7 Transportation management

Introduction to chapter 7

Transportation is any movement of animate or inanimate thing, energy, values or even intangible things using any means. When we say "freight transportation" we are obviously referring to goods, that is, material goods of any kind, which are the subject of a commercial transaction. That is, there is a seller and a buyer. Transportation management includes the management of systems, procedures, methodologies, tools, modes of transport (road freight, rail, sea and air), intermodal and international trade. In this chapter, the key parameters of transportation management are discussed from a business point of view.

Learning objectives

After reading this chapter, you will be able to answer the following questions:

- What are the main means of transportation?
- What are their main features, advantages and disadvantages?

Outline

7.1 Transportation means
7.2 Combined transportation
7.3 Transportation of dangerous goods
7.4 International transportation

7.1 Transportation means

Transportation in the broadest sense of the word means any movement of animate or inanimate objects, energy, values or even intangible things using any means.

When we talk about 'freight transport', we are obviously referring to goods, i.e. material products, 'things' of any kind, which are the subject of a commercial transaction, so there is a seller and a buyer. However, there are cases where 'materials', 'products' and 'things' are not objects of trade. Examples of this are household goods, personal items, humanitarian aid, human organs for transplantation, etc. The term 'goods' cannot be used here, because the meaning of buying and selling is missing, so

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when we mention them, we will characterize them in their general category (e.g. household goods), or we will refer to them as 'cargo'.

7.1.1 Transportation means

Means of transport/carriers can be classified into five categories:

1 *By rail*: Rail transport has the ability to transport large volumes over long distances at a low cost. Trains can carry materials in bulk form (which usually take up the whole space in the container/vessel where they are placed), either packaged or in any other form. Appropriate facilities and equipment for materials handling are provided for this purpose. In recent years, rail transport has needed to undergo modernization and improvement of the services provided. The main competitor of rail transport is road transport, which operates at comparable costs and delivers at the agreed time, while rail transport presents fluctuations in terms of promptness of deliveries.
2 *By road*: Road transport is the most popular means of transport in Europe, but it is often threatened by traffic congestion, which creates the need for new roads and new means of transport. Improvements in infrastructure are often also thwarted or significantly delayed for environmental reasons. There are many different types of road transport today, which cover any transportation need. Thus, depending on their intended use, there are tankers, refrigerated lorries, vehicles for the transportation of chemicals, heavy/large goods vehicles, trucks for transporting household goods and platforms for transporting containers. Road transport has its own advantages and disadvantages. It is faster than maritime – sea transportation, cheaper than air, more flexible than both sea and air, it allows direct (door-to-door) deliveries, it is not subject to predefined routes and there is a wide variety of vehicles available for any kind of transportation need. On the other hand, road transport is more expensive than sea, and slower than air, while not all products can be transported by road (especially very heavy loads). Finally, there is limited space available, and road carriers are subject to border controls, with additional delays as a consequence.
3 *By sea*: Maritime transport can be divided into two broad categories: domestic and overseas (international). The kind of ship used in maritime transport varies depending on the kind of cargo being transported. There are liquid fuel tankers, gas carriers, car carriers, container ships, reefer ships for goods needing refrigeration and ships that transport general cargo. Their low cost per mile and their ability to transport very large goods of all kinds are the biggest advantages of maritime transport; to some extent, this advantage offsets the very long time required to complete the service. Moreover, the transportation of hazardous and specialized cargo can only be done by sea, as this is required either for security reasons or because some countries prohibit the passage of certain materials through their territory. The main advantage of maritime transport is its competitive prices, while virtually everything can be transported by sea. Container vessels provide door-to-door delivery, no intermediate handling, low risk of damage/theft and faster transit time. On the other hand, conventional ships are characterized by slow transit times, they are expensive for small loads, they have a lower frequency than planes/lorries and they do not directly cover all destinations,

while they also require a greater financial commitment (since maritime transport takes longer).

4 *By air*: The peculiarity of air transport is that most of the time, it is used to carry passengers, while the transportation of cargo amounts to just 10%. The main service categories in this respect are described below:

   - Shipping of small parcels, usually up to 35 kg, which are delivered and received by baggage checkpoints.
   - Services provided by air freight transport, especially 'package express services, are constantly gaining ground. In the coming years, the cost of such services is expected to improve with the development of high-capacity air transport.
   - Transportation of heavier/larger cargo than the previous category, which is done through the air freight services of airline companies. The majority of airlines are of mixed form: they transport passengers, parcels and cargo, but there also exist airlines that are purely for freight transport purposes.

Items that are often transported by air include clothing/footwear, electronic equipment, printed matter, flowers, spare parts, hospital goods, fruits, vegetables and photographic equipment. In general, we can say that goods transported by air are of great value, or they have a short lifespan, or they bear the feature of urgency. The main advantages of air transport are faster transit time, low risk of damage/theft, lower packaging costs, less financial commitment during transit and a lower minimum limit to what can be transported. Air transport can also carry products from anywhere in the world, with special prices and reduced premiums. Its disadvantage is the high fares, size and weight restrictions and limited space, while not all products can be transported by air.

5 *By pipeline*: This form of transport is the most often used means of transporting liquid and gas products in Greece, through the privately-owned installations of refinery factories/companies that exploit products in liquid form. Pipeline transportation has the disadvantage that it can only be done in places where this kind of network is installed, and it mainly goes in only one direction. Although possible in theory, in practice, a change in direction would require modification of the pump network, which is not an easy matter. But pipeline transportation has the lowest transport costs, it does not require product packaging, nor is there unexploited or underemployed equipment.

There are four main types of pipelines:

1 Pipelines for crude oil, from the extraction points to the collection points.
2 Pipelines distributing crude product from the collection points to the refining points.
3 Pipelines for transporting derived and finished petroleum products.
4 Conveyors for transporting semi-solid products. In this case, products are mixed with the appropriate amount of water to form a sludge; they are transported through the pipes with the help of pumps, after which they undergo separation with different procedures for the product and water, using specialized centrifugal pumps. Limestone, coal and sulfur are examples of products that are indicative of this kind of procedure in their transportation.

7.2 Combined transportation

In many cases, combined transport using more than one kind of transportation method is used; most of the route is usually covered by either rail, pipeline or sea, while the initial or final part of the route is by road (which is as short as possible). In this case, we generally have a combined form of transportation which, depending on the use of the means of transport that it is made up of, can be classified as follows:

- Intermodal transport (means of transport that use compatible methods): This kind of transportation method is mainly carried out by ships using containers, which are then shipped overland by other means (e.g. train, truck). In this case, many companies are involved in this form of combined transport.
- Multimodal transport: This involves the transportation of goods by collaborating with more than one of the four modes of transport, or even in combination (shared in some parts of the route), e.g. goods transported overland mainly by wheeled transport, but at certain points along the route, they are placed on board a ferry or train, or the train boards a ship. The main feature of this kind of transportation is that a contract is signed with a company (bill of lading).

7.2.1 Containers

The biggest and most widespread innovation in the field of freight transport is undoubtedly the container; as transportation equipment, it can change modes of transport (ship, train, lorry) easily and quickly, without the need to interfere with the cargo itself. Containers are essentially standardized metal boxes used for international transportation, excluding countries with a large geographical area (e.g. USA, Russia), where they are mainly used for overland transport.

The concept of the container was a real breakthrough in transportation for the following reasons:

- Businesses can now import or export manufactured products in smaller quantities, in contrast to conventional shipping which requires a disproportionately large amount of product to be chartered.
- Goods are transported more safely and are subject to less risk of theft, damage, moisture, etc.
- The container introduces the concept of combined transport, where cargo can travel by different means (lorry, ship, train, barge, etc.) with door-to-door transportation services; in other words, the planned and organized transportation from one end to another, from the exporter's premises to the importer's premises.
- Shipping companies' networking is strengthened. They can then expand and extend the countries they serve, offering regular arrivals/departures. In addition, liners providing container transport services are increasing, offering lower fares, subject to competition laws.

There are many types of goods containers. The first distinctive feature is their length: containers are built to be 20, 40 or 45 feet in length. However, the way in which they are manufactured is subject to specific requirements, in terms of both portability and

the conditions laid down by international customs regulations to prevent smuggling and theft of cargo during their transportation.

Containers are mainly owned by shipping companies, which distribute them to their customers for conducting goods transportation services. When the transfer is completed, the empty containers are returned to local return points. Only a small percentage belong to the companies that ship their own goods; the containers may then be used as warehouses. Certain types of containers are not available from shipping companies (e.g. tanks). In such cases, customers turn to specialized services that lease out containers; after the transportation activity is completed, these containers are returned to a pre-agreed location.

Specific infrastructure is required to achieve the transshipment of goods from one means of transport to another:

- Terminals: Ports, Airports, Railways. These facilities are mainly for the transshipment of entire transportation units (whole trucks, containers, etc.).
- Freight Centres: These are organically integrated sets of structures, structured services and infrastructure, for different modes of transport that can be connected to a railway station or port or airport. In such cases, we observe transshipments of whole transport units, as well as smaller cargo quantities that may be unitized (or not).
- Warehouses: These installations are of lower capacity compared to the previous cases, where land-based media loads are usually carried out (in addition to other logistics services). This category may comprise a part of the two preceding cases.
- In the transshipment procedure, we will come across the term 'cross-docking', which essentially means the process of transshipment from one land-based area to another, with the goods initially having been placed in storage facilities for up to 48 hours. In other words, transshipment is not done directly from one medium/means to another medium/means, nor does the cargo remain in warehouses for a long time.

Concluding the presentation of the modes of transport, reference is also made to two classification methods. In the case of (mainly) trucks and containers, there is a different classification for cargo, which is very important in the choice of transportation means, its packaging, transport costs, safety etc. This is known as quantity-based categorization: the volume of cargo carried in relation to the means of transport, as described below:

- FTL (full truckload): Quantity that completely fills a truck.
- LTL (less truckload): Quantity that does not completely fill a truck, but the truck is fully loaded, with smaller quantities of cargo belonging to other senders/recipients, so that everything is transported altogether.
- FCL (full container load): Quantity that completely fills a container, regardless of size and type.
- LCL (less container load): Quantity that does not completely fill a container, but is fully loaded, with smaller quantities of cargo belonging to other senders/recipients, so that everything is transported altogether.

Furthermore, in the case of trucks, there is another category, which concerns their ownership status:

- Trucks for private use: They belong to a production or commercial enterprise and are used exclusively by the company for its own needs (e.g. purchasing raw materials, selling its products, transferring equipment for repair, to workshops, etc.).
- Trucks for public use (FTC): They belong to truck drivers or transport companies and are used for third-party transportation. In other words, they work in a similar way as a taxi intended for passengers.

The second category will be analyzed in the section within the frame of outsourcing practices.

7.3 Transportation of dangerous goods

Dangerous goods are generally considered goods that pose a danger to the health and safety of people working in an area and its surroundings. This is a critical factor in road transport, as around 50% of all goods transported worldwide are considered dangerous. Dangerous goods can be transported in any form – gases, liquids or solids – as described below:

- Gaseous materials: (1) Objects containing substances in a gaseous state, (2) solids that create flammable fumes, (3) substances and objects that release poisonous gases if they catch fire.
- Liquids, solutions and mixtures: (1) Liquids bound to solid materials and objects, (2) objects and materials which contain liquids.
- Solids and mixtures: (1) Objects containing solids, (2) solids and objects that create potentially dangerous dust particles during mechanical stress (i.e. while in use), (3) solids that decompose at high temperatures, simultaneously releasing high heat, (4) solids that release poisonous substances or create dangerous reactions when in contact with liquids.

Transporting dangerous goods by road/overland in Europe is regulated by the European Agreement concerning the International Carriage of Dangerous Goods by Road, known as "ADR" (Accord Dangereux Routier). The agreement entered into force for the first time in 1957 in Geneva under the auspices of the United Nations Economic Commission for Europe and it now also regulates road transportation in the Eurozone.

ADR provisions include regulations concerning goods classification, shipping procedures, manufacturers' requirements, inspection of packages/tanks, etc. carriage conditions, as well as loading, unloading, handling, crew and vehicle requirements. The above provisions are subject to modifications/updates at regular intervals (usually every two years). Newer ADR versions are incorporated by the European Commission in the form of a Directive, harmonizing national laws, and implemented by the EU Member States.

According to ADR, dangerous goods are classified in the following way (source: https://en.wikipedia.org/wiki/ADR_(treaty)):

- Class 1 Explosive substances and articles

- Class 2 Gases, including compressed, liquified and dissolved under pressure gases and vapors
    - Flammable gases (e.g. butane, propane, acetylene)
    - Non-flammable and non-toxic, likely to cause asphyxiation (e.g. nitrogen, CO_2) or oxidizers (e.g. oxygen)
    - Toxic (e.g. chlorine, phosgene)
- Class 3 Flammable liquids
- Class 4.1 Flammable solids, self-reactive substances and solid desensitized explosives
- Class 4.2 Substances liable to spontaneous combustion
- Class 4.3 Substances which, in contact with water, emit flammable gases
- Class 5.1 Oxidizing substances
- Class 5.2 Organic peroxides
- Class 6.1 Toxic substances
- Class 6.2 Infectious substances
- Class 7 Radioactive material
- Class 8 Corrosive substances
- Class 9 Miscellaneous dangerous substances and articles

Each class is classified as "restrictive" or "non-restrictive". In the restrictive classes, only the substances that belong to those classes and are explicitly mentioned are allowed to be transported; consequently, transportation of substances not mentioned within the class is prohibited. Non-restrictive classes include substances whose transportation is prohibited. According to the ADR, vehicles carrying dangerous goods must be accompanied by specific documentation, with the aim of preventing accidents that may potentially cause great loss of human life.

Road transport is the backbone of logistics, despite the fact that lorries are also associated with drawbacks, including pollution, traffic congestion and accidents. According to the European Agency for Safety and Health at Work, accidents involving transport-related vehicles are the second leading cause of fatal accidents; in the EU, about a third of workplace fatalities are related to transportation.

To address this problem, national and international organizations have established strict regulatory frameworks. For example, European legislation has made road safety a top priority and set out a series of measures to ensure the good condition of commercial vehicles in circulation. The most important measures used to achieve this goal are the introduction of Periodic Technical Inspection and Road Technical Inspection. Road Technical Inspection is defined as the series of inspections that ensure the good condition of vehicles and compliance with technical regulations in accordance with EU directives; these require Member States to enact legislative, regulating and administrative specifications and send audit data annually for the last two years to the European Commission. The data refer to the number of commercial vehicles that have been inspected, classified into seven categories as defined in the Directive, per country of registration, in relation to the inspected points, and any identified defects. The directive lists twelve points that can be checked during roadside inspection. If vehicles are not compliant with the applicable legislation, this must be reported in the inspection reports, while the use of a vehicle that presents serious defects may be suspended.

7.4 International transportation

International transport is the driving force of a global market. Reliable freight transportation is governed by both national and international laws; international conventions are co-signed by almost all countries around the world, making adherence to their content mandatory for the parties involved (sellers, buyers, carriers, etc.). The need for their existence arose in order for there to be a commonly accepted code by all without transnational transport incompatibilities. The most important agreements are mentioned below:

- CMR Convention (*Convention relative au contract de transport international de Marchandises par Route*, Convention on the Contract for the International Carriage of Goods by Road): CMR governs the procedures to be followed for international road transport, replacing any relevant local Member States' law, with the aim of imposing uniform legislation to resolve disputes between Member States' legal systems.
- TIR Convention (*Transports Internationaux Routiers*, Convention on International Transport of Goods Under Cover of TIR Carnets): TIR allows the road transport of goods to non-EU countries in the context of an international transit system with minimal on-the-road intervention by customs authorities; it also provides the guarantees required for the completion of customs formalities.
- COTIF Convention (*Organisation intergouvernementale pour les Transports Internationaux Ferroviaires*, Convention concerning International Carriage by Rail): COTIF develops uniform legislation for international rail transport in three main areas of activity – technical interoperability, dangerous goods and railway contract law.
- Hague-Visby Rules, for maritime transport.
- Montreal Convention, for air transport.
- IATA (International Air Transport Association) regulations, for air transport.
- Rotterdam Rules, for combined transport.
- ATP Treaty (*Accord European relatif au transport international des merchandises dangereuses par route*, Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage): ATP is a United Nations Convention dating back to 1970 under the auspices of UNECE, which establishes standards for the control of special equipment for the transportation of perishable foodstuffs between ratified states.
- For EU member states: the White Paper for Freight and Passenger Transport and the Green Paper for Environmental Protection.

Of particular importance are the international regulations known as INCOTERMS. These were launched in 1936 when the International Chamber of Commerce (ICC), based in Paris, first published a series of international rules called INCOTERMS 1936 (INternational COmmercial TERMS). To adapt these rules to the latest commercial practices, the original 1936 rules underwent many modifications, resulting in the current INCOTERMS 2020, which replaced INCOTERMS 2010 and 2000.

INCOTERMS are trade terms created by the ICC, which are contained in the main body of a freight contract and clearly describe the basic obligations and responsibilities of the seller and the buyer in relation to the delivery of goods, the transfer of risks and the

payment of costs involved during the movement of goods from the supplier's warehouse to the agreed destination. Despite their optional nature, they are standardized, well-recognized terms used for the avoidance of disputes in international transportation.

It is very important to distinguish between the different INCOTERMS concerning ownership, delivery and risk. The transfer of ownership is determined by the contractual clauses/laws. The place and time of title transfers as specified by INCOTERMS are directly related to the delivery of the goods and the risk transfer (for loss, damages and theft).

In an international sales contract, INCOTERMS specify the following points:

- Determination of the critical point of risk transfer from the seller to the buyer during the goods transit process (to cover loss, damage or theft of goods), thus allowing the risk-bearing party to take the necessary measures, especially in matters concerning insurance.
- Clarification of the individual, buyer or seller, who must conclude the carriage.
- Sharing between the two parties of the administrative and transport management costs at the various stages of the transportation process.
- Clarification of the person/body responsible for packaging, labeling, handling, loading and unloading of goods or the loading/unloading of containers and the monitoring process.
- Definition of the respective obligations regarding formal export/import procedures, payment of import taxes/duties and delivery of the necessary documents.

There are 13 widely used INCOTERMS, divided into four groups, depending on the obligations of the supplier and the buyer, respectively:

- Group E – The supplier makes the goods available to the buyer without further obligation.
- Group F – The supplier does not pay the fare for the main international goods transport, but only the fare up to the delivery point, to the international carrier within the exporting country.
- Group C – The supplier pays the fare for the main international transport without bearing the risk of the goods being lost or damaged during the transportation.
- Group D – The supplier must make the goods available to the buyer at the designated destination.

The main ones are:

Free On Board (FOB), where the seller:

- must place the goods at the designated loading port, onboard the ship chosen by the purchaser and complete all customs export procedures, if any, and
- completes their delivery obligations when the goods are on board, at the designated shipment port, from where, in the event of successive sales, the seller receives the goods that were delivered for transportation until the destination point, as set and indicated in the sales contract.

The buyer chooses the ship, pays the fare and insurance and takes care of the standard procedures on arrival, and assumes all costs and potential risks for loss or damage of the goods from the moment that the goods were delivered.

The Cost and Freight (CFR) allows the seller to choose the carrier, draw up the contract and bear the costs by paying the fare until the agreed destination port, without/before unloading. The seller is charged with the loading of the goods that have gone through customs on the ship as well as the shipping procedures. However, the risk transfer is carried out in the same way as for FOB. The buyer, on the other hand, assumes the transport risks when the goods have been delivered on the ship at the port of shipment, and receives the goods from the carrier at the agreed destination port.

Finally, the Cost of Insurance and Freight (CIF) states that the seller has the same obligations as the CFR, with the additional obligation that the seller must provide maritime insurance for the risk of loss or damage of goods, by paying insurance premiums. The buyer assumes the transport risk when the goods are delivered on the ship at the loading port. The buyer also undertakes the reception and receipt of the goods by the carrier at the agreed destination port. Buyers are especially likely to respect CIF terms because they do not undertake the transport management procedures.

In order to use INCOTERMS 2010, it must be clearly stated in the contract of sale, bearing "the selected INCOTERMS rule with the specified place and closing with the INCOTERMS 2020 term". The choice of the appropriate INCOTERMS term: (a) is part of the trade/commercial negotiation, (b) must be made according to the company's organizational capacity, the means of transport to be used, the degree of service that the company wants to offer to its customer or that is required by its supplier, or even in accordance with market trends, competition practices, etc. and (c) must be appropriate for both the goods to be transported and the means of transport.