

This document should be cited as:

Garcia-Sabater, Jose P.; Maheut, Julien (2023)
Introduction to Logistics.
Technical Note
RIUNET Repository UPV
<http://hdl.handle.net/10251/199963>

Introduction to logistics

Content

1. Introduction.....	3
2. Definition of logistics	4
3. Elements of logistics	6
4. Different logistical perspectives	7
5. Internal logistics.....	8
6. External logistics	10
7. Logistics service providers	11
Bibliography.....	13
Acknowledgment.....	13

1. INTRODUCTION

Two key strategies for increasing the productivity of a system are:

1. make the productive units more specialised; and
2. concentrate activity to improve economies of scale.

By separating activities originally performed together, each of the new stages generated can be specialised. This leads to significant cost reductions thanks to the learning effect that results from running a process many times.

By bringing together at a single location operations that were traditionally dispersed, facilities are increasingly specialised and, therefore, more efficient, which facilitates economies of scale and encourages investment in more productive technologies.

These two actions combined (separating and bringing together) make it possible to benefit from the comparative advantages of each area and region, and to considerably reduce the operating costs of a given activity, with the emergence of a new activity, logistics, as a consequence.

Logistics, i.e. the movement and storage of semi-finished or final products, allows each production unit to specialise in its processing activity, while logistics can in turn specialise in its own role.

The overall cost reduction resulting from specialisation and concentration implies ever larger movements of products, with these movements then seeing cost reductions in turn (also through economies of scale).

Reducing the cost of logistics activities involves standardising the interface between the various stages: products and information that circulate through channels designed to circulate products in suitably coded standard unit load components.

Logistics can be divided into internal logistics and external logistics depending on whether the activity takes place within the production facilities or between production facilities. The logic behind both types of logistics is similar: reduce costs while providing the level of service required by the customer.

External logistics can be further divided into procurement logistics and distribution logistics depending on whether the activity relates to suppliers or customers.

Clearly all this movement of materials has an impact on energy consumption (hence the importance of green logistics), on the return, recycling and recovery of products (reverse logistics), and on the recirculation or availability of empty unit load components once they have served their purpose.

2. DEFINITION OF LOGISTICS

The Royal Spanish Academy defines logistics as “part of military organisation that deals with the movement and maintenance of troops” or, leaving behind the term’s military origins for the civilian sphere, as “the set of means and methods required to organise an enterprise or a service, especially distribution”.

The first definition states that logistics is a part of the organisation, while the second refers to the required means and methods.

Interestingly, scholars say that the term “logistics” ultimately derives from the Greek λογιστιχος, which means “one who knows how to calculate”. In line with this definition, it could also apply to someone who is responsible for the logistics of an event, such as a wedding or a concert.

According to the Council of Supply Chain Management Professionals (CSCMP), formerly known as the Council of Logistics Management:

“Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers’ requirements”. (SCM Definitions and Glossary of Terms, no date)

A simpler definition would be:

Managing information and material flows to meet customer requirements.

In this definition information precedes materials, thus emphasising the importance of information flows and information storage. Unfortunately, the flow and storage of information is often taken for granted, despite practice showing that inadequate information management leads to defective materials management. In other words, when a forklift driver delivers the wrong product or delivers the product late, it is not the pallet’s fault; instead, the fault lies with the information transmitted and processed.

The CSCMP’s longer definition highlights that, while most “logistics managers” in a company spend most of their time executing/implementing, they would do well to focus on planning also, if only out of respect for the Greeks, who believed a logistician to be someone who knows how to calculate.

The CSCMP definition also describes the flows to be managed as “forward and reverse”. In this second decade of the twenty-first century, it is particularly important to distinguish between forward and reverse flows. While most systems are designed to move products downstream, the evolution of businesses (returns, quality requirements, etc.) and society (sustainability requirements: reuse and recycle) has made reverse logistics an increasingly important and relevant area of activity.

The CSCMP definition also provides a general idea of the objectives of logistics management, i.e. efficiency and effectiveness. Since control is always necessary, *someone* usually controls the logistics managers, and this person always focuses on costs (the only aspect externally measurable in a supposedly objective way). Moreover, since logistics is almost by definition a non-value-added activity, it seems that its only real objective is to eliminate itself (i.e. to reduce its cost to 0).

Perhaps to clarify the objectives of the logistics function, other definitions, such as the so-called 7Rs (*Seven R's of Supply Chain Management explained in Brief*, no date), have been created:

“Logistics is the function of delivering the right product, in the right quantity, in the right condition, to the right place, at the right time, to the right customer, at the right price”.

The logistics function is the group of activities related to logistics and should take into consideration the various elements of logistics:

- Materials to be transported (packed unit loads)
- Information to be managed (stored, communicated) which generates orders
- Monitoring fulfilment of orders
- Transport equipment
- Places through which materials are transported
- Storage sites and equipment
- People who manage equipment and sites.

The CSCMP's list below enumerates some of the main logistics management activities:

- Logistics network design
- Management of third party logistics service providers (3PL)
- Sourcing and procurement
- Inbound and outbound transport management
- Fleet management
- Inventory management
- Supply and demand planning
- Production planning and scheduling
- Storage of materials
- Materials handling
- Order fulfilment
- Packaging and assembly
- Customer service (pre-sales, sales and after-sales).

Whereas this publication considers them fundamental, the CSCMP for some reason does not include the following activities within the logistics function:

- Design and selection of packaging
- Methods of identifying products
- Communication with other functions of the business, such as marketing, sales, manufacturing, finance and IT.

In any case, movement and storage are the two fundamental tasks of logistics, whether internal or external, forward or reverse.

In addition, as “one who knows how to calculate”, a logistician does the math to minimise costs while ensuring the service is provided to the customer as promised (Christopher, 2010).

3. ELEMENTS OF LOGISTICS

The basic element upon which logistics is based is the product and, more specifically, how it is stored and transported. Changes to the product (value-to-weight ratio, cost of raw materials, safety requirements) will necessarily lead to a different structure.

Logistics affects three main elements relating to the product: transport, inventory and storage (Chopra and Meindl, 2016).

Transport (the mode and means by which the product is moved from one point to another) is generally the major cost factor.

Storage facilities (the place and equipment) where the product waits to be transported or processed are the second cost driver.

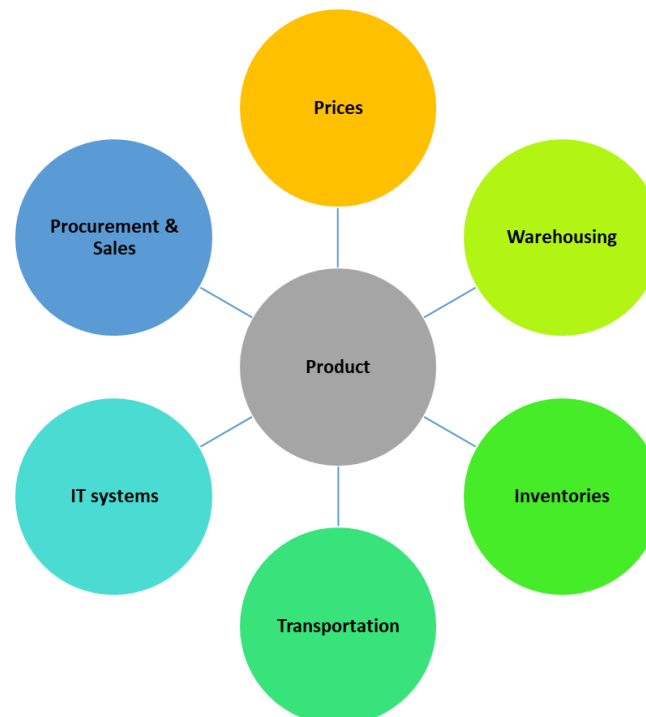


Figure 1: elements of logistics

Inventory (the amount of the product to be stored) usually depends on the two previous elements. Traditionally, logistics has tended to associate a cost to inventory (obsolescence and expiry, theft, etc.), which in reality is not so high. In a capitalist economy, inventory is usually a source of profit (linked to price fluctuations and economies of scale) rather than the source of a loss¹.

Since logistics means managing the flow of information and materials, the information system is clearly as fundamental an element as the storage facilities and transport system. Unfortunately, when it comes to choosing an information system, the logistics department usually has to make do with the tools decided on by accounting, marketing or top management, and generally develops spreadsheets that protect the system.

¹ This sentence was added knowing that it could be controversial.

The logistics system also defines the relationships between procurement and suppliers, and between sales departments and customers. These relationships which establish a contractual framework for sales and purchases require that the respective logistics departments smooth out the impact on the various levels of activity (separately from the agreements signed).

Lastly (as indicated in the case of stocks), purchase/sales prices will generate and define the requirements and needs on which the logistician must base their work.

4. DIFFERENT LOGISTICAL PERSPECTIVES

Based on its relationship with the company being analysed, logistics can have four different perspectives:

- Procurement logistics
- Internal logistics
- Distribution logistics
- Reverse logistics

In each company, depending on the product and its relationship with suppliers and customers, one of the four may be more important than the others.

Companies with a final product that contains many components (such as white goods or vehicles) often have entire departments dedicated to the management of procurement logistics. Where the focal company is larger than its suppliers, it will generally be able to make them agree to terms and conditions as regards delivery times and modes of delivery. In any case, it is essential to coordinate all suppliers to ensure that all components are available simultaneously.

Companies that work with few raw materials but which produce many high-volume products (e.g. a bakery or a paint manufacturer) typically have more complicated distribution warehouses and, as a result, have to manage continuous disruptions to manufacturing.

The aim of reverse logistics is to move materials and related information from the customer to somewhere the value of the materials can be recovered or at least to where their proper disposal can be ensured. Reverse logistics has many different aspects: where a customer returns a product it is not satisfied with, or which is defective or in which a sub-assembly or component has stopped working; or the recovery of the product at the end of its useful life or even of the product's packaging.

External logistics (procurement, distribution and reverse logistics) mainly involves subcontracting transport and renting warehouses, a very competitive market which is constantly evolving, meaning yesterday's solutions may not be very effective today. The uncertainty of not knowing whether products will be available, and the fact that movements depend on external circumstances, means that the tracking activity requires a considerable amount of staff tasked with finding out where the product is and renegotiating delivery times and locations.

In most companies, external logistics is considered an important activity (it handles large amounts of money externally and deals with customers and suppliers), whereas internal

logistics is often overlooked. Some companies design the product, the process and the layout of the machines, and only when the machines are already fixed to the floor does someone point out that they require materials or that the pallet truck cannot fit through the aisle.

Traditionally, production, rather than logistics, was responsible for transformation, but new ways of understanding the logistics activity have arisen over time. Information is transformed as part of the logistics activity, while increasingly the processes of packaging, changing packaging, assembly and disassembly are associated with the activity of logistics providers, and therefore with logistics.

Logistics activities can therefore be classified as those that design, manage or control. A distinction can also be made between activities that involve movement and those that involve storage, between those that imply direct movement (from supplier to customer) and those that imply reverse movement (from customer to supplier), or between those that move or store materials, and those that move, store, and transform information.

Logistics departments can be radically different from one company to another (even if they deal with the same physical product) depending on how the above elements are applied to their particular needs.

Companies where products pass through several stages involving multiple technologies will have more complicated internal logistics than those where the raw material is simply transformed in a reactor and then sent to a warehouse.

This second type of company may not even have staff dedicated to internal logistics (which does not mean they will have no internal logistics).

<i>Purpose</i>	<i>Object</i>	<i>Perspective</i>	<i>Activity</i>	<i>Focus</i>
Plan	Physical product	Procurement	Move	Individuals
Manage	Packaging	Internal	Store	Technology
Control	Information	Distribution	Assembly/disassembly	Process
		Reverse	Pack	Data

Figure 2: morphological matrix of the logistics function

In some companies, the logistics department reports to the chief operating officer. In such companies, efficient coordination between procurement, manufacturing and distribution is possible. However, logistics is often hierarchically disconnected from operations. This makes the coordination of internal and external activities very complicated, which in turn leads to many inefficiencies in terms of cost and lead times.

5. INTERNAL LOGISTICS

Internal logistics generally refers to activities that take place within a company's facilities. Often the growth of a company means that such activities are spread over multiple (and perhaps too many) locations. In some ways it contrasts with external logistics, which takes place externally (transport) or is treated as a whole (external warehouses).

Internal logistics is the movement and storage of products and information within a facility. However, the movement of patients within a hospital or of travellers at an airport can also be considered internal logistics.

Internal logistics is associated with the movement and storage of raw materials, semi-finished (to and from machines) and finished products, equipment, and information, but also with the management of waste and residues, products with quality issues, and unit load components (boxes, pallets, corner protectors, strapping, etc.). Furthermore, logistics often deals with packaging and sometimes with quality control.

The focus of internal logistics is to ensure that production can continue without interruptions due to a lack of material or a lack of space to store products. This need for reliability should not lead us to forget the importance of personal safety (or of the safety of equipment and materials). Another aspect to take into account is efficiency, which in terms of logistics often means avoiding the excessive movement of staff, equipment and materials.

Unfortunately, though, and perhaps because internal logistics activities are considered “non-value-added”, it is often left to the last minute to define internal logistics requirements, if they are addressed at all. In many cases, a lack of headroom will cause the system to “seize up”, usually due to shortages of space, which in turn leads to congestion and blockages.

Clearly, if logistics means managing the flow of information and materials, such information and materials define logistics (both internal and external). Moving bulk cargo, liquids or gases has different requirements from the movement of individual items. For example, moving a car is clearly not the same as moving a mattress, a bottle, a sofa or a packet of sweets.

In addition to moving goods, there is also the question of storing them (waiting for a previous operation to end). Sometimes waiting is part of the process. The product may require time to cure, cool, or ferment. At other times, the waiting period must be limited to avoid cooling or fermentation.

The main objective of internal logistics should be to ensure timely delivery to production and the swift removal of the finished product so that it does not interrupt the operation of the machine. This depends on the movement and storage of information.

Minimising errors (both in the product to be delivered and in the place where it is deposited) requires time and space. The products to be moved must also be correctly identified so that they can be selected when operators require them. It is often necessary to record information that makes it possible to trace the batch in which the products were processed at each stage.

For a product to get from one place to another, someone has to transport it or deposit it in a system that will transport it automatically. Internal logistics uses equipment that remains static as it transports, as well as equipment that moves as it transports. The former includes conveyor belts, overhead cranes, overhead conveyor systems, pipelines, and pneumatic systems, while the latter includes the various types of trolley and cart. Pallet trucks, forklifts, counterbalance stackers, etc., are used for palletised loads.

The use of mobile elements means internal logistics activities can be highly dangerous. Some companies sensibly forbid staff from walking where forklift trucks are in operation, and even specifically measure the amount of space without forklifts.

There are basically three types of space to consider: space for transport, space for storage and space for moving between means of transport and means of storage (the latter are usually forgotten and end up consuming space from the other two).

Internal logistics requires a large amount of empty space (sufficiently wide aisles, dedicated warehouse space) and excess installed capacity. Cutting this excess capacity can lead to delays in delivery and therefore production stoppages linked to material shortages. This may not be evident to a person intent on “stealing” 10 sq.m from an internal warehouse that is almost always empty, but before long this lack of space will cost them very dearly.

Internal logistics also requires personnel. The life of internal logistics staff is not easy. This is not only because they generally see their work as “non-value-added”, but also because forklift operators (internal handling staff) tend to respond to explicit and immediate requests from production workers, with decision-making essentially distributed and taking the form of shouting. Perhaps for this reason it is worth investing in IT systems that coordinate restocking and collection activities.

6. EXTERNAL LOGISTICS

When we talk about logistics, we are generally referring to external logistics. External logistics is concerned with the movement and storage of products between suppliers, companies and customers.

In almost all systems, transport is more important than storage. According to various studies, logistics contributes between 7% and 9.5% of GDP depending on the region (less in Europe, more in the US, and fluctuating according to the price of oil and the cost of money).

In the US, transport costs make up around 60% of the total cost, while in Europe they come in at 45%. Inventory costs account for around 25% of the total, while storage costs make up around 30% in Europe and around 10% in the US. In both the US and Europe, administration costs are in the order of 4%.

The use of warehouses in industrial parks with high rental costs per square metre is justified when transport costs (generally associated with the mode of transport of the product) are high. If it is possible to pack the product better, it would be preferable to rent space in warehouses located at a distance from the so-called ‘centre of gravity’. Since transport and warehouse rental costs constantly change, the balance between them is in constant flux also, making it necessary to continually reassess their configuration.

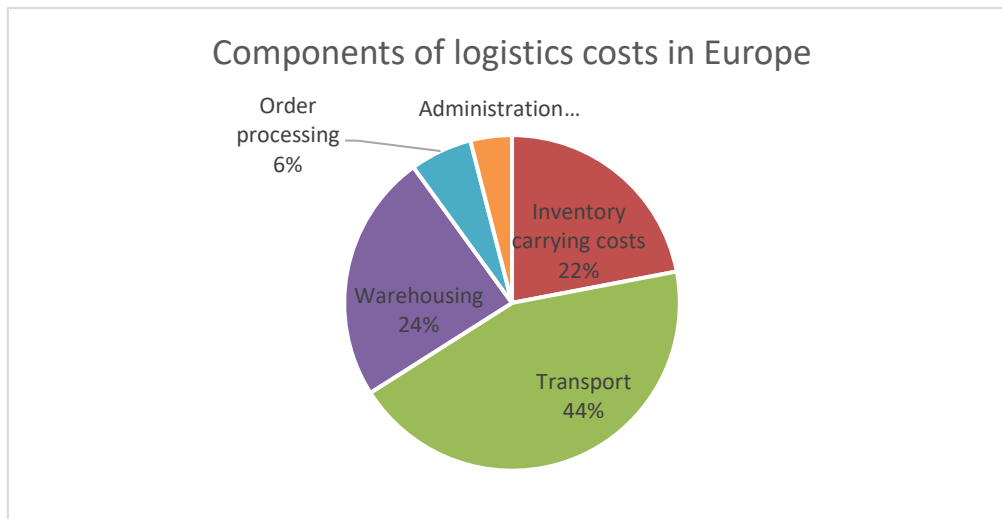


Figure 3: components of logistics costs. Source: prepared by author based on TOP100 in European Transport

7. LOGISTICS SERVICE PROVIDERS

The logistics activity is particularly complex and uncertain, and since it is unrelated to the company's core business, it is easily outsourced (Garner, 2017).

If the first party is the supplier of products and the second party the receiver of the products, the third party is the provider of logistics services. This is the origin of the term "third-party logistics" (3PL). Next came fourth-party logistics (4PL), where the logistics service provider subcontracts its activity to a transport and/or storage provider.

This gives us an alternative perspective on the name. The producer may start with its own fleet of transport vehicles (for inward and/or outward transport) but soon realises that controlling all this equipment, as well as staff who work off-site, at their own pace, can be very complicated and expensive. One day the producer looks on the market for a service provider (or usually providers) to call upon on an as-needed basis. As a result, the company manages, but does not own, the equipment. Control of the activity, as well as the associated costs and risks, is transferred to a third-party provider, the transport company.

The company continues to grow and finds it more convenient to outsource not only the physical transport but also all the other logistical activities. One of its suppliers (now sufficiently large) will achieve savings by managing the logistics in full. What's more, it knows the market better and has sufficient equipment and manpower at its disposal.

Transport companies provide resources (trucks) to their customers for an agreed price. The transport company then seeks to optimise its routes and how it uses its trucks by finding new customers that add to the business it already receives from its initial customer. In some cases, the transport company goes on to provide additional warehousing services and even logistics management services.

Third-party logistics (3PL) is where the main company outsources all or part of the logistics activity (often including management) to a company that has the necessary resources and the appropriate specialised knowledge. Sometimes 3PL providers are spun off directly from the parent company, which can make better use of the resources (transport and warehousing) made available to them.

In any case, the logistics provider is paid to provide knowledge about the specific freight transport market. It can add value by seeking economies of scale with other manufacturers or distributors of the same type of good.

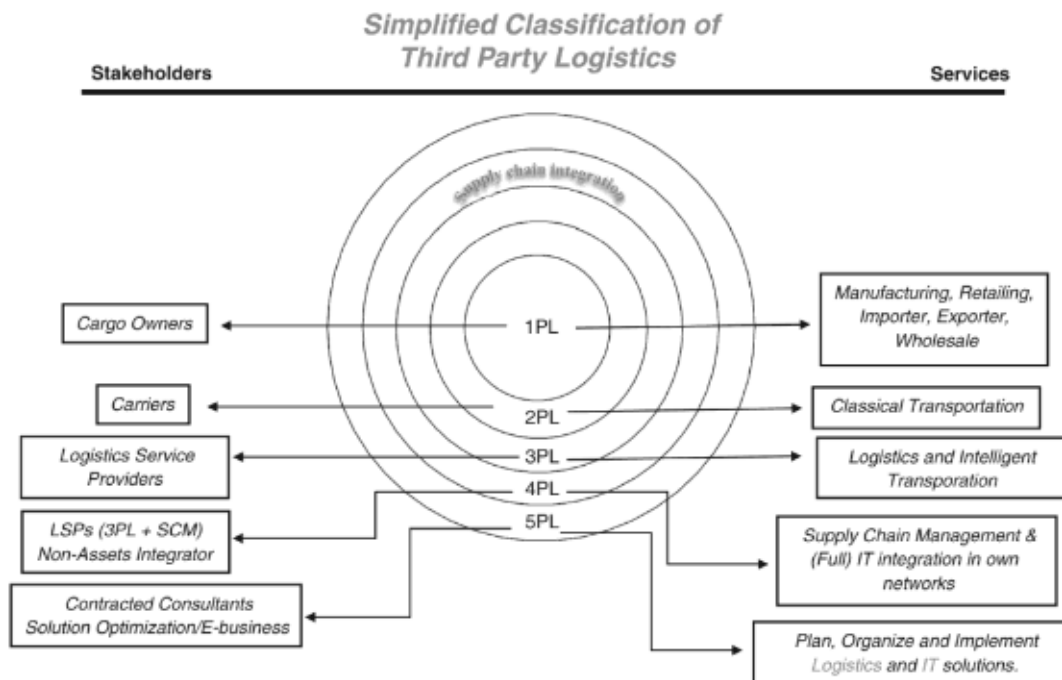
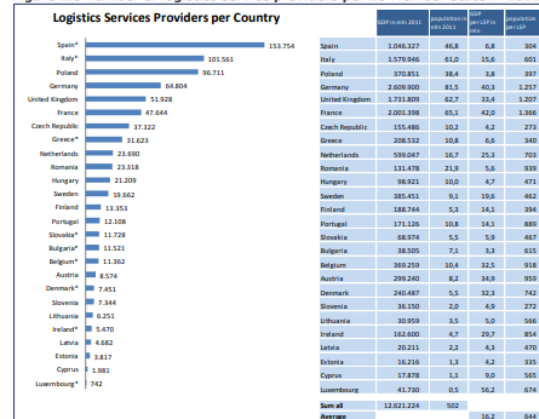


Figure 4: Classification of Third Party Logistics (source: Nayak, R. (Ed.). (2020). *Supply chain management and logistics in the global fashion sector: the sustainability challenge*. Routledge.)

Another type of logistics operator is the fourth-party logistics (4PL) provider. 4PL providers contribute knowledge and value and do not require their own warehouse or transport resources, instead using what the market makes available to them. 4PL providers support the company's management in making strategic decisions. They are often spin-offs from logistics advisory firms or transport companies.

A special type of logistics operator very often found in the vicinity of car factories is the so-called "Tier 0.5" supplier, which acts as a link between the car manufacturer and its suppliers by performing receiving, storage and logistics activities. This type of logistics operator explains the very high number of logistics providers in EU statistics.

Figure 2.8 Number of logistics service providers per EU Member State in 2011



Source: Eurostat 2014 (all values for 2011; Malta/Croatia missing)¹⁹; population from Institut der deutschen Wirtschaft Köln.

Figure 5: number of logistics service providers. Source: (Fact-finding studies in support of the development of an EU strategy for freight transport logistics Lot 1: Analysis of the EU logistics sector Final report, no date)

BIBLIOGRAPHY

Chopra, S. and Meindl, P. (2016) *Supply Chain Management: Strategy, Planning, and Operation*. Pearson Education. Available at: <https://www.scholars.northwestern.edu/en/publications/supply-chain-management-strategy-planning-and-operation-2> (Accessed: 8 April 2019).

Christopher, P. M. (2010) *Logistics and Supply Chain Management (Financial Times Series)*.

Fact-finding studies in support of the development of an EU strategy for freight transport logistics Lot 1: Analysis of the EU logistics sector Final report (no date). Available at: <https://ec.europa.eu/transport/sites/transport/files/themes/strategies/studies/doc/2015-01-freight-logistics-lot1-logistics-sector.pdf> (Accessed: 17 February 2019).

Garner, H. (2017) *2017 European Logistics Report*. Available at: <https://collectgo.eu/wp-content/uploads/2017/06/European-Logistics-Report-2017.pdf>.

Nayak, R. (Ed.). (2020). *Supply chain management and logistics in the global fashion sector: the sustainability challenge*. Routledge.

SCM Definitions and Glossary of Terms (no date). Available at: https://cscmp.org/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms.aspx (Accessed: 16 February 2020).

Seven R's of Supply Chain Management explained in Brief (no date). Available at: <https://blog.mitsde.com/7-rs-of-supply-chain-management-explained-in-brief/> (Accessed: 16 February 2020).

ACKNOWLEDGMENT

The authors received financial support for the translation of this technical note through the Program “Plan de Acciones Estratégicas para la Internacionalización de la UPV, “UPV - No Borders” of the Vicerrectorado Internacionalización y Comunicación” de la convocatoria 2021.