents and invoices are send via e-mail. Using these publicly available communication tools is efficient and with no additional costs, in accordance that companies do not operate any information systems ensuring own communication platform, as is described in chapter 4.4 Information Systems Used in Enterprises below.

## **4.3 Cooperation of the Enterprises**

As mentioned above in 4.2.1 Freight Transportation Business of MANINA SRL, core of the cooperation between the sister enterprises lies in forwarding orders to each another. Mostly from EURIKA s. r. o. to MANINA SRL, because the Romanian company consist of more administrative workers and, when not dealing with shortage of drivers, also operates more vehicles.

It is a dispatcher's responsibility in MANINA SRL to deal with forwarded orders from EURIKA s. r. o. In case of such order, dispatcher attempts to adjust schedule of already planned routes or plans a new route when any vehicle is free.

In case of that MANINA SRL is not capable of handling the order on its own, operator is responsible for outsourcing of the order by another provider. He either directly contacts another freight transportation provider, with whom the company already cooperated, or he uploads the order on another freight exchange server, mostly BursaTransport, for other providers. Further communications and other legal necessities are then a responsibility of CAO according to her workload as described above in 4.2.2 Employees of MANINA SRL. The process is illustrated in the process diagram in Figure 13: Process Diagram of Order Forwarding below.

Forwarding of the orders works nearly the same way even from MANINA SRL to EURIKA s. r. o., with minor differences. If the dispatcher of EURIKA s. r. o. is not capable of adjusting a route plan and fulfil the order, it is send back to MANINA SRL for either direct contacting of another provider or uploading the order on another freight exchange server.

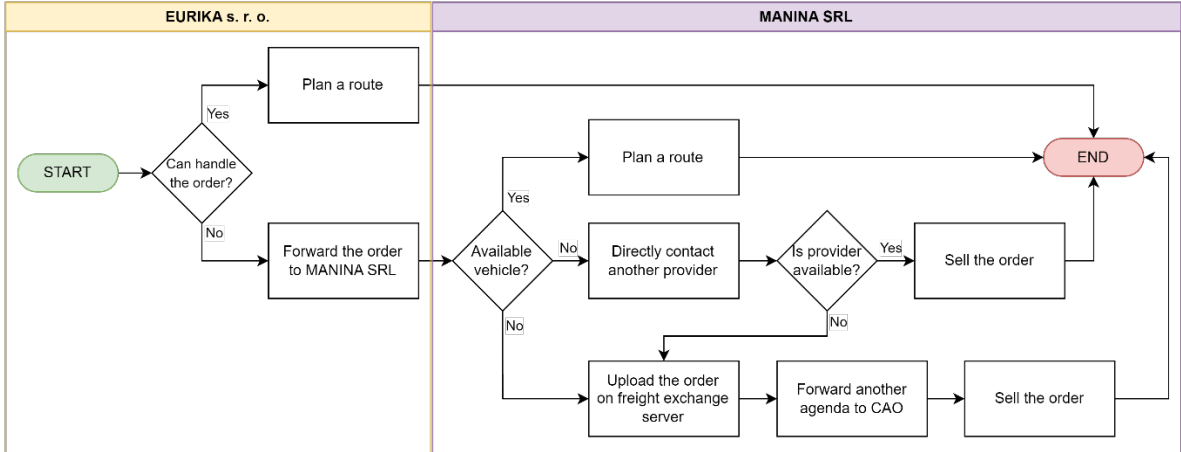


Figure 13: Process Diagram of Order Forwarding  
Source: own representation

## **4.4 Information Systems Used in Enterprises**

Due to the size of the sister enterprises and the nature of their business, the enterprises do not use a single information system that integrates all information flows into a single interface. Moreover, no existing information systems designed for freight forwarders were identified during the literature research. It is only possible to identify individual systems that are used either for order collection, freight exchange, tracking truck movements or various economic software for accounting, asset management, etc.

Therefore, as mentioned above, EURIKA s. r. o., as well as MANINA SRL use as a communication platforms publicly available platforms like WhatsApp, e-mail or mobile phones since these technologies being the most common and widely used services among everyone, whether economical subjects, public authorities, drivers or private individuals.

### **4.4.1 RAALTRANS**

RAALTRANS is a software ensuring communication between freight transportation providers and manufactures demanding those services. It is a databank of loads and free vehicles. The software originated in Czech Republic and is used across the Europe, however it is not the only software of such kind. EURIKA s. r. o. as well as MANINA SRL are using also other software which will be described below.

The software offers two elementary functions. In the first function user can place an actual offer of load which needs to be transported or place an offer of a free vehicle available for transportation of load. The second function is searching the offers of other users. These two elementary functions are complemented by many other possibilities for effective searching and making offers.

#### **Licences**

The software is available in several licences depending on the customer which licence suit him the best. The licences, software's description and price range is summarized below in Table 6: Overview of RAALTRANS Software Licences. The amount displayed

in euros is illustrative according to the exchange rate 1 EUR = 24 CZK. However, the English adaptation of the software offers only the highest available licence. It can be caused by the fact that English speaking freight transportation subjects would not operate within Czech or Slovak Republic, but still this fact is striking to say the least.

*Table 6: Overview of RAALTRANS Software Licences*

Licence	Description of the licence	Price of elementary software	Odometer module	Monthly fee for database services
Vnitro CZ	The <i>Vnitro CZ</i> version includes offers starting and ending in the Czech Republic.	7.000, - CZK (292 EUR)	1.000, - CZK (42 EUR)	600, - CZK (25 EUR)
Československo	The <i>Czechoslovakia</i> version combines <i>Vnitro CZ</i> and <i>Vnitro SK</i> including movement between the Czech Republic and Slovakia	8.000, - CZK (333 EUR)	1.000, - CZK (42 EUR)	700, - CZK (30 EUR)
Euro	The <i>Euro</i> version allows to enter and view international offers outside of offers starting and ending in the Czech Republic or Slovakia	12.000, - CZK (500 EUR)	2.000, - CZK (84 EUR)	1.000, - CZK (42 EUR)
Global	The <i>Global</i> version allows to enter and view all domestic and international offers	12.000, - CZK (500 EUR)	2.000, - CZK (84 EUR)	1.000, - CZK (42 EUR)

Source: own representation according to [RAALTRANS \(2023\)](#)

EURIKA s. r. o. as well as MANINA SRL use RAALTRANS under the Euro licence, because of their focus on freight transportation between Romania and Czech Republic which is mentioned above. Module Odometer is also briefly described below although none of the selected enterprises uses it. Monthly fee for RAALTRANS database is obligatory.

### Registered Users

Users who purchased the software and pay monthly fees are registered to the database under special code which RAALTRANS provides them. Those users provide information about their company like address, contact information, registration details, and others (see [Figure 14: Sample Detail of a User of RAALTRANS](#) below). Users also have an option to rate others according to their experiences, but only for their own information, this rating is not visible to others. In case of any inconveniences with any user, for example user is non-payer, RAALTRANS

bans him out of the database. RAALTRANS states, that the software is used by up to ten thousand users.

Uživatelský kód: 001		
<b>Identifikace</b>		
<b>Adresa registrace:</b>	<b>IČ:</b>	44416903
Radek Žilka	<b>DIČ:</b>	CZ6604280452
Předměřická 192	<b>Vznik firmy:</b>	17.09.1992
50301 Hradec Králové, CZ	<b>V RAALTRANSu od:</b>	17.09.1992
<b>Adresa v databance RAALTRANS:</b>		
RAALTRANS		
Předměřická 192, 50301 Hradec Králové		
<b>Kontakty</b>		
<b>Předvolba (stát, město):</b>	420 (CZ)	<b>Telefon:</b> 495 217 481-2
<b>Mobil:</b>	604 105 758, 777 848 843	<b>Fax:</b> 495 217 481
<b>Skype ID:</b>	raaltrans01	<b>ICQ:</b> 363880075
<b>Web:</b>	www.raal.cz	
<b>E-mail:</b>	info@raal.cz	
<b>Dispečer vyřizující nabídku:</b>		
<b>Ostatní informace</b>		
<b>Jazyky:</b>	CZ,GB,D,PL	<b>Specializace na státy:</b>
<b>Vlastní auta:</b>	NE	<b>Pojištění nákladu:</b>
<b>Poznámka:</b>	info@raal.cz, 604 105 758, 777 848 843, tech.podpora od 17 do 18.hod. 721 762 924	
<b>Uživatelská poznámka:</b>		
provozovatel	<b>Uživatelská klasifikace firmy:</b>	1 <input type="checkbox"/>

Figure 14: Sample Detail of a User of RAALTRANS

Source: RAALTRANS (2023)

### Submitting an Offer

The first elementary function mentioned above is submitting an offer of transportation or vehicle available. User inputs into the system information of the departing place and place of destination, dates of realisation of the transportation, which type of vehicle (see chapter 2.2.3 Types of Road Transportation Vehicles) is necessary and especially weight of the load. Input form for submitting an offer can be seen below.

Other details are optional. User can provide information about number of pallets, width and height in metres and loading surface of the load in square metres, alternatively volume in cubic metres. Other important yet optional information are if the load is marked as ADR (Carriage of Dangerous Goods) or if the load needs

another special treatment. Price is commonly not filled in the form and is negotiated with a specific provider. Most users fill the telephone number instead of price.

Figure 15: Sample Input Form for Submitting an Offer  
Source: RAALTRANS (2023)

EURIKA s. r. o. as well as MANINA SRL do not place offers as described above. Dispatchers of both companies search between offers entered by other users of the system database and subsequently negotiate the contracts with the provider of the manufacturer.

## Database of Offers

Interface of the database of offers can be seen in [Figure 16: Sample View of the Offers Entered by Other Users](#) below. The main part of it consists of table with details of each of the offer. From left to right the table contains information of code 64



of the country, postcode of the town and town of the departure followed by the country code, postcode and name of the town of the arrival. Next columns *N, S, J* stands for *semi-trailer, trailer with additive trailer* or *other*. Information about length and weight of the load can be found next as well as information about demanded type of vehicle (see chapter 2.2.3 Types of Road Transportation Vehicles).

Other optional information is about ADR, volume in cubic metres or number of pallets precede information of the date when the transportation has to be completed. As mentioned above, following column with price is often empty or filled with telephone number of the potential client who can provide the offer with note in another column followed by his personal code, which is provided to him by RAALTRANS on registration. Last visible information on the figure below is time stamp when the offer has been placed.

MPZ	PSČ	Odkud	MPZ	PSČ	Kam	N	S	J	L [m]	M [t]	Druh	ADR	V [m3]	P [ks]	Datum	Cena	Poznámka	Kód	Přijato
A	1000	Wien	CZ	10000	Praha	N			13.60	24.00	Frigo				11.6			472	10.06.2013 16:13
A	1000	Wien	CZ	10000	Praha	N	S		6.00	1.50	Frigo				13	11.6	13p/1.4t	472	10.06.2013 16:13
A	1000	Wien	CZ	10000	Praha			J		2.50	Plachta				16	13.6	16pal, 2.5t	N11	11.06.2013 09:41
A	1000	Wien	CZ	25701	Buchov	N			13.60	24.00	Plachta				11.6	DOHODA	13.6	3L8	10.06.2013 11:23
A	1000	Wien	CZ	25763	Trhový Štěpánov	N			13.60	24.00	Plachta				11.6			13U	11.06.2013 08:06
A	1000	Wien	CZ	27201	Kladno	N	S		13.60	22.00	Plachta				11.6	Dohodou		230	11.06.2013 09:26
A	1000	Wien	CZ	30100	Píseň	N	S		13.60	22.00	Plachta				11.6	Dohodou		230	11.06.2013 10:18
A	1000	Wien	CZ	33501	Nepomuk			J	3.00	7.10	Plachta	ADR			11.6	773085625		2Y0	11.06.2013 08:50
A	1000	Wien	CZ	33501	Nepomuk	N	S		3.00	7.10	Plachta	ADR			11.6	530331361		82<	11.06.2013 09:37
A	1000	Wien	CZ	40001	Ústí nad Labem	N	S		13.60	22.00	Plachta				11.6	Dohodou		230	11.06.2013 10:18
A	1000	Wien	CZ	51721	Týniště nad			J	2.00	0.50	Plachta				12-14.6	277002014	Zldm, 0.5t	918	11.06.2013 08:36
A	1000	Wien	CZ	53000	Pardubice				13.60	24.00	Walkingfloor				12-14.6	739307486		6LS	11.06.2013 08:26
A	1000	Wien	CZ	60000	Brno	N			13.60	24.00	Plachta				11.6	dohoda	13.6	3L8	11.06.2013 08:14
A	1000	Wien	CZ	60000	Brno	N			13.60	24.00	Plachta				12.6	dohoda	13.6	3L8	11.06.2013 08:14
A	1000	Wien	CZ	60000	Brno	N			13.60	24.00	Plachta				13.6	dohoda	13.6	3L8	11.06.2013 08:14
A	1000	Wien	CZ	68764	Slavkov	N	S		3.00	0.15	Plachta				20.6	918414184		52i	11.06.2013 09:37
A	1000	Wien	CZ	76001	Zlín	N			13.60	22.00	Plachta				12.6			Ax0	11.06.2013 08:48
A	1000	Wien	CZ	76833	Morkovice-S	N	S		13.60	24.00	Plachta				11-12.6	775952642	N/S13.6m24t	S96	11.06.2013 10:25
A	1000	Wien	CZ	77200	Olomouc				13.60	22.00	Plachta				18.6			7BT	10.06.2013 18:30
A	1000	Wien	D	01445	Radebeul	N			13.60	24.00	Plachta				11.6			9PC	10.06.2013 16:18
A	1000	Wien	D	06110	Halle		S		15.40	15.00	Plachta				120.00	12.6	235091921	0T8	11.06.2013 09:26

Summary section:

Odkud: A.1000/Wien      Kam: CZ.77200/Olomouc      N, S, J:      Délka [m]: 13.60      Výška [t]: 22.00      Druh: Plachta      ADR: Ne      Objem [m3]:      Palety [ks]:  
Datum od: 18.06.00:00      Datum do: 18.06.23:59      Cena:      Poznámka:      Šířka [m]:      Výška [m]:      Lož. plocha [m2]:      Přijato: 10.06.2013 18:30      Způsob nakládky: ze zadu, bokem  
Doplňky:      Dispečer:      Způsob nakládky: ze zadu, bokem

Zadavatel: 7BT - Transport Est srl, Via Paradisi 15/3, 38122 Trento      Vlastnosti záznamu:  
Stát: 390, Město: 75, Fax: 3720 564, Tel.: 3720 558, Mobil: 3273 440 264

Figure 16: Sample View of the Offers Entered by Other Users  
Source: RAALTRANS (2023)

Screenshot of the interface of the software from EURIKA s. r. o. can be found in the Attachment A RAALTRANS System Interface. As can be seen, after the time stamp an information about width and height in metres and loading surface of the load in square metres follows. Another column may include additional information on whether, for example, the whole loading surface is needed to be in one

level and not divided into several “pieces”. If the cargo needs a special way of loading, for example from above, another column is dedicated for this kind of information. The last column can contain an information about dispatcher of the provider.

As can be seen in the Figure 16: Sample View of the Offers Entered by Other Users, some of the records are coloured. This distribution is based on user’s rating of other users, as mentioned above. The offers of the companies marked in this way will then be highlighted in green, yellow or red. For example, user can mark companies he does not want to work with classification 3. Their offers will then be underlined in red or their offers will not be displayed.

The database of offers is provided with filter above the table allowing user to filter any option needed. In the Attachment A RAALTRANS System Interface, a filter for transportation from Czech Republic to Romania for tautliners is active.

### **Module Odometer**

The Odometer module, as mentioned above, is not purchased and used by any of the selected enterprises. It serves for the calculation and display of the routes. A route can be entered with almost unlimited number of transit points. The optimum route is selected with regard to the parameters of the selected type of vehicle. In the case of a multi-point route, the module can also select the optimum order of transits through individual points of the route. The criterion for optimisation can be distance, time or financial costs.

Module further offers to arrange the offers of transportation or free vehicles according to the transit kilometres or to display the offers at a certain distance from the place of current loading and unloading. Transit kilometres means kilometres travelled without load. The function saves the tedious search for the optimal offer and the cost of lost opportunity when transporting the empty truck.

The module also allows to search for suitable additional loading for the main shipment. All available shipping offers are thus sorted in terms of suitability for decision whether the load is compatible to be added.

#### **4.4.2 TIMOCOM**

Timocom GmbH is a logistics system solution provider based in Erkrath, Germany. The company provides software of the same name TIMOCOM. As the company presents, the software is a marketplace for road freight transportation in Europe. Within the system, company provides several modules for different logistics solution.

Users of the system, of which there are up to 53.000, are freight transportation providers and manufactures or other producers demanding a freight road transportation. They have to register in the system similarly to RAALTRANS. In contrast, TIMOCOM also offers other logistics solutions exchange as warehousing or tracking of the vehicles. These modules are described in more details below.

#### **Freight Exchange**

Module of freight exchange is almost the same as the one provided by RAALTRANS. Its interface can be seen in the [Attachment B 95TIMOCOM System Interface](#) or in other figures below in this topic. The user, depending on the nature of his business, either offers or search for freight.

Offer freight means that producer places an offer and searches for a freight transportation provider. Interface of the input form can be seen below in [Figure 17: Sample Form of New Freight Offer in TIMOCOM](#). User provides information about location and date of loading and unloading as well as freight description and requirements for transport vehicle. Since the selected enterprises for this thesis are not producers but freight transportation providers, there will be more emphasis put on the provider section than producer interface.

Search for freight is the part of the module designated to freight transportation providers. Interface of this module can be seen in the [Attachment B 95TIMOCOM System Interface](#). Just like the RAALTRANS, the main part of TIMOCOM Freight exchange consists of table with details of each of the offer.

On the left side, user is provided with the information about client, followed by green columns containing demanded date of loading and its place. Blue columns represent date and place of destination. This is further followed by information of route distance

in kilometres, offered price, number of loadings and unloadings, dimensions of the load and its weight and demanded type of vehicle (see chapter [2.2.3 Types of Road Transportation Vehicles](#)). Requirements for the vehicle are usually not filled, because there are not any. The last two columns represent information, whether the load requires packaging exchange and eventually if the offer is private and available to a few providers selected by advertiser only.

**New freight offer**
✕

**Loading and unloading places**

Loading place  Unloading place

	<b>Country</b>	<b>Post code, Place</b>	<b>Date</b>	<b>Time</b>
<span style="color: green;">📍</span> Loading p...	<input type="text" value="GB"/>	<input type="text" value="Please select..."/>	<input type="text" value="20/12/2022"/> - <input type="text" value="20/12/2022"/>	<input type="text" value="hh:mr"/> - <input type="text" value="hh:mr"/> <span style="float: right;">+</span>
<span style="color: blue;">📍</span> Unloadin...	<input type="text" value="GB"/>	<input type="text" value="Please select..."/>	<input type="text" value="dd/mm/yyyy"/> - <input type="text" value="dd/mm/yyyy"/>	<input type="text" value="hh:mr"/> - <input type="text" value="hh:mr"/>

**Freight description**

Length\*  Weight\*  Type of goods

Additional information  Loading equipment exchange  No  Yes  Not specified

**Freight charge**

Freight charge  Payment due

Receive price proposals  Yes  No i

**Vehicle requirements**

Vehicle type\*

Body types\*

Characteristics & certificates

Must be trackable via the Smart Logistics System

External comments

**Contact details**

Contact in your company

Show in offer  E-mail address  Fax number  Phone number  Mobile number

Internal comments

**Limit publication**

Publish in closed freight exchange i

After  minutes publish to all

Comments for closed freight exchange

Figure 17: Sample Form of New Freight Offer in TIMOCOM  
 Source: TIMOCOM (2022)

Offered price is usually empty. As well as RAALTRANS, price is later negotiated individually between client and freight transportation provider. User can also use filters in order to find suitable offers. In the [Attachment B TIMOCOM System Interface](#),

an active filter for offers only from Czech Republic to Romania is displayed. Users can also save some of their often-used filters, as can be visible there too. This module is currently the only one which selected enterprises uses.

## Vehicle space

In another section of the system, freight transportation forwarders can offer a free vehicle for any transportation, for example in case they did not ensure any order for transit without load between unloading and another loading, in order to reduce costs of lost opportunity.

**New vehicle space offer**
✕

**Start and destination**

<b>Country*</b>	<b>Post code, Place*</b>	<b>Date*</b>
<input type="text" value="DE Germany"/>	<input type="text" value="Please select..."/>	<input type="text" value="28/09/2022"/>
<b>Country*</b>	<b>Post code, Place</b>	<b>Area</b>
<input type="text" value="DE Germany"/>	<input type="text" value="Please select..."/>	<input type="text" value="50 km"/>

**Description of vehicle**

<b>Vehicle type*</b>	<b>Type of body*</b>								
<input type="text" value="Articulated truck"/>	<input type="text" value="Curtain"/>								
<b>Rigid truck</b>	<b>Characteristics &amp; certificates</b>								
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;"><b>Length</b></td> <td style="width: 25%;"><b>Weight</b></td> <td style="width: 25%;"><b>Trailer Length*</b></td> <td style="width: 25%;"><b>Weight*</b></td> </tr> <tr> <td><input type="text" value="0.00 m"/></td> <td><input type="text" value="0.00 t"/></td> <td><input type="text" value="13.60 m"/></td> <td><input type="text" value="24.00 t"/></td> </tr> </table>	<b>Length</b>	<b>Weight</b>	<b>Trailer Length*</b>	<b>Weight*</b>	<input type="text" value="0.00 m"/>	<input type="text" value="0.00 t"/>	<input type="text" value="13.60 m"/>	<input type="text" value="24.00 t"/>	<input type="text" value="Please select..."/>
<b>Length</b>	<b>Weight</b>	<b>Trailer Length*</b>	<b>Weight*</b>						
<input type="text" value="0.00 m"/>	<input type="text" value="0.00 t"/>	<input type="text" value="13.60 m"/>	<input type="text" value="24.00 t"/>						
<input type="checkbox"/> Trackable via the Smart Logistics System									

**External comments**

**Limit publication**

**Publish in closed vehicle exchange** ⓘ

**Comments for closed vehicle exchange**

**Contact details**

**Contact in your company**

**Show in offer**

E-mail address       Fax number

Phone number       Mobile number

**Internal comments**

Figure 18: Sample Form of New Vehicle Space Offer in TIMOCOM  
Source: TIMOCOM (2022)

User provides information about the planned route, place and date of departure as well as arrival and especially description of the vehicle. Which type of vehicle is being offered, a load surface dimensions and load weight capacity.

### **Routes & costs**

Another module of TIMOCOM relevant for freight transportation providers serves as a route planner. It includes a fuel consumption calculator, fuel prices and toll prices. The route and expense planner calculates transport costs based on the request and order. It can be used by both freight transport providers and clients to calculate truck transport costs or van transport cost per kilometre. Optimal route is instantly displayed directly on the map, so it can be easily reconfigured.

The route calculation on the map takes into account all criteria such as toll sections or information about individual petrol stations. In case of any delays occurred during the route such as traffic jams, the system is capable of finding alternative routes in real time.

### **Tracking**

The system also allows to link telematics systems of 286 providers into the TIMOCOM software and track company's vehicles. Information of the route in real time is important for the freight transportation providers, but it can also be shared with a client in order to increase transparency and even reduce a surplus communication.

### **Warehouse**

The wide usability of the software is demonstrated by another module Warehouse. The module operates on the same principle as Freight exchange module. TIMOCOM facilitates the exchange of free warehouse capacity similarly to the exchange of the free capacity of the vehicles in freight transportation. Users are able to offer as well as search for a free capacity they need. TIMOCOM states that in the system there are more than 9000 warehouse and logistics providers in 46 European countries. User is able to filter between uncovered area, tempered warehouse, cold storage maintaining specific temperature, covered area, shelf storage, etc.

### 4.4.3 BursaTransport

BursaTransport is another communication platform popular between those who have goods to transport and those who have trucks available to transport goods, just like RAALTRANS and TIMOCOM. The difference between BursaTransport and other exchanges consists primarily in the largest number of users resident in Romania. BursaTransport is the name of the platform in Romania, while abroad the platform is called 123cargo. However, the platform is used mostly with regard of inbound or outbound freight transportation of Romania. BursaTransport has been founded in 2001 and since then it has become the market leader in Romania expanding to Central and South-Eastern Europe. The company states, that more than 8 million commodities are posted by more than 16.000 customers yearly.

#### Licence

BursaTransport offers to its customers subscription for three, six or twelve months. The tariffs are listed in the [Table 7: Tariffs of Subscription of BursaTransport](#) below. The access subscription includes all extra users and the sum of all available services. Company users are segmented into standard users and junior users. The difference between the two categories is the limitation of administration rights to your own contact person and user profile, in the case of the junior category.

*Table 7: Tariffs of Subscription of BursaTransport*

Licence	Cost of the licence
3 months	135 EUR / 3 months (45 EUR / month)
6 months	225 EUR / 6 months (37,50 EUR / month)
12 months	360 EUR / 12 months (30 EUR / month)

Source: own representation according to [BursaTransport \(2023\)](#)

#### Freight Exchange

BursaTransport system operates on the same principle as the already mentioned RAALTRANS and TIMOCOM above. User can either offer a free vehicle for transportation or offer a load to be transported and vice versa search for free vehicles to transport his own load or search for a load he can transport.



The screenshot displays the BursaTransport search interface. On the left, there are filters for 'Loading' (Liberec, CZ), 'Starting with' (04-06-2023), 'For' (10 day), 'Download' (Romania), and 'PRODUCT DESCRIPTION' (Truck required: van, platform, Tipper, car transport, tank, food tank, tractor head; Regime required: indifferent, FTL, LTL; Tons: empty; Volume: empty; No. of cars: 12). The main area shows a map of Europe with a route from Liberec, CZ to Turda, Cluj, RO. Below the map is a table of results:

Origin	Destination	Start Date	End Date	Weight	Volume	Truck Type
Liberec, CZ	Turda, Cluj, RO	06/06 + 1	12.00 p.m	1031 Km	13.60 m	van, tarpaulin
Görlitz, Saxony, DE (02)	Covasna, RO (525200)	05/06	24.00 t	1391 Km	13.60 m	Canvas
Görlitz, Saxony, DE (02828)	Constanta, RO	05/06 + 1	18.00 hrs	1708 Km	13.60 m	Canvas
Chotětov, Central Bohemia, CZ (294 28)	Sibiu, RO	05/06	1.80 t   4.00 m	1121 Km	Canvas	Canvas
Nowogrodzic, Lower Silesia, PL (59-730)	Negresti-Oaş, Satu Mare, RO	02-06-2023 - 10-06-2023	3.00 t   3.50 m		Canvas	Canvas

Figure 19: Interface of BursaTransport  
Source: internal sources

When searching for a freight transportation demand, user can use several filters as in the RAALTRANS and TIMOCOM offers. User enters information about required place of loading and unloading. The place can be specific or it can be state as a whole as can be seen in the case of Romania in the [Figure 19: Interface of BursaTransport](#) below. User can filter according to the type of truck (see chapter [2.2.3 Types of Road Transportation Vehicles](#)), weight, loading surface, if the load is marked as ADR, which means Carriage of Dangerous Goods, as also briefly described above in chapter [4.1.1 Freight Transportation Business of EURIKA s. r. o.](#), etc. Appropriate offers are then listed to the user.



Unlike the other two already above-mentioned systems, BursaTransport provides user with the map of the searched route, as can be seen in the [Figure 19: Interface of BursaTransport](#). Below the map, user can find records of offers in the list. Each of the record contains place, date and time of loading and unloading, number of kilometres of the route and information about weight and dimensions of the load. All of these records are indicated in the map and the map is interactive. This feature allows dispatcher to get information about the location of the loading or unloading faster, then searching for it in another application like Google Maps. This little feature is very helpful and efficient for the dispatcher's workload.

#### **4.4.4 TAGRA.eu**

According to the legislation of European Union and member states, all freight transportation enterprises, their vehicles and drivers have to meet specific legal requirements. Those are several kinds, like considering the total length of the freight train, its maximum weight, but especially working hours of the drivers. This is a very serious topic of freight transportation. In order to meet those requirements, every vehicle is equipped with a tachograph.

The first analogue tachographs have been in use since the 1950s. Today, all relevant vehicles manufactured in the EU since 2005 must have a digital tachograph, before them, there have been a tachograph charts. From June 2019, regulations require every newly manufactured vehicle to have a smart tachograph. Smart tachographs have enhanced features such as improved security, efficiency and open interfaces to other services. They also help simplify the inspection process with a dedicated short-range communication system.

Digital tachographs are devices that automatically record activity, such as driving time, speed and driving distance. This device tracks the vehicle as it starts moving. Digital tachographs record various data about the vehicle and the driver, which is essential for compliance with legal regulations on drivers' working time. Digital tachographs automatically ensure legal compliance. Companies that fail to comply with those regulations on drivers' working time risk fines or, if there is a repeated transgression, their licence to operate may be even withdrawn. Data

from tachographs have to be controlled at least once in every 3 months and data from drivers' cards at least once in 28 days.

TAGRA.eu operates mainly in Czech Republic, Slovakia and Hungary but products can be used all over Europe as they meet European regulations. The company cooperates with major industry associations and Control bodies.

TAGRA.eu Control software considers both European Regulation 561/2006 as amended by Regulation 1054/2020, AETR, 462/2007 and Czech legislation 589/2006, 262/2006, 478/2000, 3821/1985, etc. The software is used by control bodies, such as the Police of the Czech Republic, the Customs Administration of the Czech Republic, Ministry of Transport Czech Republic, Regional Authorities, Labour Inspectorates, Municipalities with extended powers, etc. The TAGRA.eu software allows downloaded data to be archived and subsequently evaluated according to the law. The software also has a wide range of other useful reports which is further described.

### **Vehicle Monitoring**

TAGRA.eu, or rather Truck Data Technology which is the developer of TAGRA.eu also offers to their customers a system for monitoring of the vehicles in real time via GPS and internet. It allows managers or dispatchers to track vehicles in real time, view travelled routes and generate a logbook. Access to the app is via the internet or mobile app (IOS and Android). This system is suitable for interfacing with the module *Tracking* of the TIMOCOM software, as mentioned above in chapter 4.4.2 TIMOCOM. Price of the system is 3.013, - CZK (126 EUR) and a monthly fee for usage within Europe of 250, - CZK (11 EUR). This system is not in use in neither of the enterprises. Moreover, another system described in the next chapter is used for tracking.

### **Licence**

EURIKA s. r. o. as well as MANINA SRL in order to fulfil the legal requirements of European Union use technologies provided by TAGRA.eu in each of their vehicles. TAGRA.eu offers its services and technologies in several variants, which can be seen in the Table 8: Overview of TAGRA.eu Technologies and Software Prices below.

All vehicles of the selected enterprises have digital tachographs, therefore only the option with evaluation of data from driver cards and digital tachographs is relevant. As mentioned above, EURIKA s. r. o. owns and operates four vehicles and MANINA SRL owns five vehicles. However, only two of them are currently in operation due to shortage of employees, tachographs are still installed in the vehicles and ready to use. EURIKA s. r. o. uses variant Digi 4 and MANINA SRL uses the variant Mini 6, even though it contains evaluation of tachograph charts, but it is cost effective.

*Table 8: Overview of TAGRA.eu Technologies and Software Prices*

Variant	Evaluating and archiving of data from driver cards and digital tachographs	Evaluation of tachograph charts	Number of Vehicles	Purchase price	Annual licence fee
Digi 1	YES	NO	1	4.828, - CZK (202 EUR)	1.490, - CZK (62 EUR)
Digi 2	YES	NO	2	7.865, - CZK (328 EUR)	1.490, - CZK (62 EUR)
Digi 4	YES	NO	4	12.088, - CZK (504 EUR)	1.490, - CZK (62 EUR)
Mini 6	YES	YES	6	16.928, - CZK (705 EUR)	1.490, - CZK (62 EUR)
Digi	YES	NO	Unlimited	20.558, - CZK (857 EUR)	2.490, - CZK (104 EUR)
Combi	YES	YES	Unlimited	26.608, - CZK (1.109 EUR)	2.490, - CZK (104 EUR)

Source: own representation according to [TAGRA.eu](https://tagra.eu) (2023)

#### **4.4.5 easyTRACK**

T.E.L.L. Rendszerszolgáltatások Kft. is Hungarian company developing system solution for freight road transportation providers called easyTRACK. The system solution offers several services regarding the field of business, similar to as above described TAGRA.eu.

Core product of the T.E.L.L. company is the easyTRACK system. It is designed to track the movement of the vehicles and their status. In addition to the current position of the vehicles, user is able to see the direction and the route travelled, monitor the condition, fuel level, driver and speed of vehicles, depending on

the service. easyTRACK is available via interface accessible from the web and mobile apps for Android as well as iOS.

User can choose from the route form-type reports available in all packages, where can be seen the time of the stop, downtime or location of the vehicle. In a detailed journey form report tracking fuel levels, mileage, start time, route time, distance travelled, speed and fuel consumption are also available. Data of the vehicles can be stored for up to 24 months. Users are able to replay vehicle's route over a period of up to 7 days and examine any event.

Alert management system allows user to be notified about specific events via easyTRACK web interface, email or SMS. User can set alerts for border crossings, fuel cap openings, stopping points or individual mileage or time-based alerts.

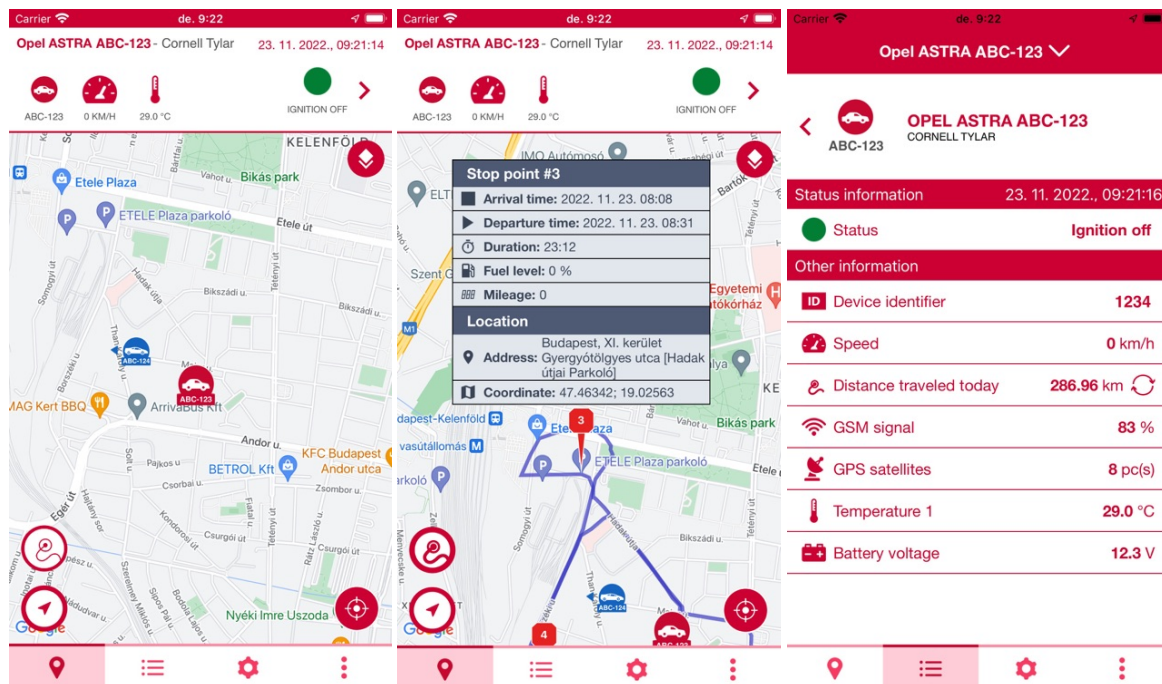


Figure 20: easyTRACK Mobile App Interface  
Source: [EASYTRACK \(2023\)](#)

For cars and vans, by installing a CAN adapter, the on-board computer can determine the fuel level and the percentage of fuel used. In the case of light, medium and heavy trucks, a diesel sensor can be used to measure fuel levels in litres.

System is even capable of continuous monitoring of the temperature values in cargo area and notification if there is a deviation in the figures. Temperature data can be

retrieved from the system. It is also possible to monitor the opening and closing of the cargo door.

Tracking can be also used not just in the freight tractors, but also in the trailers in real-time. The device allows users to view the position of the trailer even without power, during battery operation.

### **easyTACHOGRAPH**

One of the modules of easyTRACK system is easyTACHOGRAPH designed for, as its name suggests, downloading and evaluating tachograph data. The system allows user to automatically access vehicle's tachograph and driver's card data at a present time without any human interaction. The software automatically downloads the data, stores it in secure storage and evaluates it if required in the form of various reports, such as infringement, driving incidents, vehicle reports, etc.

The company ensures continuous and up-to-date compliance, so that the freight transportation provider does not need to be familiar with the current legislation. By managing the data download process and storing the downloaded data in one place, user can comply with legal requirements conveniently and securely.

### **Licence**

The system is available in several packages depending on the selected services the packages are silver, gold and gold+. Company does not publish costs of the licences of each package on their websites. All of the prices are individually negotiated with customers according to their demand. The only traceable item for the system is physical device for GPS tracking which is installed into the vehicle. The basic price of the device is about 200 EUR. However, the price depends on the individual negotiating and order of the customer.

As mentioned above, the exact financial costs and statements could not be publicly disclosed in the thesis except for those that are publicly available for legal reasons. Therefore, exact amount paid by both selected enterprises are not listed. However internal sources state that the amount is close to the TAGRA.eu price.

## **5. Evaluation and Suggestions**

Information flows and processes in the selected enterprises as well as between them are described in the chapter 4 Processes in Selected Enterprises and illustrated using information flow diagrams and process diagram. In this part of the thesis, selected processes and information systems are evaluated with regard to their effectiveness for the enterprises and further suggestions for optimization of the processes and potential effectiveness increase are provided.

The analysis was carried out as a series of observations of the day-to-day business operations and structured interviews with owner and chief executive officer, as well as dispatcher of EURIKA s. r. o.

Analysis, its evaluation and suggestions for optimization are tailored and cannot be generalized for other economical subject of the segment of the market with regard to specific conditions as well as culture differences across enterprises and nations and states even within the European Union.

### **5.1 Employees of Enterprises**

As mentioned above in appropriate chapters related to each of the enterprises, chief executive officer is not involved in the business on daily basis. However, in case any inconvenience occurs, CEO intervenes and addresses the necessities in person or immediately via mobile phone, in addition to his workload consisting of strategic and other planning for both of the enterprises, maintaining relations with regular clients and providing repairs of vehicles for EURIKA s. r. o. His workload and position are evaluated as efficient, taking into account his constant availability via mobile phone.

#### **5.1.1 Accounting and Dispatcher of EURIKA s. r. o.**

Usage of external accounting office is standard for small enterprises due to the financial demand and the little agenda that accountants handle in such companies. EURIKA s. r. o. uses a wider range of services than most of the companies,

which can manage invoicing by their own, like MANINA SRL. The use of an external accounting office is therefore effective for the company and hiring another in-house employee would be completely unprofitable. According to the Indeed (2023), the average costs per an accountant are 42.700, - CZK (approximately 1.805, - EUR), whilst company pays monthly fee to the external accounting office an unspecified sum of several thousand CZK (up to 400, - EUR). The exact financial costs and statements could not be publicly disclosed in the thesis except for those that are publicly available for legal reasons. However, there are certain possibilities for optimization related to the accounting services, which are mentioned in next paragraph.

Apart of the drivers of EURIKA s. r. o., only in-house employee is dispatcher. Her workload consists of sourcing orders in information systems, communication with the clients as well as drivers and coordination and planning of freight routes. Employee struggles with a language barrier as the only language she speaks is Czech. Using online translators is not efficient enough and it makes the communication slower. In addition, invoicing and other economic and administrative responsibilities are agenda of external accounting office, as mentioned above, which increases costs paid for the accountant services, while dispatcher is not sufficiently busy, as the observation during analysis of the enterprise revealed. A SWOT analysis of dispatcher is performed below according to the topic.

*Table 9: SWOT Analysis of EURIKA s. r. o.'s Dispatcher's Agenda*

		Positive	Negative
Internal		<b>Strengths</b>	<b>Weaknesses</b>
		<ul style="list-style-type: none"> <li>• Knowledge and experience of business</li> <li>• Negotiable but firm person</li> </ul>	<ul style="list-style-type: none"> <li>• Only Czech language</li> <li>• No economic education</li> <li>• Not flexible and computer-savvy</li> </ul>
External		<b>Opportunities</b>	<b>Threats</b>
		<ul style="list-style-type: none"> <li>• More administrative task</li> <li>• Invoicing</li> <li>• Payment processing</li> </ul>	<ul style="list-style-type: none"> <li>• Miscommunication</li> <li>• Administrative mistakes</li> </ul>

Source: own representation

According to the amount of workload, dispatcher does have enough time within working hours for other tasks corresponding to her current workload. These tasks,

such as order processing, invoicing or monitoring of payments received, require almost no economic education. By transferring this agenda to the dispatcher, costs paid to external accounting office for the accounting and administrative services can be lowered up to 200, - EUR and save approximately 200, - EUR. This is an average amount paid for accounting services according to author's personal research. External accounting office would remain providing accounting services or taxes.

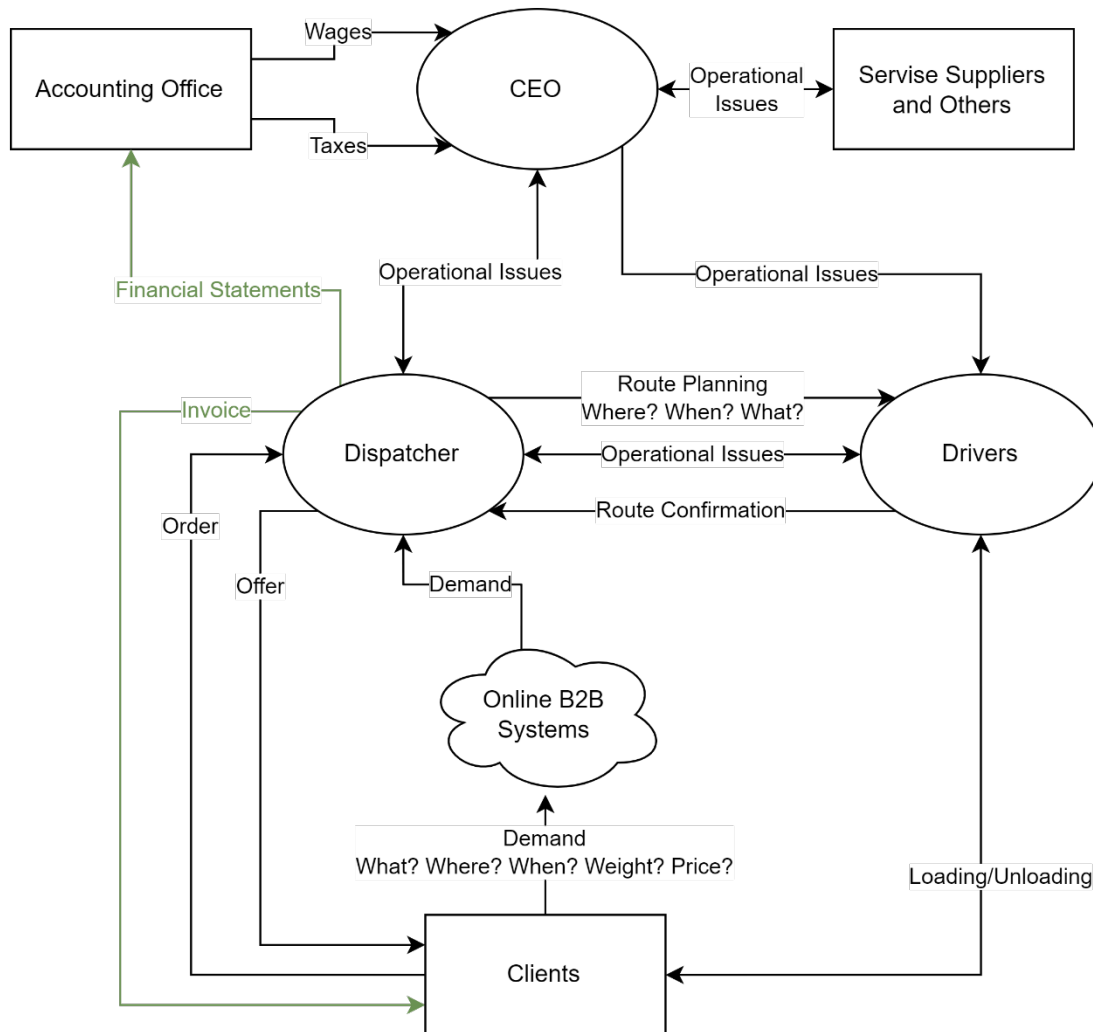


Figure 21: Modified Information Flow Diagram of EURIKA s. r. o.  
Source: own representation

Current employee in the dispatcher position is a middle-aged woman with no economic education and experience, who is not computer-savvy and also does not speak any other language than Czech. She is also not flexible and not used to different kinds of task in a time. On the other hand, she is firm when negotiating a contract with clients which leads to better revenues. However, transferring such



agenda into her personal responsibility could lead her into work overload and a number of administrative mistakes. Unpopular but effective solution for the enterprise would be replacing the employee for someone more flexible with better language skills. Those suggested changes in the enterprise are illustrated in the Figure 21: Modified Information Flow Diagram of EURIKA s. r. o. above.

### **5.1.2 Employees of MANINA SRL**

Obvious and significant struggle regarding employees of MANINA SRL is a shortage of drivers caused by enormous demand for those employees in Romania. A solution for this struggle is to expand the offer of employee benefits. On the other hand, such a small enterprise cannot compete with the offers of big freight transportation providers.

Usage of external accounting office is standard for small enterprises due to the financial demand and the little agenda that accountants handle in such companies, especially the little amount of workload in MANINA SRL. According to the SalaryExplorer (2023) the average salary per an accountant in Romania are 9.250 RON (approximately 1.860 EUR). However up to 65 % of people earn salary in the range from 4.730 RON to 7.860 RON (951 EUR to 1.580 EUR)., whilst company pays monthly fee to the external accounting office an unspecified sum of approximately 1000 RON (200 EUR). As mentioned above, the exact financial costs and statements could not be publicly disclosed in the thesis except for those that are publicly available for legal reasons. The usage of an external accounting office is therefore effective in current state according to the fact that any of in-house employees do not have an accounting background.

### **5.1.3 Restructure of MANINA SRL**

Administrative tasks in MANINA SRL are handled by three in-house employees – chief operating officer, chief administrating officer and a dispatcher. In comparison with EURIKA s. r. o., there is important to notice that chief executive officer is not involved in the business in Romania at all, unlike in the Czech Republic. His role is superseded by COO. Responsibilities and workloads of those employees are described in chapter

4.2.2 Employees of MANINA SRL. By comparison of workload of employees, it is possible to state that same agenda CEO, Czech dispatcher and external accounting office are responsible for, are done by those in-house employees in Romania. Moreover, Romanian dispatcher is responsible for overtaking orders from EURIKA s. r. o. as described above.

However, as depicted in the Figure 11: Information Flow Diagram of MANINA SRL, information flow related to demands and orders transferred between chief administration officer and dispatcher might seem illogic:

1. Dispatcher selects demands from B2B platforms and transfers them to CAO,
2. CAO negotiates those demands and approved ones transfers back to dispatcher,
3. Dispatcher plans a route according to approved orders from CAO.

During the analysis and structured interviews with chief executive officer, when pointing this topic, a culture difference has been identified, as the behaviour is common within Romanian structures as the employees tend to communicate and consult decisions together. Consulting together is evaluated as a positive, however transferring communication is unnecessary and therefore a restructure of the enterprise is suggested for effectiveness improvement.

The dispatcher who is in charge of schedule of freight routes would still search for and select demands from the platforms, nevertheless communication of the offer to the potential clients and negotiating would be his responsibility. After the order is approved, current CAO is involved in order to invoicing. Dispatcher would plan a route as usual.

Invoicing would remain for chief administration officer. Lack of workload caused by the transfer of workload to the dispatcher would be able to transfer the agenda of external accounting office, into the responsibility of the CAO. Restructure counts with the transformation of the chief administration officer into chief accounting officer. The position is also called as CAO, however, to avoid any confusion further in the thesis it will be mentioned as chief accounting officer. That requires an employee who has an economic and accounting education and experience in order

to fulfil new agenda. Chief accounting officer would be directly subordinated to chief operating officer.

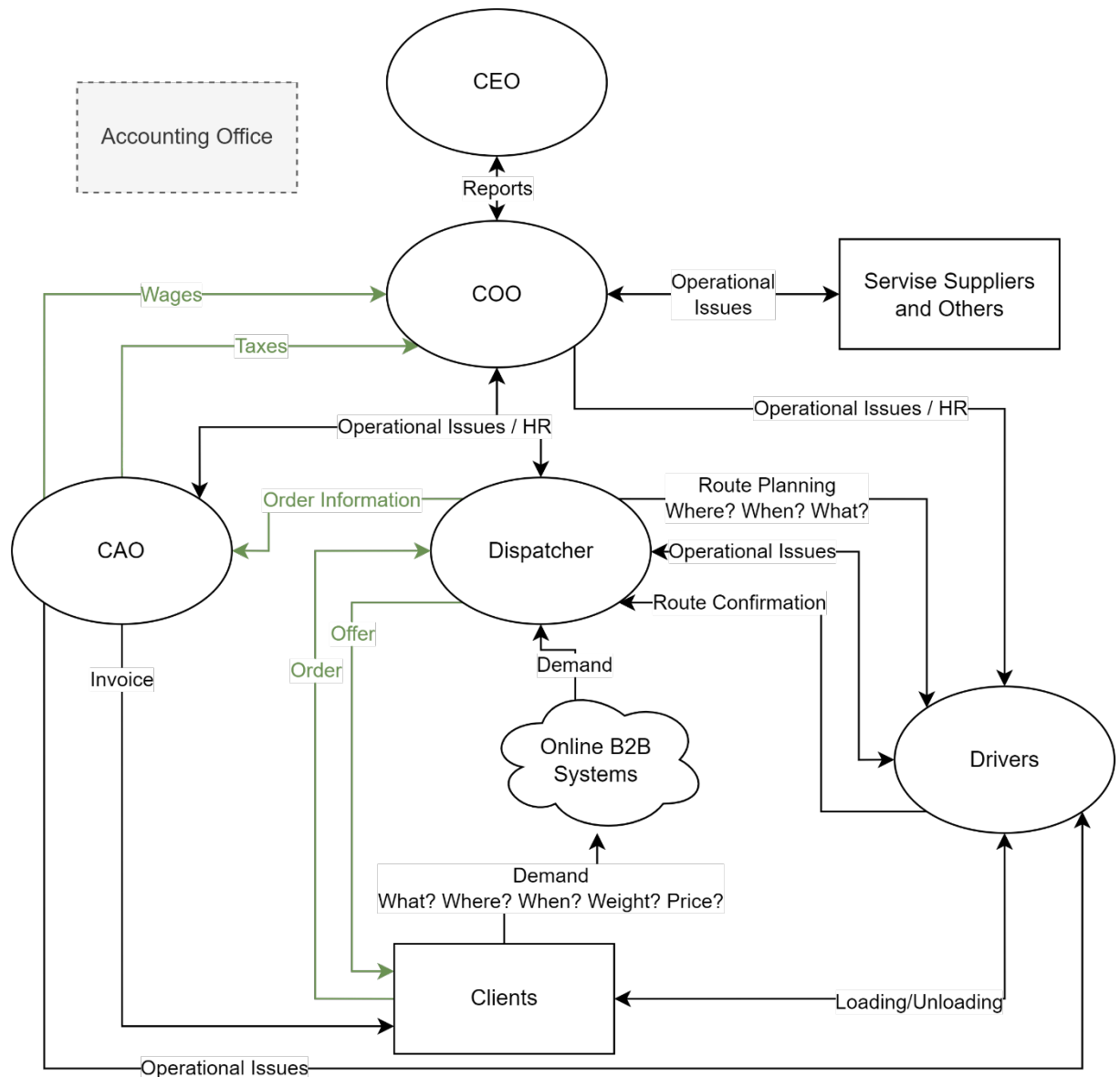


Figure 22: Information Flow Diagram of Restructure of MANINA SRL

Source: own representation

This suggestion offers an effectiveness increase in the enterprise together with the costs saving for external accounting office of approximately 1000 RON monthly (200 EUR). Processing of orders handled only by one employee would make the process faster and smoother as well as planning of routes since it is an agenda of the same employee. Increase of efficiency allows to handle more orders and expand the company. Changes in the enterprise cause by the restructure can be seen in Figure 22: Information Flow Diagram of Restructure of MANINA SRL above.

## 5.2 Information Systems

As is described in chapter [4.4 Information Systems Used in Enterprises](#), both enterprises use several information systems for securing company operation. Most of the systems are B2B portals for collecting demands and orders from clients. It could be assumed that companies are overwhelmed in such a multitude of information systems. However, it is important to note and understand, that the B2B portals are only communication platforms between potential clients and the providers of freight transportation and since different manufacturers uses different B2B portals, it is only a competitive advantage to cover demands on as many platforms as possible.

However, information systems TAGRA.eu and easyTRACK are different software yet offering nearly the same service according to the level of licence purchased. Services are described in the chapter [4.4.4 TAGRA.eu](#), respectively [4.4.5 easyTRACK](#).

TAGRA.eu is used in both enterprises to monitor, read, evaluate and store data of digital tachographs and drivers' cards according to legal requirements of European Union and its member states, while for tracking of vehicles easyTRACK licence and devices are paid.

In order to simplify and clarify the usage of information systems, using only one software for both services is suggested. According to chief executive officer, costs of the licences are nearly equal, as same as the level of services, as mentioned in the description of systems. The exact financial costs and statements could not be publicly disclosed in the thesis except for those that are publicly available for legal reasons.

According to the research done by author of the thesis, TAGRA.eu is suggested to take over current use of easyTRACK in providing tracking of vehicles. This decision is made based on possibility to interface with module *Tracking* of the TIMOCOM software also used by both of the companies for collection of orders as mentioned above.

Following of this suggestion will not bring any significant benefits or costs savings for EURIKA s. r. o. as well as MANINA SRL apart of the simplifying and clarifying the usage of information systems in both enterprises. As mentioned above, most of the information solutions used in both of the companies are efficient and provide a competitive advantage in the market.

### **5.3 Freight Transportation Business and Cooperation**

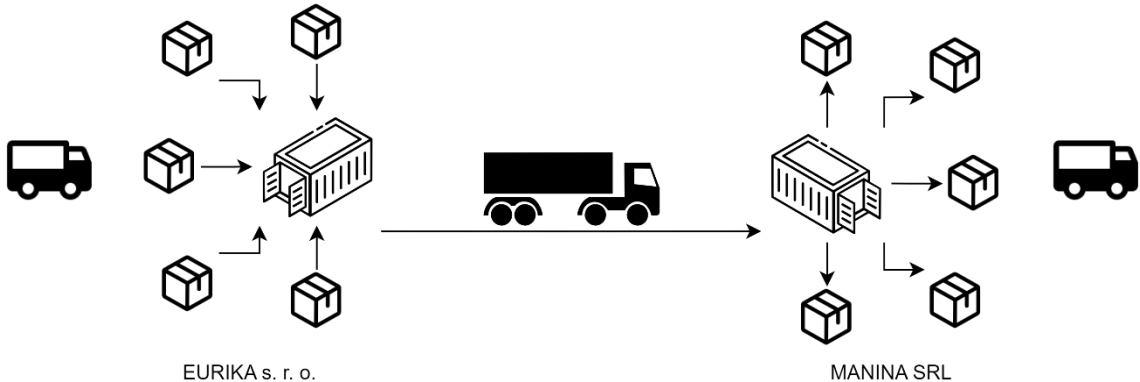
In chapters 4.1.1 Freight Transportation Business of EURIKA s. r. o. and 4.2.1 Freight Transportation Business of MANINA SRL were described principles of the business of both companies. Although EURIKA s. r. o. currently has a few regular clients, their operations are the same. Both can be characterized as second-party logistics providers (see chapter 1.4.1 1PL, 2PL, 3PL, 4PL and 5PL). Modus operandi of both enterprises is also the same, they use online B2B platforms for collecting orders (see chapter 4.4 Information Systems Used in Enterprises), load the freight at a place of origin and deliver it directly to the place of destination. EURIKA s. r. o. and MANINA SRL are sister enterprises and principles of their relations are described in chapter 4.3 Cooperation of the Enterprises.

The orders are selected by dispatchers according to weight and dimensions of the freight in order to use the capacity of vehicle as efficiently as possible. Occasionally when client publishes several demands on the same route with less weight, they are conjoined together and transported at once. Vehicle which is not operating is causing only costs and no revenues, therefore even if the truck is not sufficiently loaded, it is on its way.

For future development, expansion and strengthening of the cooperation of enterprises, thesis offers a suggestion related to already mentioned conjoining of orders. It is not unusual that clients demand a transportation of load which is not necessary to be carried by tautliner truck. However transportation of that freight for such distance (between Czech Republic and Romania) by rigid trucks (see chapter 2.2.3 Types of Road Transportation Vehicles) is not efficient in terms of fuel consumption per transported unit and therefore costs.

As SMMT (2020) states, standard tautliner with payload of 26 tons achieves a fuel consumption of 30 litres per 100 kilometres, which makes 1,15 litres per 100 kilometres per 1 ton. On the other hand, a van with payload of 1,5 tons typically achieves fuel consumption of 16 litres per 100 kilometres, which makes 10,7 litres per 100 kilometres per ton.

A simple suggestion is to satisfy those kinds of demands are to offer a transportation using principle of HUB. That means by rigid truck collect freights at the place of origin and transport to the HUB point. There the freight would be loaded onto the tautliner truck for the long-distance route to the HUB of the sister company and there using the rigid truck, delivered to the destination. This is a principle of combined transportation mentioned in chapter 2.2.2 Combined Transportation.



*Figure 23: Suggestion for Future Development of Enterprises*  
 Source: own representation

This solution also does not require merger of the enterprises as could be seem. Each of the companies would provide either collection of freight or distribution to destination as a service which would be invoiced. For example, as illustrated in the Figure 23: Suggestion for Future Development of Enterprises, EURIKA s. r. o. concludes an order for delivery of little freight to Romania. EURIKA s. r. o. by its own means transports the load to the EURIKA HUB. Then tautliner of EURIKA s. r. o. transports the freight to MANINA HUB. MANINA SRL unloads the freight of the vehicle, and using its own rigid truck, delivers the freight to the destination. The unloading and delivery would be invoiced to EURIKA s. r. o. as a provided service.

## Conclusion

Logistics is a complex discipline affecting nearly each sector of production processes. Transportation, especially road transportation, is only a part of the logistics, however the most perceived part by public.

Road freight transportation is a highly competitive market, especially within continental Europe. A proper management of information processes and flows is required in order to stay competitive in this constantly accelerating industry.

The aim of the thesis was to identify weaknesses in the management of information flows and processes in the selected enterprises and between them with regard to the international context and to suggest an adequate solution suitable for each of the companies, which would eliminate any inefficiencies. For this purpose, a SWOT analysis and cost benchmarking were used. Information flows were described using information flow diagrams and process were illustrated using process diagrams.

In conclusion, as the primary source of inefficiency in both of the enterprises was identified the distribution of responsibilities and workload among the employees and subcontractors in the case of external accounting office. The suggestion describes in detail how to improve those inefficiencies of information flows and processes in EURIKA s. r. o. and MANINA SRL, including restructure.

Furthermore, a suggestion for future development of both enterprises and their collaboration was drawn up based on the observations and structured interviews with dispatcher of EURIKA s. r. o. during the analysis of the enterprises.

The contribution of the thesis is providing and evaluating of the analysis of the enterprises regarding efficiency. This is especially a contribution for the CEO as he is not involved in the business on daily basis. Furthermore, the contribution consists especially of suggestions for increasing the efficiency an improving information flows and processes within and among the enterprises.

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## List of Attachments

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Attachment B	TIMOCOM System Interface.....	95



# Attachment B TIMOCOM System Interface

Úvodní stránka

Přepisy

Nabídnout přepravu

**Hledat přepravu**

Cerové nabídky

Úložit jako předlohu

Připisovat burzu nákladů

Vyhledávání firm

Nápoje

RO → SK

RO → CZ

RO → X

Hledat přepravu

Nové vyhledávání

Vybrat předlohu

Zjistit více

Filter vyhledávání: Z: CZ X Do: RO X

Pouze nové nabídky  Zrušit filtr

Aktualizovat automaticky  Ne  Oznamění

Firma	Výchozí místo	Chcované místo	km	Typy nástaveb	Vázanosti vozidla
EXPRESS HEROES S.R.L.	22.05.+2 CZ   120.00   Praha	24.05. RO   550009   Sibiu	1079	1/1 13,60 24,00	Plachta - Ne
Gopet Romania Srl.	22.05. CZ   120.00   Praha	24.05. RO   500030   Brasov	1217	1/1 13,60 24,00	Plachta - Ne
Gopet Romania Srl.	23.05.+1 CZ   120.00   Praha	-	1217	1/1 13,60 24,00	Plachta - Ne
Gopet Romania Srl.	23.05. CZ   120.00   Praha	24.05. RO   310182   Arad	782	1/1 13,60 24,00	Plachta - Ne
Gopet Romania Srl.	23.05. CZ   120.00   Praha	24.05. RO   410065   Oradea	782	1/1 13,60 24,00	Plachta - Ne
Wildenhofler Spedition und ...	22.05.+2 CZ   12000   Praha	-	1352	1 625,00 E. 1/1 13,60 19,00	Plachta, Frigo, Skříň - Ano
C.B.SPED, a.s.	05.06. CZ   19000   Praha	07.06. RO   107005   Adunați	1296	1/1 13,60 24,00	Plachta - Ne
Shecha Transport s.r.o.	22.05.+2 CZ   273 51   Svárov	23.05.+6 RO   300002   Timisoara	853	1/1 6,50 6,20	Plachta - Ne
UNITY s. r. o.	23.05. CZ   285 01   Ralsko	-	1548	700,00 EUR 1/1 5,20 4,00	Plachta - Ne
UNITY s. r. o.	23.05. CZ   285 01   Ralsko	-	1548	700,00 EUR 1/1 5,20 4,00	Plachta - Ne
UNITY s. r. o.	23.05. CZ   285 01   Ralsko	-	1548	700,00 EUR 1/1 5,20 4,00	Plachta - Ne
KSC Transport Srl	26.05. CZ   334 42   Chlumčany	29.05. RO   400394   Cluj-Napoca	1220	1/1 13,60 24,00	Plachta, Tautliner, Mega -
KSC Transport Srl	26.05. CZ   334 42   Chlumčany	28.05. RO   400394   Cluj-Napoca	1220	1/1 13,60 24,00	Plachta, Tautliner, Mega -
KSC Transport Srl	24.05. CZ   334 42   Chlumčany	25.05. RO   400394   Cluj-Napoca	1220	1/1 13,60 24,00	Plachta, Tautliner, Mega -
KSC Transport Srl	24.05. CZ   334 42   Chlumčany	24.05. RO   400394   Cluj-Napoca	1220	1/1 13,60 24,00	Plachta, Tautliner, Mega -
KSC Transport Srl	22.05. CZ   334 42   Chlumčany	23.05. RO   400394   Cluj-Napoca	1220	1/1 13,60 24,00	Plachta, Tautliner, Mega -
A&C Trans Company Internati...	22.05.+2 CZ   341 01   Budějice	-	1385	1/1 13,60 24,00	Plachta - Ne
A&C Trans Company Internati...	22.05. CZ   341 01   Budějice	-	1385	1/1 13,60 24,00	Plachta - Ne
IRBIS GROUP, s.r.o.	26.05.+3 CZ   375 01   Týn nad Vltavou	-	1020	1/1 13,60 24,00	Plachta - Ne
Ziemar Usť nad Labem s.r.o.	26.05. CZ   375 01   Albrechtice nad Vltavou	28.05. RO   401180   Turda (Turda)	1033	1/1 13,60 24,00	Plachta - Ne
Jiffi Karfičák - DELIATRANS	24.05. CZ   38241   Káplice (Káplice)	26.05. RO   041517   București (Sectorul 4)	1262	1 000,00 E. 1/1 5,50 2,20	Plachta - Ne
Jiffi Karfičák - DELIATRANS	24.05. CZ   38241   Káplice (Káplice)	26.05. RO   041517   București (Sectorul 4)	1262	1 000,00 E. 1/1 5,50 2,20	Plachta - Ne
JKD SPED s.r.o.	23.05. CZ   380 02   Tábor	-	1046	1/1 13,60 22,00	Frigo - Ano
ALBENI CONSULT SRL	22.05.+1 CZ   383 01   Pelhřimov	-	884	1 000,00 E. 1/1 7,00 8,00	Plachta, Tautliner, Mega - Ne
Jan Rylich	22.05. CZ   383 01   Pelhřimov	-	884	1 300,00 E. 1/1 7,00 8,00	Plachta - Ne
ANASPED SRL	23.05.+1 CZ   439 03   Chlumčany	-	994	1/1 13,60 24,00	Plachta - Ne
DISCORDIA SRL	22.05. CZ   500 02   Hradec Králové	22.05. RO   300002   Timisoara	790	1/1 13,60 24,00	Plachta - Ne
Gopet Romania Srl.	22.05. CZ   500 03   Hradec Králové	-	1179	1/1 13,60 24,00	Plachta - Ne