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Freight consolidation and digital marketplaces: new business and operational models

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Index

1 Introduction: Definition of the problem

Urban population is steadily growing and cities around the word face continuously increasing challenges in terms of efficient transportation of persons and goods, while controlling and trying to reduce its negative impacts, as gas emissions and traffic congestion.

Managing the continuously increasing need of the population to ship items is an endless challenge since it involves a high number of actors, including carriers, shippers, end customer, technology providers, intermediates, supply chain solutions providers and many others.

Every transaction in logistics begins with an end-customer order and ends with a satisfied customer. In order to do this, the actors have specific relationships and connections between each other, based on cooperation, coordination, collaboration and integration, with the purpose of satisfying customer needs in the process of generating profit, also taking into account the low margins in the sector.

Cooperation is defined as acting or working together for a shared purpose, toward a common goal. Coordination refers to a more direct, active cooperation. It is defined as "the act of making arrangements for a purpose," and making separate things working together. Compared to cooperation, coordination indicates an interactive, joint decision-making process, where separate entities influence each other's decisions more directly. Coordination aims at achieving global optimization within a defined process and even acting as one single entity by collaborating. Thus, a lack of coordination occurs when decision makers have incomplete information.

After the end-customer order, a shipper needs to send him one or more items. From the shipper's point of view, which in our case can be individuals, retailers, manufacturers and distributors, the main needs are shipping at low prices, with on-time deliveries, transparency and visibility. As far as their increasing requests are concerned, consumers are better informed and dispose of many resources to compare the quality of available services. The ability to satisfy the consumer becomes then the main challenge of

competitiveness in order to provide a complete service. To face this, logistics companies should develop their ability to satisfy and anticipate the evolution of consumers' requirements.

Nowadays, thanks to the evolution of technology it can be easier to have access to the information needed: it is well recognized that information and communication technologies (ICTs) are changing many aspects of the way in which business is conducted. The implications for transportation and logistics systems structure and, more generally speaking, supply chains are continuing to unfold. Moreover, Internet of Things (IoT) allows the transfer of data over networks without human input. It helps companies monitoring inventory, managing warehouses, optimizing fleet routes, improve real-time transport visibility and reduce dead mileage. Besides, also Artificial Intelligence (AI) plays a huge role to play in logistics, such as automation, predictive supply chains and AI-powered customer experience.

Logistics service providers are enhancing their roles in distribution systems by influencing flows of goods and the corresponding activity structures as well as reorganizing the logistics resources. Value creation is more dynamic since there are interdependencies not only between activities, but also between actors and between the resources they use, with the goal to reduce costs and be competitive in the market, fulfilling the customer demand in a cost-efficient and flexible manner.

So, growing populations, urbanization, digitalization and sustainability are all trends that have an impact in the entire industry. But how is the logistics industry changing in order to follow the trends that shape the world?

I developed this study during a 5 months internship at Clear Destination, in Montréal, Canada. Clear Destination is a logistics software solution provider which is innovative and forward-looking. This experience helped me to fully understand the logistics world by being surrounded by it all day long and most of all by people passionate about it.

The aim of this thesis is to answer to this question by studying and analyzing different firms playing in the wide logistics environment.

In the second chapter, State of the Art, we will start by giving some definitions in the field of logistics, identifying the different actors playing in the industry and giving an overview of the current state of the art by analyzing literature and scientific articles. We will then proceed by studying the environment thanks to the PEST analysis and the industry through Porter's 5 forces.

In the third chapter, Methodology, we will define the tools used in this study: the Actor ID in order to identify each customer and their gains and pains and to define the purpose of each solution offered by logistics actors, the Social Business Network through which we can have and overview of the relationship between the actors, and finally, the taxonomy and the different axes that characterize it to try and classify existing companies.

We will proceed, in the fourth chapter called Outcomes, by focusing our attention on the firms leading the market and implementing the tools previously described to identify the trends shaping this industry in the future and explaining the results obtained.

Finally, in the last chapter we will deal with Conclusions and Future opportunities.

2 State of the art

This chapter gives an overview of the current state of the art of the logistics' industry in order to fully understand the importance of logistics and the fundamental role played by each actor.

2.1 Literature

This section, which is focused on literature, aims to introduce and define concepts that will be needed further on. For this purpose, we will introduce the concept of supply chain and then talk about the history of logistics and describe its different actors their role.

Starting by a broad definition, supply chain is the connected network of individuals, organizations, resources, activities, and technologies involved in the manufacture and sale of a product or service. A supply chain starts with the delivery of raw materials from a supplier to a manufacturer and ends with the delivery of the finished product or service to the end consumer [1].

Simchi-Levy et al. (2003) defined Supply Chain Management (SCM) as "a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores, so that merchandise is produced and distributed in the right quantities, to the right locations and at the right time, in order to minimize system-wide costs while satisfying service level requirements." Such a definition suggests that SCM is both a managerial and strategic function of businesses, which is characterized by the pursuit of efficiency and effectiveness in networked systems.

Instead, logistics[1] has to do with the coordination and movement of goods. It is that part of supply chain that plans, implements, and controls the efficient forward and reverse flow and storage of goods, services, and related information between the point of origin and point of consumption in order to meet customer requirements [2].

Therefore, SCM is viewed as managing product flows across multiple enterprises whereas logistics is seen as managing the product flow activities just within the firm.
The supply-chain system is hierarchically structured and consists of the following four highly interrelated levels: the overall supply chain system which is the network of enterprises; the individual enterprise involved in a supply chain; the different business functions of a given enterprise; and the various components of the logistical system (for example, purchasing and material management and distribution system).
This hierarchical relationship leads to the fact that changes occurring in the environment of the supply chain system not only affect the management of the supply-chain system per se, but also strongly influence the logistical system organizational structure, as well as the structure, management, and utilization patterns of the freight transportation system.

[1] Definition by the Council of Supply Chain Management Professionals

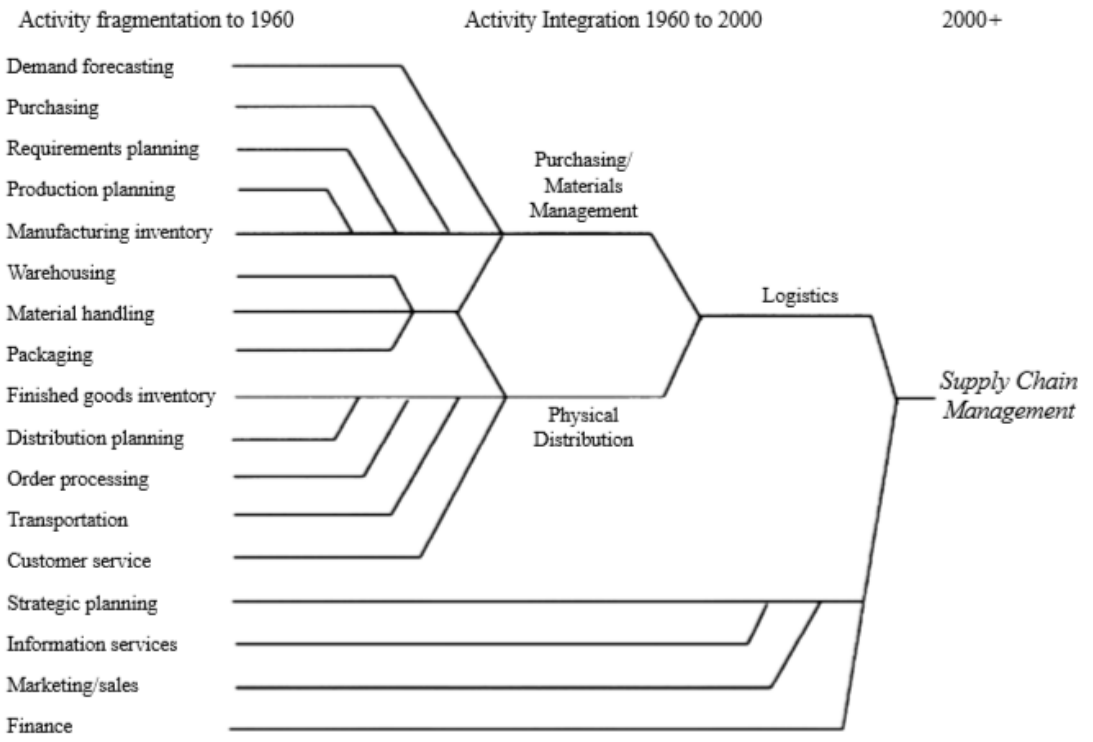

Figure 1 – Evolution of Supply Chain Management (Source: Center of Supply Chain Research, Penn State University)

2.1.1 Logistics from the beginning

The study and practice of physical distribution and logistics emerged in the 1960s and 1970s as a series of fragmented, uncoordinated movements of goods and information. Its costs were high: on a national level, it was estimated that logistics cost in the USA accounted for 15 percent of the gross national product (Heskett et al., 1973).

During the years, logistics have evolved from a purely operational clerical function to a sophisticated approach which integrates complex strategies and technologies. For those reasons, firms recur to outsourcing as business strategy since turning non-core functions over to external suppliers enables companies to leverage their resources, spread risks, and concentrate on issues critical to survival and future growth. A study by Persson and Virum [3], discusses the potential economic advantages of logistics outsourcing. Some of these are: the elimination of infrastructure investments, access to world-class processes, products, services or technology, improved ability to react quickly to changes in business environments, risk sharing, better cash-flow, reducing operating costs,

exchanging fixed costs with variable costs and access to resources not available in own organization.

Outsourcing is the main reason of the birth of Logistics Service Providers (LSPs), which are companies that provides management over the flow of goods and materials between points of origin to end-use destination. The provider will often handle shipping, inventory, warehousing, packaging and security functions for shipments.

We talk about first-party logistics service provider (1PL) when only two parties are involved in the transaction, the receiver and the party shipping the goods, which does not outsource transport and logistic activities to third parties. These functions are carried out by the company's own departments.

Firms began to outsource with 2PLs, which are used when one of the parties, usually the manufacturer, involves a subcontracted service provider for a clearly defined logistical task like transport by road, air, rail, sea and sometimes storage.

Then outsourcing became more and more important thanks to third-party logistics services providers (3PL), which specialize in integrated logistics services such as transportation, warehousing, inventory control, order processing, customs brokerage and other logistics activities in a comprehensive and seamless supply chain management system. Their emergence and rapid growth are directly linked to the increasing trend of outsourcing supply chain management activities.

Moreover, Celestine (1999) reported that firms may save between 15% and 25% in the cost of logistics by outsourcing to 3PL service providers, depending on industry and country.

In the logistics industry we also have transportation intermediaries, which can be categorized as either freight brokers or forwarders. Brokers perform a matching function, by finding carriers for shippers and vice versa, predominantly for truckload shipments. Instead, forwarders perform a coordination function by arranging transportation across different transportation modes to provide continuity of transport, as well as all other related administrative procedures [4].

2.1.2 Making a step further: 4PLs and 5PLs

However, lately, freight forwarders, brokers, and third-party logistics (3PL) providers, have been joined by new intermediaries: 4PLs and 5PLs.

A 4PL is a supply chain integrator that assembles and manages the resources, capabilities and technology of its own organization with those of complementary service providers to deliver a comprehensive supply chain solution (Accenture, 2003). This requires a high collaboration with the client and the sharing of risks and benefits. Most 4PL companies have no assets and they provide services to the customers in the form of responsibility and knowledge of how to fulfill the customer requirements. The physical movement of the goods is outsourced to other third-party service providers.

Making a step further, the concept of 5PL is focused on providing e-logistics solutions for the entire supply chain (Ho and Lim, 2001). 5PL providers have become regarded as virtual entities which manage the supply chain at a strategic level. The major tasks of 5PL companies include mapping and reengineering the supply chain, the 4PL functions (integration and control of transport, handling, warehousing, etc.,) and providing integrated information systems to ensure real-time visibility and control of the entire supply chain to satisfy the demand from all partners, including manufacturers, suppliers, carriers and buyers. The key to success in these activities is the effective integration of IT and computer systems.

Greater competitiveness in the transport industry has created higher quality added-value services, further supply chain integration and strategic partnerships. Alliances, mergers and acquisitions between 5PL providers and between customers are set to continue apace (Hertz and Alfredsson, 2003). When combined with continued global competition among firms, this will force the speed and intensity of innovation and exert downward pressures on costs, leading to further efficiencies (OECD, 2002). Thus, a congruence of goals and effective communication between supplier and customer are critical to generating much value in such partnerships. A continuing challenge for 5PL providers will be to balance the capacity to be flexible for individual customers while coordinating its entire systems, and serve the needs of multiple customers (Hertz and Alfredsson, 2003).

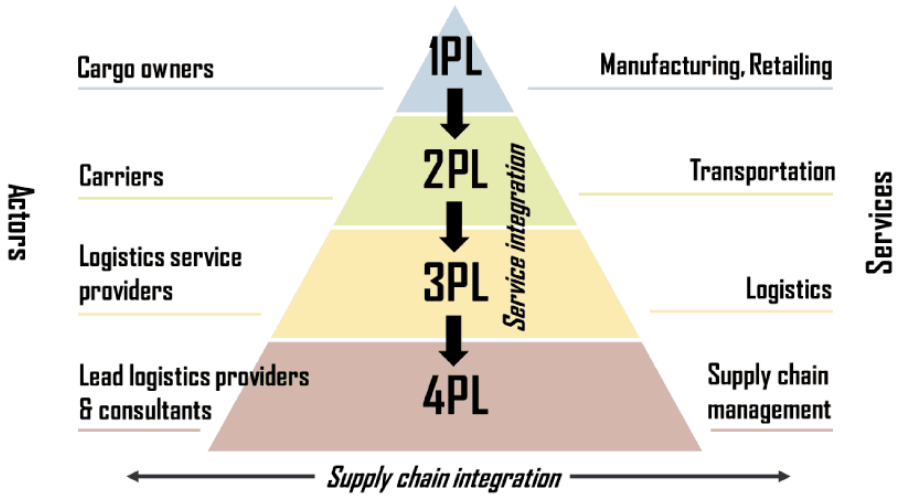

Figure 2 – An overview of Logistics Service Providers (LSPs)

Figure 3 graphically displays the cost reductions evident with the sequential introduction of 3PL and 4PL solutions. In the constant search for global competitiveness, *Figure 4* raises the question of what lies ahead, as 4PL cost reductions run their natural course. Clearly, the necessary technology is capable to deliver more advanced logistics systems but the question is whether the cost involved in deploying innovative solution can be justified. Incremental gains in cost reductions and efficiencies may be enough to justify the investment in such systems.

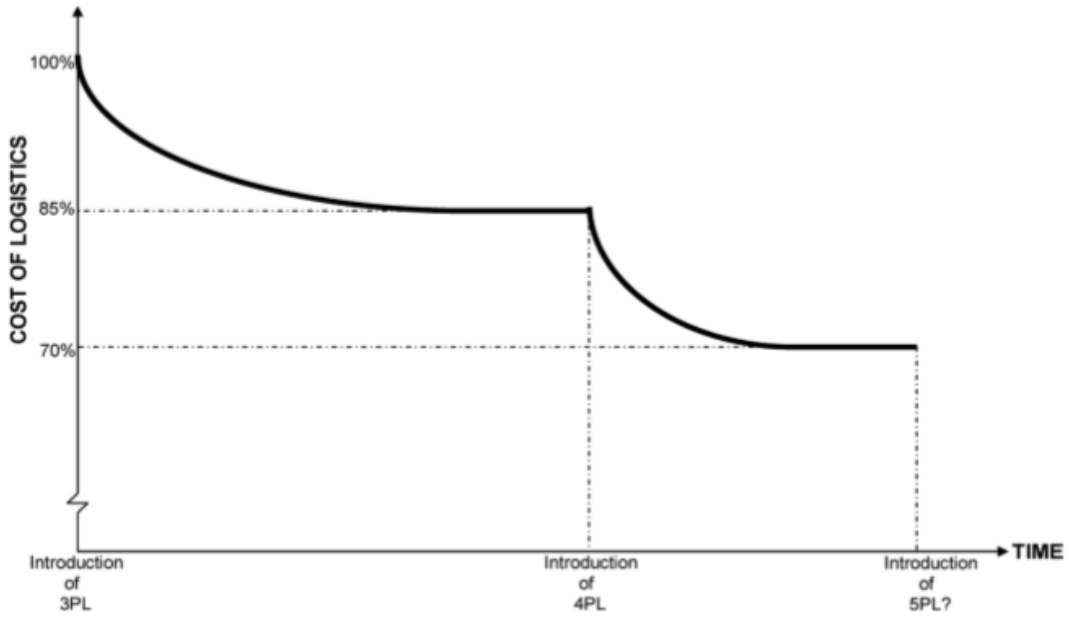

Figure 3 – Costs of logistics over time (Source: Hosie, Egan, Tan & Li)

Several of the factors that have determined the uptake and success of 3PL and 4PL are also likely drive the adoption of 5PL. Shippers who enter a logistics outsourcing project want a single point of contact with one company and supply chain visibility. Customers will increasingly demand more strategic, solution-driven results.

	3PL	*4PL*	*5PL*
Asset basis	*Asset based*	*Non asset based*	*Not specific*
Role	Basic logistics services	End to end coordination	Innovative and integrated logistics services
Business impact	Maximised use of resources	Assurance of high supply chain reliability	Using innovative solution to optimise processes
Key performance metrics	Cost	Reliability	Productivity / Costs

Table 1 – Comparison between 3PL, 4PL and 5PL

2.1.3 Logistics today: Load boards and marketplaces

Caplice (1996) concluded that shippers enter into contracts not only to reduce transaction costs but also to benefit from economies of scope, which means the reduction in costs by sharing resources. During the last years, infomediary firms experimented with many different business models. The first innovative models used spot-market exchanges that allowed shippers and carriers to post available loads or capacity on a web-based board. While a few of these firms are still up and running, most went out of business quickly or were replaced by those offering more services such as tracking, automated payment, and freight matching [5].

Nowadays, load boards are online matching systems that allow shippers and freight brokers to post loads as well as carriers to post their free equipment. These systems allow shippers and carriers to find each other and enter into agreements to move freight [6]. It consists of a database of loads (an origin and destination and an associated time window for pickup or delivery) posted by the shippers or transportation capacity posted by carriers. The agents in these cases, shippers or carriers or third-party logistics providers (3PLs) examine the database and initiate negotiations with other players one-on-one.

As shippers, carriers and intermediaries gain more experience with these new infomediaries, more distinct preferences will emerge, of particular interest is how marketplaces appeal to small and medium-sized businesses. The main drivers in the

development of these new companies are progress in information and communications technologies, development of web-based and online freight transportation marketplaces, and worldwide emergence of business-to-business electronic marketplaces [7]. Advances in information technology enable many new operational paradigms and their efficient integration in supply chains.

Marketplaces are online markets for transportation services in the form of Internet sites that dynamically match shipments (shippers' demand) and transportation capacity (carriers' offer) through auction mechanisms: shippers post loads and carriers compete over them by bidding.

They allow to gather large amounts of data and their aim is to match freight transportation demand and capacity to reduce costs and increase equipment and facility utilization [7].

Thanks to market liberalization, it is possible to skip classical brokers and use an online service acting as a digital broker: this solution gives autonomy also to small trucking firms and independent truckers, while enabling shorter response time, more efficient routes to pick up and delivery and a better payload. As supply chains have become more global, more expanded and thus more complex, the need for the use of electronic marketplaces for logistics has become evident: it is a place where the buyers and suppliers of logistics-related services meet. The development of such markets is expected to contribute much in the integration and improvement of the supply chain.

As opposed to previous solutions, that mainly benefited the shipper by driving the price down, the focus is on connecting shippers and carriers directly and efficiently, by avoiding external brokers, and giving the carriers tools to maximize asset utilization and efficiency leading to lower costs for shippers.

Marketplaces can be public or private depending on whether all interested carriers can participate or if the participation is limited to a selected few, since an important feature is to guarantee reliability of the marketplace by assuring all that participants have been certified based on their service records and business credentials. Trusted relationships are crucial as they also impact customer service and satisfaction which translates to shipper’s brand reputation. It is why most of the freight is still being transported by

contracted carriers and does not use the spot market. As a consequence, the newest online solutions don't exclude having 'preferred carriers' in order to solve this problem.

Finally, a way to further improve the service for customers is by providing a Transportation Management System (TMS). Such systems can be hosted on the Internet and can provide better collaboration among shippers and carriers. It is used to plan freight movements, do freight rating, select the appropriate route and carrier, manage freight bills and payments and measure KPIs. The ability of a TMS to properly track a shipment and ensure it is traveling on the most appropriate and cost-effective mode throughout its journey is a critical component of modern systems.
According to Transparency Market Research, the market for TMS is growing at more than 13% a year and will become a $30 billion market by 2025. Those using a TMS can save approximately 8.5 percent on their freight costs, according to a report from ARC Advisory Group, and a Gartner survey found that TMS users typically expect between a 5 percent and 15 percent yearly savings.

2.2 PEST Analysis

Given the concept defined in the previous chapters, we can now analyze the industry environment.

The supply chain system encompasses activities dealing with the efficient and cost-effective flow of goods and information from a point of origin of raw materials to a final consumer. Freight transportation is a vital element of the organization and structure of any supply chain management system. The hierarchical relationship between the supply chain and the logistical system leads to the fact that not only changes occurring in the environment of the supply chain system affect the management of the supply chain system itself, but they also strongly influence the structure of the supply and distribution networks, which in turn influence the organization, structure, and use of the freight transport system.

Three main elements constitute the environment of the supply chain system: technological, political, and socioeconomic. Changes in the environment of the supply chain system affect the way that supply chains are organized and operate [8].

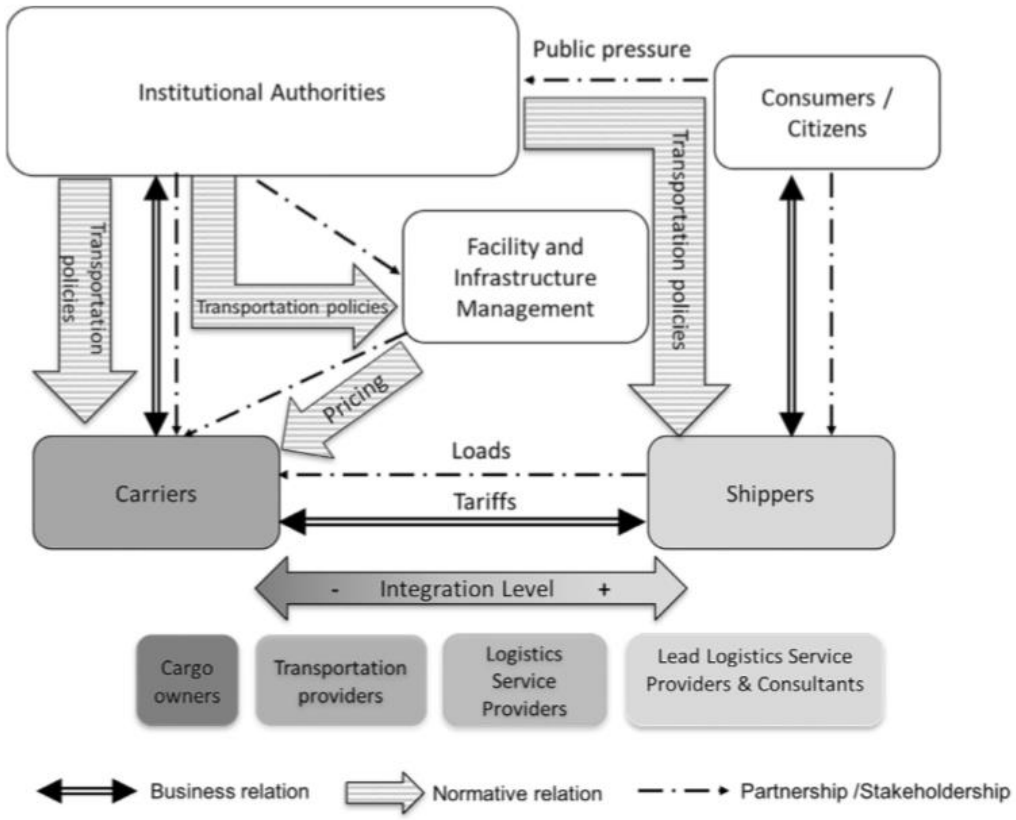

Figure 4 - Relationships among the main actors in freight transportation systems (Source: T.G. Crainic et al., European Journal of Operational Research 2018)

2.2.3 Political and social impact

To succeed in global markets, enterprises and logistics professionals must be mindful of the factors that drive change in the international movement of goods:

- Infrastructure development: While some countries currently have insufficient markets and transportation infrastructures to handle fast growth, government in many countries are placing greater resources toward that development. This

can include the creation or expansion of intermodal terminals, roads, airports, railways and ports.

- Government attitudes: Views regarding the balance of strong economic growth, environmental policy, community and social responsibility, product safety and social services vary by country and culture. These considerations often dictate the development of tariffs, duties, taxes, customs declaration processes and general import/export compliance. What is important to one country may not be a high priority in a neighboring region.
- Sustainable development: Public policies to reduce logistics' footprint embrace transport strictly speaking, since this activity alone emitting about one-quarter of global greenhouse gas, but also packaging, handling, warehousing. Considering all these issues, several governments tend to integrate logistics into their policy concerns. This involvement depends on the role of public decision-making, regarding transport infrastructure provision, safety or environment regulation and standardization.

The internationalization of supply chains due to globalization of procurement, production and distribution requires firms that have a global presence and can offer global logistics solutions [9].

The importance of intermodality for the efficient operation of transport and logistical systems and the benefits that intermodality can bring about in reducing external costs of transport have been recognized internationally. Intermodal freight transportation is becoming increasingly important, driven by congestion and environmental concerns, the changing requirements of global supply chain systems, and the rapid advancement of information and communication technologies (ICT) [8].

Government policy towards freight transport has greatly evolved in recent decades, recognizing the need to see transport as part of a larger logistical system, to manage its environmental as well as economic impacts, and to deploy a wider range of measures to achieve long-term sustainability.

Given the magnitude of the environmental challenges now facing us, particularly from climate change, the governments of more progressive countries will have to give greater priority to the greening of logistics in the years ahead.

Here are some examples.

Germany appears as the reference case in Europe, given its industrial and commercially leading position and the prominent importance given to its freight transport and logistics system, three of the biggest global logistics providers are based in Germany (DHL, DB Schenker, and Kuehne and Nagel).
In the Netherlands, logistics is traditionally regarded as a priority for the development of the country. Professional organizations cooperate with public authorities to support the development of logistics.

Announced in December 2015 and enforced in November 2016, the Paris Agreement set the objective of limiting the increase in the global average temperature below 2°C above preindustrial levels (2DS) and pursuing efforts to limit the temperature increase to 1.5°C above preindustrial levels. Partners to the Declaration call for a decisive joint effort towards sustainable transportation.

On the other side, Brexit is creating some confusion in Europe since it is reshaping the existent relationships built in the European entourage by changing the continent-wide flow of goods by all modes: the border becomes an additional stop and incremental cost in the supply chain of a not so large market. As a result, Brexit will change the UK's role as a gateway to the continent, with many manufacturers expected to migrate production and distribution of EU goods out of the UK to continental Europe, and UK ports will also lose volumes [10].

Each case is specific, but some general conclusions emerge from this list. In all these examples, logistics is approached as a system, the efficiency of which requires a multi-dimensional perception and a dependence on the quality of relationships between

actors. Public–private balanced cooperation always appears as a key issue for the success of logistics development policies.

2.2.2 Economic impact

Logistics is a major component of modern production and distribution systems and a key contributor to macroeconomic development. In 2014, logistics related costs accounted for 8.3% of the US GDP and totaled 1.449 billons dollars [11]. Beyond its costs, logistics efficiency or inefficiency affects the whole production and exchange process.
Moreover, regulatory materials and energy pricing is an important topic: fuel costs is a determining factor in the decision to approach global markets, source raw materials from abroad or outsource manufacturing to low-cost jurisdictions.
Globalization moves transportation to a more prominent role in any organization. Growth-oriented enterprises that source from around the world will face a continuing challenge: the added cost, complexity, and risk that come with moving products across multiple borders.
At the same time, global transportation requires deep cooperation and integration of all the parties, in terms of both technology platforms and strategic intent, which is essential for an effective global transportation plan and the success of the company.

2.2.1 Technological impact

The spatial concentration of production and inventory, the globalization of markets, and the advancement of ICT technologies and e-commerce have contributed to the creation of geographically dispersed logistical networks, which in turn generate demand for long-haul transportation services. Therefore, there is a need for global, reliable, efficient, and cost-effective transportation services. This implies an intense need for effective information flows between the parties and a sharing of sensitive information with the SCM service provider. In these conditions, trust is a critical and enduring component for

a successful partnership: there is a need to coordinate, communicate, and collaborate with other companies within the supply chain [12].

A study conducted by the Material Handling Institute surveyed 1,000 supply chain executives to identify the top technologies projected to shape supply chain processes in the coming years. The answers included cloud computing and storage, inventory and network optimization, predictive analytics and IoT [13].

Hence, companies are turning to managing demand as a way to optimize resources and performance. Data mining, data marts and other database analysis techniques have long provided companies with the ability to derive business intelligence (BI) from internally generated sources. Statistical aggregation of consumption data from multiple sources can provide market information for manufacturers and suppliers essential to planning merchandising decisions, promotion plans, and new product development decisions. The combination of comprehensive demand data and transparency across the supply chain opens the door to the next stage in supply chain integration: demand management. While many view demand as an unpredictable variable in their attempts to plan, there are many opportunities to manage demand and bring it with the rest of the supply chain [14]. According to SAS, "predictive analytics is the use of data, statistical algorithms and machine learning techniques to identify the likelihood of future outcomes based on historical data". The benefits of predictive analytics over previous methods is the ability to leverage the millions of data now available within the supply chain, and in doing so, improve the overall efficiency of the operation [15].

As a form of BI, Location Intelligence (LI) brings business and location data together. ESRI defines LI as "the capacity to organize and understand complex data through the use of geographic relationships. LI organizes business and geographically referenced data to reveal the relationship of location to people, events, transactions, facilities and assets". This has major implications for the transportation industry. According to Gartner, the number of organizations using LI will grow four-fold by 2021, while Dresner Advisory Services' 2018 Location Intelligence Market Study found that 66 percent of enterprises questioned consider LI "decisive to improve their revenue and growth strategies".

Customized location intelligence helps drivers get to the right location without unnecessary delays, wasted miles or safety risks. From a carrier's perspective, detailed location information produces better mileage results, improves last-mile routing, provides more precise drive times to the right gate and ultimately provides better turn-by-turn directions to drivers. This leads to better on-time delivery success and customer service.

According to a recent McKinsey Global Survey on data and analytics, the companies that derive new value from data are more likely to be leaders in their industries and experience rapid growth [16]. Firms that can creatively imagine, combine and interpret various types of data through information platforms are likely to be the big winners. The IoT-enabled opportunities for improving supply chains are limited only by the bounds of our creativity.

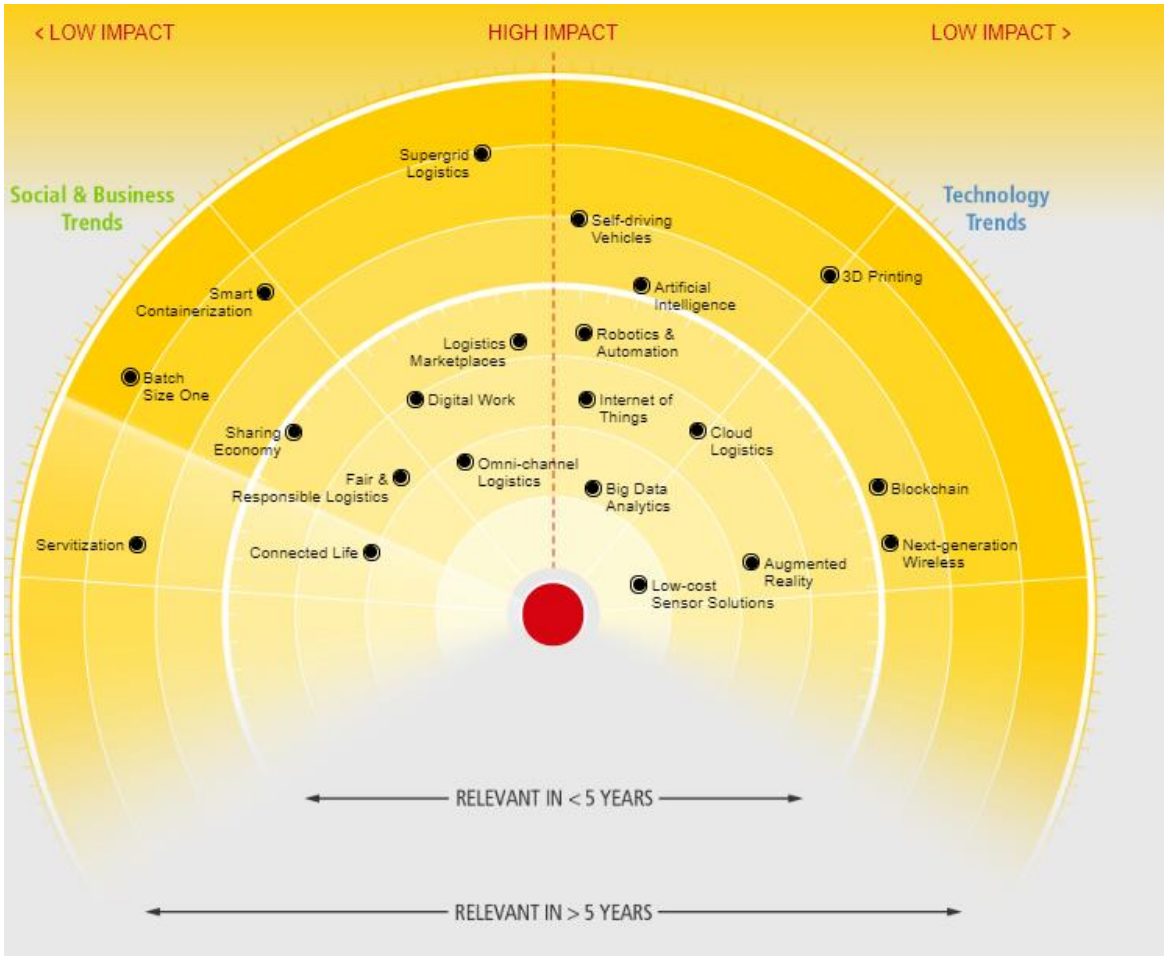

Figure 5 – Trends in technology in the logistics industry (source: UPS website)

2.3 Porter's Five Forces

Porter's Five Forces is a model that identifies and analyzes five competitive forces that shape every industry and helps determine its weaknesses and strengths in order to establish the level of competition within the industry and enhance a company's long-term profitability and establish a strategy.

Those are: competition in the industry, potential of new entrants into the industry, power of suppliers, power of customers and threat of substitute products.

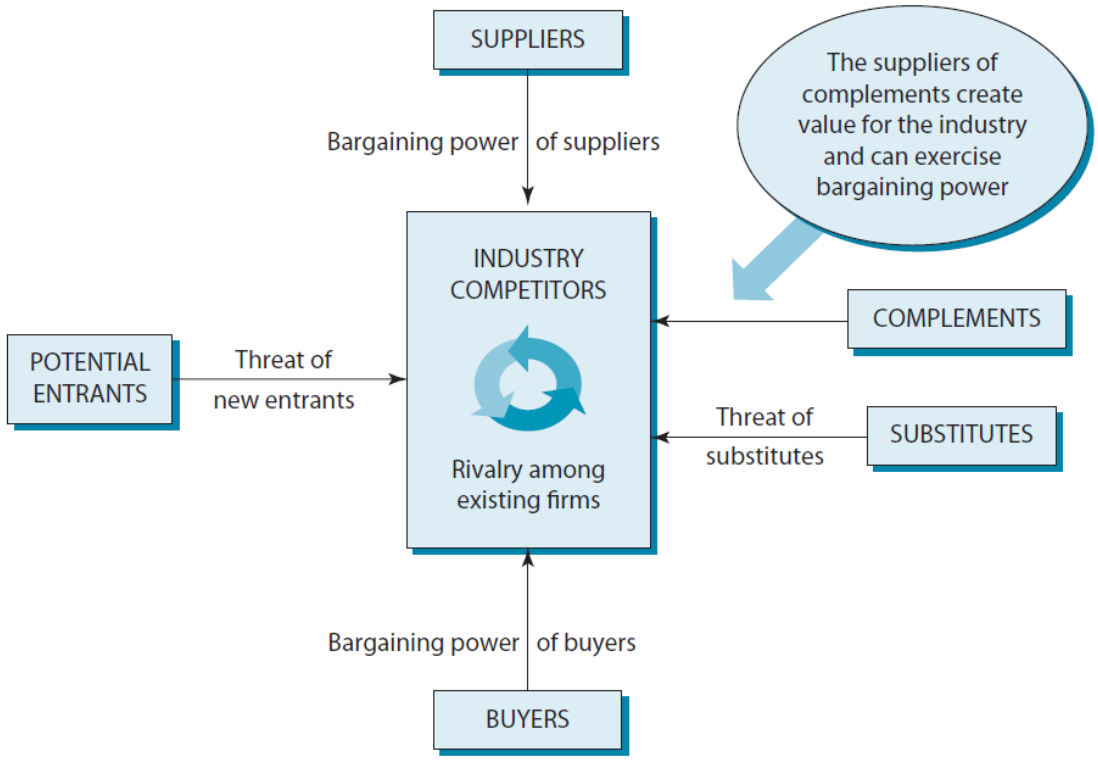

Figure 6 – Porter's Five Forces

Logistics companies are facing an era of changes as digitalization and customer expectations evolve. New technologies are allowing efficiency and collaborative operating models, re-shaping the market in different ways. But also new entrants, whether they be start-ups or the industry's own customers and suppliers, are shaking up the sector. Moreover, globalization and reduction of trade barriers boosted the growth of the industry.

In this section we will analyze the current situation.

2.3.1 Competition in the industry

In the logistics industry we can find an increasingly competitive environment due to the existence of internationally known firms which detain the biggest slice of the market share. Incumbents improve their efficiency, reduce their environmental impact and try to develop new business models, such as sharing networks and marketplaces. But differentiation is low, and firms are competing with prices and quality of the service they offer.

Besides, the low barriers of entry (section 2.3.2) and the high industry growth increase competition among incumbents and new entrants and drives down prices. It is very easy for buyers to switch firms if they are able to offer a better deal or lower prices. On top of that, profits in logistics are relatively low.

2.3.2 Potential of new entrants

A company's power is also affected by the force of new entrants into its market. The less time and money it costs for a competitor to enter a company's market and be an effective competitor, the more an established company's position could be weakened.

Barriers of entry are low, since nowadays it is not fundamental to possess means of transportation, given the fact that partnerships are widely used. On the contrary it is important to have software that allow to control and coordinate transportations. All this gives the opportunity to new entrants to get into the market.

Some of the sector’s own customers are starting up logistics operations of their own, and new entrants to the industry are finding ways to exploit technology using data analytics and blockchain to offer a match between shippers and carriers with available capacity. Besides, many of the new entrants are basing their offer on more transparent prices: enabling carriers to bid on loads and allowing them to lower their bids in order to fill up capacity.

2.3.3 Power of suppliers

Suppliers provide trucks or modes of transportation, fuel oil, repair services etc. to companies. Suppliers have very low bargaining power, especially to the dominating shipping companies, while it may affect to certain extent small players who are struggling to establish within the industry. However, suppliers could enter into the market and provide services, becoming competitors.

2.3.4 Power of customers

Low differentiation and switching costs give a high bargaining power to customers and their expectations are increasing greatly. Both individuals and businesses expect to get goods faster, in a more flexible way, improving efficiency, at low or no delivery cost and with more transparency and traceability.

2.3.5 Threat of substitute products

The threat of substitutes is low, logistics range from transportation to warehousing to supply chain and customers don’t have alternatives for the service provided by logistics.

3 Methodology

In order to identify trends and future developments of the logistics' industry, we decided to put in place a taxonomy to classify the different firms operating in the sector. We selected some important players in the logistics' industry in North America, Europe and Asia in terms of revenues and market share of the sector.

All the information and data used for this taxonomy have been found in the official websites of the companies, on reports available on the net and on reliable articles of scientific magazines and online logistics journals such as Forbes, Market Insider, Freight Waves, Business Insider, Wall Street Journal, CNBC, Supply Chain 24/7 and so on.

Moreover, the research process has been performed by general keyword research such as supply chain management, logistics providers, logistics' platforms, etc. on Google Scholar, IEEE, Emeraldinsight online research platforms.

In the sample of 40 firms we took into consideration, we included carriers, logistics service providers (2PLs, 3PLs, 4PLs, 5PLs), load boards, marketplaces, providers of software solutions for logistics, transportation management systems (TMS) and visibility platforms.

We did this since those are the logistics actors that are the most relevant in order to define future trends in this industry as they detain its biggest market share and are directly connected to shippers. We decided not to include in the sample logistics facilities such as ports, terminals and warehouses in order to simplify the already complex taxonomy and we opted to deal only with interurban logistics, putting aside urban deliveries.

Besides, all the selected categories of enterprises are linked between each other, not only because they are industry-related, but also because they collaborate with each other by having a customer-seller hierarchy, for example carriers are clients for

marketplaces and load boards, TMS are clients for logistics' service providers, and so on. Therefore, this will lead them to create strong partnerships, as we will see further on through the Social Business Network, which is defined in section 3.1.4.
Furthermore, in order to create the taxonomy and link the firms and technology in logistics, we had to fully understand the relationship between the companies and the various shareholders. In order to do so, we followed the GUEST methodology (Perboli et al., 2017; GUEST, 2018): for each selected category in the sample, we built the Actor ID and its related Value Proposition. Then, within the taxonomy, we created the Business Model Canvas (Osterwalder and Pigneur, 2010; Osterwalder et al., 2014) for each of the 40 firms.

This process will be fully explained in the following section.

3.1 From the actor ID to the Business Model Canvas

The GUEST methodology, mentioned above, has been developed by a pool of researchers from the Politecnico di Torino and aims to provide companies with an innovative framework for business management.
Every step of this methodology allows the actors to monitor their projects and, at the same time, grants the standardization of documents and tools that should be used to evaluate ideas, actions and results.
The GUEST methodology is made of 5 steps, but for the purpose of this study only a part of its tools will be used since usually this methodology is utilized to develop new ideas and startups, whereas in this case we need to analyze some already existing firms.

3.1.1 Actor ID

The Actor ID is used in order to identify stakeholders and its related gain, pain and job according to the timeline (today, tomorrow and next future).

Actor (Market segment or specific partner, client or customer, user, stakeholder)	**Contact channels** (How I am in contact with the actor)
Actor type (User/Stakeholder) Actor Description Social-Economic stratification with quantification Gender Age Geolocalization Salary	

Actor situation (Our assessment of the problems and current situation of our actor)

Jobs (What is our actor trying to achieve and what actions do they take to do that)

Pains (current downsides to their jobs)	**Gains** (current benefits of their jobs)

Provider

Pain relievers (proposed block removers)	**Gain creator** (proposed rocket fuel)

Products and solutions (The specifications of our offer that allow us to enhance gain and minimize pain)

Value proposition (The summary of the value the provider proposes. Our sales pitch to the specific customer)

Figure 7 – Actor ID

Gains describe the outcomes and benefits customers want, including functional utility, social gains, positive emotions, costs savings and revenue increases. Pains describe anything that annoys the customer before, during and after trying to get a job or simply prevents them from getting a job done.

Then, by fully understanding this first part, it can be possible to identify gain creators, pain relievers and a service or product. Gain creators describe how a company's products and services create customer gains. It's important to focus on what is relevant to the customer and where a product or service can make a difference. Pain relivers describe how products and services can alleviate customer pains, or at least the main

ones. In the end, product and services describes the bundle of products and services a company offers to satisfy the customer's basic needs.

In the end, the Value Proposition is defined, which is the summary of the values the provider proposes.

3.1.2 Business Model Canvas

The Business Model Canvas is the set of organizational and strategic solution, through which the company obtains a competitive advantage: how an organization creates, delivers and captures value.
The graphic template makes it is easy to visualize and define the company's business model as a whole.

The Value Proposition, which is the value the company offers to its clients, observed from the latter's point of view, is the focus of the document. On the right side of the canvas there are the ideal characteristics to which the business must aspire in order function. On the left side of the canvas are listed the tools the company needs in order to implement its plans.

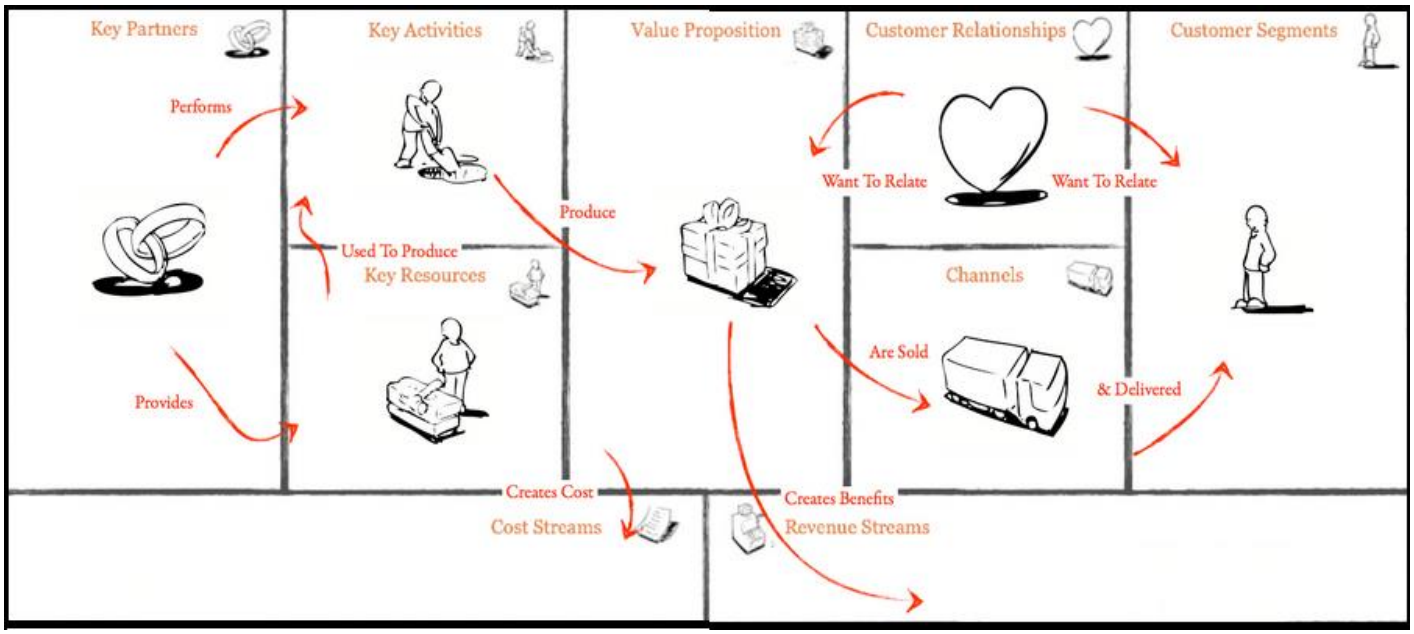

Figure 8 – Business Model Canvas

The *Customer Segments* category defines the different groups of people or organizations that a company wants to reach and serve by satisfying their needs and demands in the best possible way. To do this it's necessary to group customers into distinct segments based on their common needs, behaviors, or other characteristics.

The *Value Proposition* is the set of goods and services which create value for a specific customer segment and is the reason why customers choose this firm. The Value Proposition solves a customer's problem and meets his needs through a specific mix of elements.

Channels represent the way a company interacts with its customer segments to deliver its Value Proposition.

The *Customer Relationships* block outlines the ways in which the company acquires, retains customer and grows sales.

The *Revenue Streams* part describes the flows of revenues received by the company via the sale of products or services to a particular customer segment.

The *Key Resources* block highlights the strategic assets that a company must have to implement their own business model.

The *Key Activities* describes the strategic activities that must be performed to create the Value Proposition, reach customers, and generate revenues.

The *Key Partners* block describes the network of partners and suppliers essential in running the company's business model. Conceiving the company as a system that operates within a larger ecosystem, it's not possible to think about it as 'self-sufficient'. There are in fact strategic actors outside of the company who are essential to implement the business model and to increase the chances of success in the market. The goal of these partnerships is to allow the company to respond to different needs, internal and external, which are not accounted for in its business model.

Finally, the *Cost Structure* defines the costs that the company sustains in order to run its business.

3.1.3 Social Business Network

The Social Business Network (SBN) is a visual document aiming to represent the company in its environment in order define the link between the actors and the environment and to assess the interactions between all elements of the system.

Each player is represented by a node categorized according to the type and numerosity and each node will be connected by one or more arches according to the type of relationship.

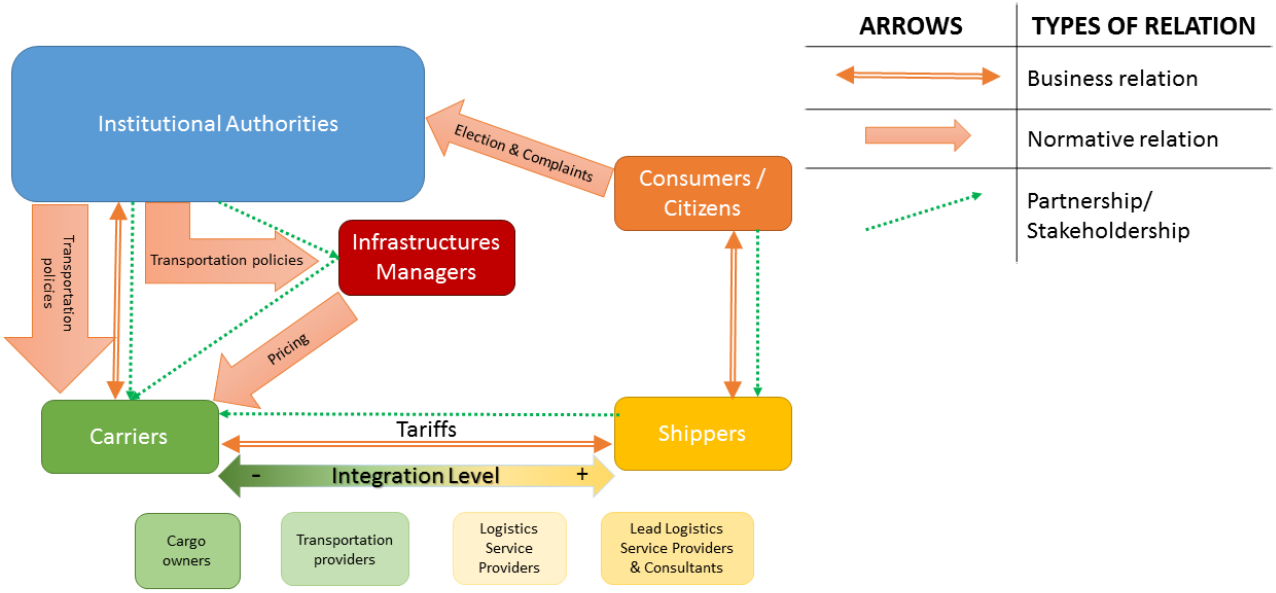

Figure 9 - An example of Social Business Network

3.2 Taxonomy

The challenge of this paper is to put together different types of firms belonging to the logistics world in order to try to have a complete overview. Therefore, in this first attempt, our aim is not to define in a very detailed manner all the aspects of logistics, since we analyze various kinds of enterprises, which are very different from each other from the point of view of the service proposed in order to achieve the transportation of goods and other related tasks.

As we wanted to focus on firms and their technological aspect, the taxonomy designed for this study is composed of three different axes, which represent the three main criteria used to classify the various aspects of the firms.
Those axes are Description, which gives an overview of the firm and its role in the logistics' field; the Business Model Canvas, in order to understand its business model, the customers and the actors playing around; and Technology, because we believe that in this era it is the key capability in order to succeed.

They are fully described as follows.

Description					
Number of services	Service type	Network type	Shipment consolidation	Geographical location	Territory
1 service	Carrier	Unimodal (road, rail, sea or air)	Yes	EU	International
1 principal service	LSPs	Multimodal (road, rail, sea and/or air)	No	US	National
More than one service	2PL	Intermodal (Yes or no)	Both	ASIA	
	3PL			CA	
	4PL				
	5PL				
	Provider of software solutions for logistics				
	Load board				
	Marketplace				
	TMS				
	Visibility Platform				

Table 2 – Description axis

Business Model Canvas				
Key Partners	Key Activities	Key Resources	Customer segment	Revenue Stream
Carriers Shippers LSPs Universities Payment processing softwares Provider of software solutions for logistics Load board Marketplace TMS Visibility Platform Other IT firms None	Transportation Tracking Inventory management Warehousing eSolutions eCommerce Freight rating Freight matching Routing	Fleet and buildings HR Software Acquisitions Carrier LSP Provider of software solutions Other IT firm	End customers (retailers, manufacturers, distributors and individuals) Carriers Shippers (retailers, manufacturers, distributors and individuals) LSPs	% on the price Fixed fee Unit price depending on quantities

Table 3 – Business Model Canvas axis

Technology					
Transportation technology		Information and Decision Technology	Connectivity		
Power source	Degree of automation	None	With partners and customers	With vehicles and cargo	
				IoT	ITS
Internal combustion	None	Big Data analysis	Informative collaboration		
Electric	Movement	Business Intelligence	Sharing of resources	Yes	Standard ITS
					Interconnected
Hybrid	Decision making	Artificial Intelligence	Collaborative decision-making	No	ITS
		Dynamic pricing and revenue management			
		Forecast capabilities			
		Simulation capabilities			

Table 4 – Technology axis

3.2.1 Description

This axis provides an overview of the enterprise and its context, focusing on:

Number of services describes the number of services provided by the firm. It can be:

- one service: the firm offers only a single service.
- one principal service: the firm is specialized in a specific service but offers also other services.
- more than one service: the firm is specialized in more than one service.

Service definition defines the service the firm offers to its customer. In the case of one service and one principal service will be characterized by only one description, in the case of more than one service, there would be several. As said before, we considered firms in the field of:

- Carrier
- Logistics service provider (LSP)
    - 2PL
    - 3PL
    - 4PL
    - 5PL
- Provider of software solutions for logistics
    - TMS (Transportation management system)
    - Load board
    - Marketplace

Network type specifies the degree of modal combination, meaning if one or more types of transportation infrastructure are used in a single shipment. It can be:

- Unimodal: a single shipment is transported by only one type of transportation infrastructure, which will be specified, choosing between road, rail, sea and air.

- Multimodal: a single shipment is transported by at least two types of infrastructures. In this case the list of transportation infrastructure used or supported by the firm will be provided.
- Intermodal: it involves the transportation of freight in an intermodal container or vehicle, using multiple transportation infrastructures, without any handling of the freight itself when changing modes. The firm can either do it (Yes) or not (No).

Shipment Consolidation (SCL) is the combination of two or more orders by different customers so that a larger quantity can be dispatched on the same vehicle to the same market region. It can be done (Yes), not done (No) or both.

Geographical location is where the firm has its headquarters. We considered firms located in the US, Canada, Europe and Asia.

Territory means the geographical extension of the firms, more precisely if it operates at a national or international level.

3.2.2 Business Model Canvas

The Business Model Canvas axis offers information about the categories present in the Business Model Canvas by Osterwalder and Pigneur (2010) described in section 2.1.3. which are:

Customer segment is the category of customers involved into the service that the firm proposes. In our case they are:

- Shippers (retailers, manufacturers, distributors and individuals)
- Carriers (carriers' firms or individuals)
- End customers (retailers, manufacturers, distributors and individuals)
- LSPs

Since each firm does not always have a single customer segment, it is possible to make a list.

Key partners: are other firms or entities that cooperates, building a strong and trusted relationship, to deliver a quality service to the customer. This category lists the network of partners and suppliers essential in running the company's business model.

- LSPs
- Carriers
- Shippers
- Universities (such as research programs or collaborations)
- Payment processing software (for online payments)
- Provider of software solutions for logistics
    - TMS
    - Visibility platforms
    - Load boards
    - Marketplaces
- Other IT firms: other firms associated with the technology industry which includes computer hardware, electronics, internet, telecom equipment and computer services.
- None

Key activities describe the strategic activities that must be performed to deliver the service, reach customers and generate revenues. They are activities such as:

- Transportation
- Tracking
- Inventory management: which supervises the flow of goods from manufacturers to warehouses and from these facilities to a point of sale. It keeps a detailed record of each product as it enters or leaves a warehouse.
- Warehousing: all the functions related to storing products and materials into a building.

- eSolutions such as
    - Freight matching: process of pairing shippers to freight carriers in an automatic way by using truck load boards.
    - Freight rating: defining in real-time the price at which a certain freight is delivered from one point to another.
    - eCommerce service: providing a service to electronically sell products over the internet on behalf of another firm.
    - Routing: creating the most cost-effective route through minimization of distance or travel time necessary in order to reach a set of planned stops.

Since the firms selected in the sample for the taxonomy are of different nature, we will consider key activities also those supported and made possible by the firm. For example, a marketplace firm does not directly transport items, but without its services that would not be possible.

Key resources are the strategic assets that a company must have to implement their own business model such as:

- Fleet and buildings, such as transportation vehicles, warehouses, buildings and infrastructures owned by the firms.
- Human resources (HR)
- Software: proprietary software that support and make possible the core activities of the firms.
- Acquisitions, which is when a company purchases most or all of another company's shares to gain its control. The company acquired can be:
    - Carriers
    - LSPs
    - Provider of software solutions
    - Other IT firms: other firms associated with the technology industry which includes computer hardware, electronics, internet, telecom equipment and computer services.

Revenue stream defines the revenues received by the company in exchange of one or more services offered by the firms. They can be differentiated in three categories:

- Unit price depending on quantities (for example, a price depending on the number of shipments)
- Fixed fee (for example, a monthly fee to sign in a platform or a contract)
- Percentage on the price paid

We decided not to include *Costs Streams* since those data are not disclosed by firms, and *Customer Relationship* and *Channels* since they are strongly similar from one company to another and not particularly relevant for the aim of this study.
Moreover, the *Value Proposition* was not included in this axis. We can find information about it in the following axis since it fits better as we discuss the solution implemented through the technology.

3.2.3 Technology

Technology is one way to describe how the service is provided to customers and how to yield meaningful information tools to support the decision making and through which data are collected and processed.

Transportation Technology: it describes the hardware technology used by the firm or supported by it. We furthermore divided it in:

- *Power source:* which can be one or more among internal combustion, electric and hybrid.
- *Degree of automation,* concerning transportation technology it can be:
    - None, when a vehicle is driven by someone
    - Movement, which means that it is able of moving without someone driving it
    - Decision making, when it is capable of making decision in autonomy

Information and decision technology are made by information systems that are designed to support the decision-making process in a complete and integrated manner. It can be:

- None
- Big Data: technology in order to analyze, extract information from, or deal with a large amount of data.
- Artificial Intelligence (AI): it provides a reliable insight by helping predict consumers' behavior through real-time data gathering, trend analysis and forecasting.
- Dynamic pricing and revenue management: setting flexible prices for products or service based on current market demands.
- Forecasting capabilities: predictive analytics which tries to understand and predict customer demand to optimize supply decisions.
- Simulation capabilities: the simulation of problems and solutions in operations research in order to adopt the best option.

Connectivity is the way we can classify the flow of data in input and output from the firm and how decisions are taken in the firm. It can be mainly of two type:

- With partners and customers
    - Informative collaboration, by which the only connectivity provided is the exchange of data between the firm and partners and customers
    - Sharing of resources
    - Collaborative decision-making
- With vehicles and cargo
    - IoT, which can be implemented (Yes) or no (No)
    - ITS, which can be standard ITS (that is composed by classical communication tools and GPS) or interconnected ITS with more advanced systems than the aforementioned one.

For each of the firms selected, all the axes will be analyzed and by comparing the results through tables and graphs, we will observe the current picture of the logistics' sector.

From this, it will be possible to make further considerations on the future by identifying the way the sector is moving, if the firms are shaping themselves in a similar way or if they are following their own path, if there is a hole in which nobody is interested in and the reasons beneath all of this.

4 The outcomes

This section highlights the results obtained by applying the methodology described in the previous chapter. Data were collected and processed in order to create a database to gather all the information and analyze them.

4.1 Actor ID

As you can see in the following pages, an actor ID was created for each of the customers identified, that are:

- Shippers (retailers, manufacturers and distributors)
- Carriers
- End customers (retailers, manufacturers, distributors and individuals)
- Logistic service providers (LSPs)

Those actors were analyzed, and a solution was proposed in order to solve pain, increasing gain and getting the job done by pooling together all the categories of solution providers that could help.

Actor's description: Shippers (retailers, manufacturers and distributors) Pains and gains: Need of reliable and on-time shipments at low cost Job: Sending items to a business or end user
Solution Providers: Carriers, LSP, load board, marketplace Pain reliver and gain creator: tracking system, coordination and control skills, instantaneous booking, freight visibility Product and solution: Through their network those firms are able to transport items in a fast and trusted way
Value Proposition: Managing the transportation without any problem from the pick-up to the delivery

Actor's description: Carriers Pains and gains: Low margins, need to optimize capacity, fleet and routing, empty miles problem Job: Transportation of items
Solution Providers: LSPs, load board, marketplace Pain reliver and gain creator: instantaneous booking, freight visibility, optimization skills, routing Product and solution: Through their network, they are able to fill up trucks and help increasing profits
Value Proposition: Offering freight in need to be transported, in an organized way and allowing to improve capacity and routing

Actor's description: End customers (retailers, manufacturers, distributors and individuals) Pains and gains: Need of reliable and on-time shipments at low cost Job: Receiving one or more items on time
Solution Providers: LSPs, carriers Pain reliver and gain creator: Tracking system, transportation means and coordination skills Product and solution: Delivering and keeping track of items in an efficient way
Value Proposition: Easy and reliable way to deliver items on time

Actor's description: LSPs Pains and gains: Need of a reliable and on time service increasing the value of their service and supporting it. Job: Transportation of items and other related services such as warehousing, inventory etc.
Solution Providers: TMS, LSPs Pain reliver and gain creator: IT systems, network skills, supply chain services Product and solution: Managing and delivering and keeping track of items in an efficient way
Value Proposition: Supporting freight transportation by increase efficiency, control and reliability

4.2 Social Business Network

According to the study and the Actor ID, we developed a Social Business Network in order to define the relationships between the actors.

The relationships may be of three types: normative, business and partnership.

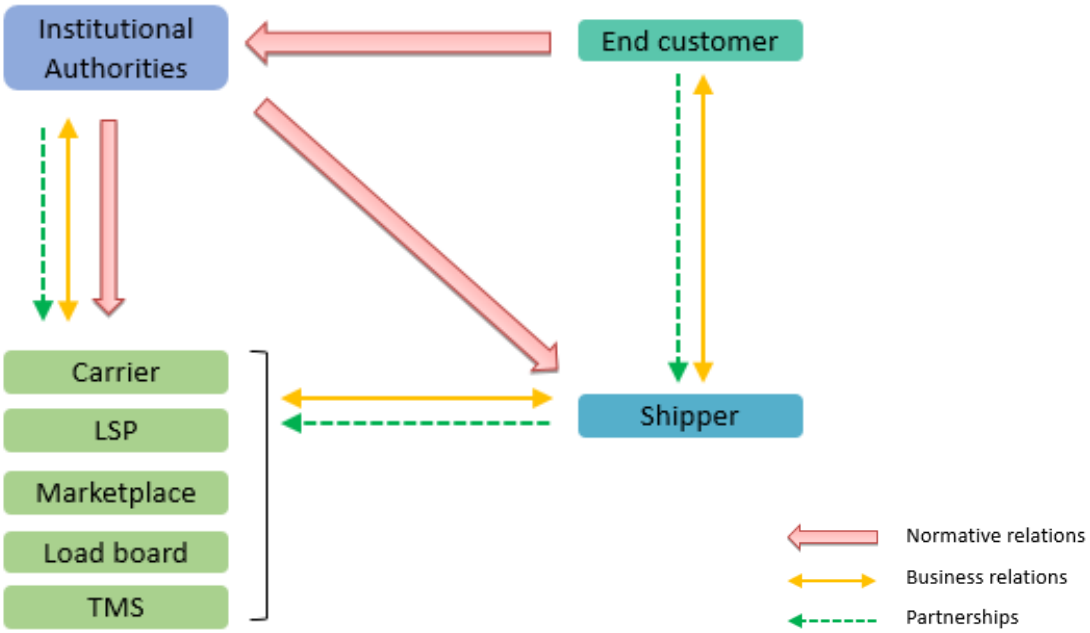

Figure 10 – Social Business Network

Institutional authorities have normative relations with each actor due to their nature: governments need to regulate and control exchanges by setting rules to monitor the incoming and outcoming movement of good through shipments.

End customers have business and partnership relations with shippers, due to the nature of their jobs.

Since the relations between carriers, LSPs, marketplaces, load boards and TMS are complicated, we decided to furthermore describe them in *Figure 12*.

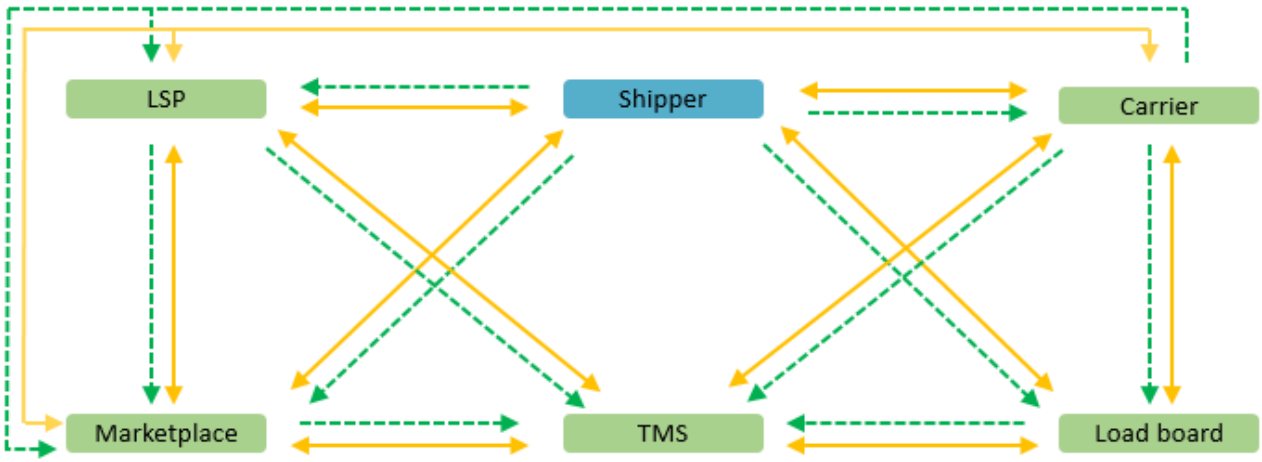

Figure 11 – Social Business Network, detail

As it is possible to observe, almost each player has a partnership or business relation with each other, therefore this industry is complicated due to the coordination and collaboration necessary to accomplish tasks.

In particular, shippers have links with everybody since they can choose the most suitable way to ship their items. They do not have relations with TMS since it directly supports logistics firms in facilitating to manage transportation and not shippers.

All the other logistics categories of firms have business or partnership relations since they help each other given the fact that each of them is specialized in different sectors.

The only thing we can observe is that marketplaces and load boards have no links, but this is explained by the fact that they are competitors, and this entails no collaboration between the two typologies of firms.

4.4 The taxonomy analysis

During my internship at Clear Destination I collected all the data needed in order to put in place the taxonomy, following the criteria described in the section 3.2, and I created a database. Then, I extracted the relevant information by analyzing it.

This first attempt aims to analyze the logistics industry and find its future path in terms of business model and technology.

This section will only contain the results of the taxonomy. We will discuss them after.

4.4.1 Description analysis

The firms selected and analyzed for this study are composed by ¼ 3PLs, ¼ TMS, ¼ marketplaces and the rest by carriers, 2PLs, 4PLs, 5PLs and load boards.

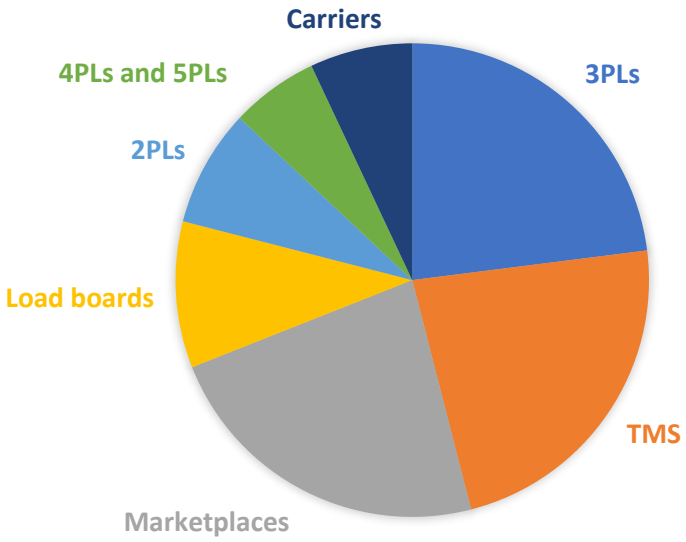

Figure 12 – Taxonomy composition

30% of them are based in Europe but all operate at an international level.
60% are US-based firms. ¼ of them work at a national level but it is understandable since they all are load boards or marketplaces and thus, in case of international services, it would require a wider carrier network and flexibility.
The remaining 10% are firms based in Canada or Asia and are mostly international.

20% of the businesses do not perform consolidation and operate only with full loads since it is simpler and requires less coordination, 5% move only little items and 75% of the businesses do both.

One out of three of the enterprises does unimodal transportation and are exclusively load boards or marketplaces since those are platforms made specially to match freight and truck drivers. The rest does multimodal: among those, all of them operate on the road, 88% on air and sea and 43% on rail. Moreover, 88% of multimodal firms do intermodal transportation.

Furthermore, every single multimodal firm moves freight through road, 88% through air and sea and 60% through rail.

Even if the percentage of air and sea modes in logistics firms is the same, air freight is more than four times as popular as sea freight. 9.5 billion tons of trade goods are shipped by boat worldwide each year, but over 42 billion tons of goods are transported by air and this is presumably because it is much faster.

4.4.2 Business Model Canvas

The most interesting aspect highlighted by this section of the taxonomy is the fact that there is a thick network of partnerships and collaboration existing between all this firms. In fact, they are all linked by customer-seller relations, and sometimes when link is strong, it is defined by a partnership.

Of course, whenever organizations are non-asset based, meaning they do not own a fleet, partnerships are always created with carriers or logistics service providers in general. More specifically we can find partnerships also between logistics service providers, since 5PLs need 4PLs, 4PLs may need 3PLs or 2PLs and so on.

Marketplaces and load boards are more likely to create partnerships with carriers and TMS or other IT firms.

And TMS mostly create partnership links with each other and with marketplaces and load boards, but also with almost every other category. This is explained by the fact that management systems are fundamental in order to collaborate in an efficient way and having everything in control.

On the other side, from the customer point of view, obviously shippers and end customers are the most redundant clients. Also carriers and LSPs are very quoted, since

they belong to the basic levels of logistics and sometimes they need to address to other actors in order to outsource some tasks to fulfill needs they are not capable to.

Another key aspect is that almost all the enterprises are software owners. Additionally, every firm analyzed is an expert in tracking, which implies that nowadays this service is taken for granted from the point of consumers.

For what concerns activities performed by firms, tracking is now a basic task for every single firm. It is also very common to find firms that perform inventory management and ecommerce. On the contrary freight matching and freight rating is performed only by marketplaces and load boards, even if it could be useful also for other categories of firms in this industry. Routing is done only by TMS and platforms, since they have the software able to do so and warehousing is accomplished only by the ones that possess buildings big enough.

4.4.3 Technology

We can now talk about the technological aspect, which is the central part.

Obviously, every firms transports freight with internal combustion means. But the percentage of firms using only internal combustion, both internal combustion and electric or hybrid or all of the options is interesting, as you can see in the diagram below.

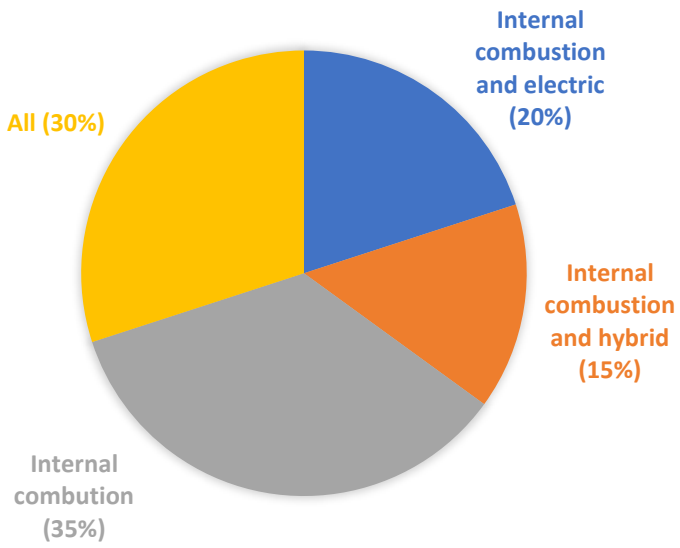

Figure 13 – Percentage of power source types in transportation technology

Of course, we must take into account that included in these results we considered also transportation technology supported by TMS systems, which is obviously all since it does not depend on the power source.

From the point of view of automation, 1 out of 4 of the sample firms are adopting movement automation which is mostly about drones' delivery and related researches. On the other side, 12% of the firms are doing research on decision making vehicles and some are already testing it.

We must now consider information and decision technology, which is a central aspect since nowadays it is fundamental to collect data in order to make future decisions.

Big Data analysis is performed by every firms as well as Artificial Intelligence which is usually used to improve customer experience by personalizing it, whereas Business Intelligence is implemented by only half of the firms.

Forecast capabilities, such as demand forecast, are employed by 65% of the organizations. This percentage is relatively high since it is very important to for coordination and collaboration.

Dynamic pricing is implemented by every marketplace or load board and also by some TMS.

Whereas simulation capabilities are used way less, only 15% of the firms apply it, but this is because it requires specific IT skills that are not always needed in a firm.

Concerning connectivity with partners and customers, we have different models: carriers only do informative collaboration, 3PLs sometimes also do resource sharing, but all the other firms' categories (such as 4PLs, 5PLs, TMS, load bords and marketplaces) share information, resources and decision-making because their work is not only about delivering a service, but also about trust and network, which makes connectivity among actors fundamental.
70% of the firms use IoT to connect with vehicles and cargo, 45% of which employ interconnected Intelligence Management systems while the rest operate with the standard one.

4.4.4 Cross-axis analysis

If we focus on US firms are more projected towards technological innovation, by choosing interconnected ITS instead of the standard one, by implementing Big Data, Artificial Intelligence, Business Intelligence, forecast capabilities, dynamic pricing and when it is possible also simulation capabilities and by trying to develop movement and/or decision- making automation. Canada is following this technological trend, preferring to develop platforms and software and then, Europe is next.

An important aspect to highlight is partnerships and collaborations in multimodal transportation. As said before, the results obtained from the application of the taxonomy to the sample of firms highlights that 2 out of 3 firms do multimodal transportation do deliver freight, but of course not all of them possess a fleet including each means of transport. So, partnerships and collaborations are developed between owners of such means and firms in need in order to allow this.

For the point of view of LSPs, we can affirm that they all perform multimodal transportation at international level and the great majority does intermodal too.

Moreover, only 30% of the LSP in the sample use internal combustion vehicles, all the others have already started to head towards other types of vehicles such as electric or hybrid.

When talking about load boards and marketplaces, it is possible to notice that forecast capabilities and dynamic pricing are almost necessary characteristics together with informative collaboration, sharing of resources and collaborative decision-making among the actors involved.

As for what regards TMS systems, some of the key activities performed are routing and inventory management and for this reason these are technologically advanced from the point of view of connectivity with partners and customers and with vehicles and cargo.

4.5 Comments

A common fact between all these firms is their intention to commit in going green, given that everybody is socially aware of climate change. In fact, reducing emissions may reduce costs and improve finances, but for many firms green freight is also about being good corporate citizens. Doing the right thing has seen over 70 percent of the 500 largest US-traded companies now issue Corporate Sustainability Reports. It has also seen many freight forwarders sign up to programs like SmartWay (U.S.) and Green Freight Europe. Good corporate citizenship can mean influencing other companies, such as Walmart's Project Gigaton, which requires sustainability commitment from its suppliers [17].
Another example of action against CO2 emissions is the carbon tax. Its purpose is to reflect the true cost of burning carbon making sure companies and consumers pay for the external costs they impose on society [18].

The issues of survival and future growth constitute the initial drivers of outsourcing non-core functions to providers that possess the relevant expertise, so that operating costs are decreased, and capital investments are avoided. Today, the drivers of outsourcing

have expanded significantly towards a more strategic direction, aiming to respond to the global competitive pressure, develop supply chain partnerships, reengineer business processes, achieve operational flexibility, penetrate new markets, access updated technology, share risks, optimize inventory levels and lead times, improve customer service and overall service quality, and broaden the portfolio of services. The risks that can arise from outsourcing are mainly referring to service or quality issues, loss of control over the outsourced functions, lack of trust and proper communication mechanisms, inability of management to communicate the notion of outsourcing to employees, financial affairs, and no actual value added.
An example of outsourcing could be third-party logistics companies that have a vast resource network that allows them to execute each step in the supply chain in an efficient and cost-effective way.

The evolution and advancement of collaborative software applications encourages the development of such partnerships supporting trust among firms. Furthermore, it has been argued that technology has allowed individuals and smaller organizations to connect to the world's knowledge pools to create an enormous set of opportunities for collaborations in supply chains.

Technology has had a major impact on supply chains as a facilitator of change as companies have transformed their process. However, it is also a major force in the dynamics of the market: individuals and organizations are connected 24/7 and have access to information on the same basis via the internet, search engines such as Google have made it possible to gather timely information quickly. We have become what some individuals describe as the "click here" generation. We no longer have to wait for information to be pushed to us via the media, we can pull information as we need it. Vast stores of data and information are virtually at our fingertips. Social networks are playing an increasing role in business organization and will influence supply chains because of the impact on customer demand and the speed of information transfers.

The internet has empowered buyers and conditioned them to expect price visibility, service ratings, instant service, and more. Technology is seen as a means to an end: building a business that provides customers with what they want.

For the past three years, Freightos has conducted mystery shopping surveys of the top twenty global freight forwarders, measuring freight digitalization. The 2018 report shows a massive jump in platforms offering instant online freight quoting, up from just one to five. In other words, those firms can provide quotes in seconds, whereas the manual companies take hours of work and the customer experience gap is tangible.

The two IT capabilities shippers most demanded are tracking and real-time booking, both of which give customers transparency. The advantage of these are that both can save time and reduce cost as a consequence, for both logistics firms and shippers, while improving service reliability. In short, shippers are expecting logistics providers to find those efficiencies by automating processes.
Technology is changing the way logistics actors have to serve their customers, but it should also be seen as a way to help them run their businesses more profitably.

For real impact, though, we must look beyond the hyped hardware technologies: the core infrastructure required to move freight, such as containers, planes and trucks, is not fundamentally changing. Improving the data movement that guides freight movement is seen as key to increasing efficiency.
Due to technological development, large areas of logistics that were once computationally intractable are now open for exploration using the power of optimization for creating important opportunities to advance theoretical and practical understanding.

The Big Data technologies are fundamental to analyze data and gain insights that can help in making strategic decisions. Whether we realize it or not, the collection and use of customer and operational data affect a growing number of our everyday activities. With the help of modern predictive optimization tools, logistics companies can shift to an anticipatory strategy based on accurate demand forecasting, and thereby achieve far

greater operational efficiency. Thus, it is fundamental to implement a forecasting model to predict capacity demand, relying on a combination of their own historical data and multiple external variables. Most logistics firms are tracking each of their activities by collecting data about every aspect of their business and every piece of freight they move. And doing this will lead to more effective utilization of company assets, lower costs, and better customer experiences.

One example of the utilization of Big Data combined to Artificial Intelligence is dynamic pricing of freight. By understanding trends such as seasonality, weekly and monthly fluctuations, or just specific contracts, it is possible to reflect them in almost daily price changes and perform revenue management.

Logistics companies are also making great strides with autonomous vehicles: industry giants are starting to leverage the technology into their transportation. Google, Mercedes Benz and many others are investing heavily in the concept of autonomous vehicles, it is only a matter of time before autonomous trucks are seen on roads around the world. Moreover, autonomous vehicles are already starting to be used within the warehouse by assisting the human employees with picking, sorting and moving goods. According to an analysis from the World Economic Forum, by 2025 the technological transformation of the logistics industry could bring $1.5 trillion of value to logistics players, plus an additional $2.4 trillion worth of benefits to society through reduced emissions, less traffic congestion and better prices.

We can also combine AI with IoT, which is a network of devices that can share data among themselves and track all sorts of data wherever it has sensors enabled. This can furthermore help collecting data, controlling fleet and planning demand.

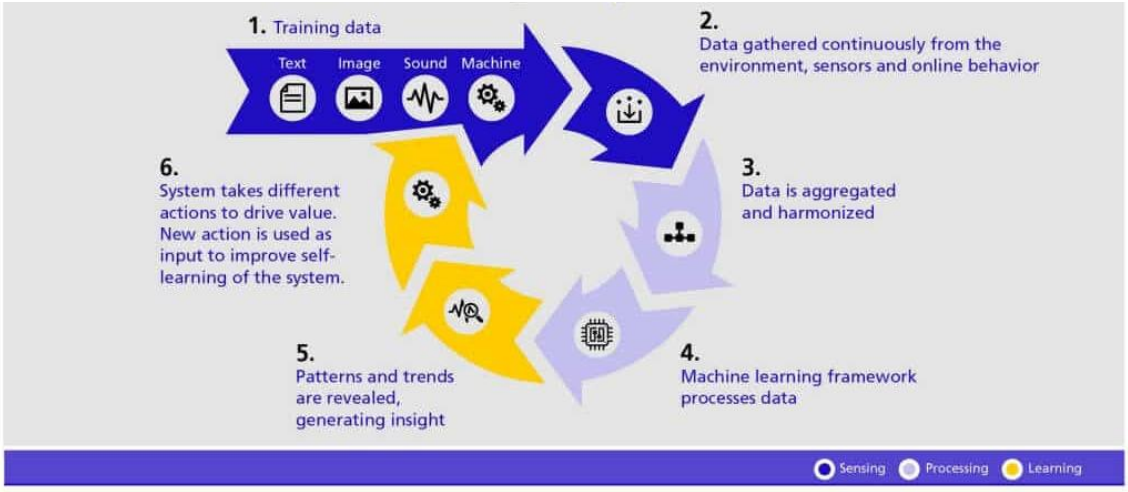

Figure 14 – AI cycle (Source : IBM)

Talking about freight matching and technology, according to a 2016 report by Strategy&, part of PwC, "Trucks will eventually be able to determine whether they can take on additional freight. The truck trailer itself will be able to determine through sensors its available space and weight, as well as scheduled route, ETA and other relevant information, and communicate this data to a digital freight-matching platform" [19].

Since the technology supporting logistics is evolving, also actors may change. In fact, 2PL and 3PL will probably start disappearing because marketplaces are starting to be more convenient and cheaper. On the other side, 4PL and 5PL are expanding since they are about trust and cooperation, add more value for customers and finally, reduce costs.
Network facilities (plans, distribution centers, terminals and so on) and supporting transportation services have always been considers important. However, the network system in a dynamic, global environment is critical. One of the challenges is the rapid changes that can take place. Companies and other organizations need a network system that is capable and flexible to respond and change with the dynamics of the marketplace whether in the short run or the long run.

Food, furniture, electronics and clothing are by far the most commonly shipped varieties of items in the U.S. These items make up the majority of the income for shipping companies. In fact, various businesses use internal e-auctions in order to define which

shipping modality is more convenient. An e-auction is a transaction between sellers and bidders that takes place on an electronic marketplace.

From the seller's point of view, it provides professionals with competitive prices for their products, pitching the suppliers directly against each other to see who can offer the lowest prices. It also streamlines the procurement process and saves times, since each supplier is not required to submit a full proposal.

Whereas, from the bidder's side, a winning bid can lead to more business and to compete in new sectors.

5 Conclusions and future perspectives

Changing an industry is a gradual process. What appears as small changes today, may be precursors to massive shifts in direction. This first attempt of study aims to understand the perspectives of those at the helm: how are they approaching current challenges, and which direction they are following.

The value proposition that creates end-customer value is a combination of efficiency, effectiveness, and relevancy. The fundamental question becomes "How should a firm be structured to create end-customer value as it moves into the 21st century?".
Given the change in end-customer perceptions of value, firms need to rethink their value drivers and reposition their product or service offerings. Firms must develop the ability to satisfy not only existing needs but also those that may emerge. By continuously matching service capabilities with changing customer expectations, providers can stay ahead of competition. Take for example freight tracking technology: it started relatively recently as an expensive value-added service that few firms could offer and few shippers could afford. Today even small shippers won't ship unless they can check the status of their shipment.

Outstanding customer service is important when business is going well; understanding customers is absolutely crucial. This means recognizing what shippers are looking for in a logistics relationship. Two factors critical for shippers when selecting providers are reliability and cost, while communications, crisis management and a close relationship are well behind.

Then there is the demographic reality. More and more of today's logistics managers and freight buyers grew up with a smartphone in their hand and take for granted instant access to streaming video, e-commerce shopping and, in general, everything they needed when they wanted it. Actual logistics managers have used high tech modelling, gaming, and forecasting software most of their young lives and unsurprisingly, they now expect instant service from logistics providers.

By 2025, over 50% of the global workforce will be millennials, people born between 1980 and 2000. By their early teens, most of these employees in advanced economies were online. A millennial born in 1984 was just 10 when Amazon was founded, and 18 when Facebook was founded. When they joined the workforce, 50% of US mobile users had already migrated to smartphones. And they are expecting advanced technology at work since they are running procurement and logistics departments. This explains why, according to logistics providers, 83% of their clients want real-time tracking and 70% want online booking: millennials grew up with exposure to ecommerce shipping, which provided that. New workers with new expectations are searching for new technology and new platforms [19].

Given the importance of technology for logistics services and given the speed of technological change, firms will have to renew their hardware and software technology regularly to stay competitive. Information technology should therefore become one of the key focuses of their investment strategy, allowing to integrate the different components of the supply chain and facilitate information flows. But in addition to infrastructure and technology, also human capital is important. Logistics employees are also key assets in the logistics industry's ability to adapt to changing conditions and take advantage of new market opportunities. Logisticians are key partners in rethinking firms' supply chain strategies and ensuring success on international markets by controlling costs. This will require that they remain informed of the evolution in the sector and ready to adapt and retrain.

A new consortium called the Blockchain in Transport Alliance (BiTA) is working to apply blockchain to solve some of the biggest problems in trucking. Companies from each piece of the logistics' industry have joined BiTA, including: UPS, Salesforce, McCleod Software, DAT, Transfix and other firms all being part of the study conducted. If implemented well, blockchain could be a way to make the entire trucking supply chain more efficient. But to do so everyone should trust the blockchain as the single source of truth, small carriers and shippers should participate en masse and the entire industry should embrace data standardization. All of this is not easy, but it's feasible [20].

As we know, the foreseen resource shortage and sustainability requirements have significant impacts on logistics and supply chains worldwide. Therefore, sustainable transport systems will have to be developed even more. According to IBM, “much of the opportunity to address CO2 emissions rests on the supply chain, compelling companies to look for new approaches to managing carbon effectively – from sourcing and production, to distribution and product afterlife”. A report from PRTM says that “Environmental sustainability is a key consideration in the development of future globalization strategies. Today, sustainability is mainly driven by the need for regulatory compliance and satisfaction of customer demand. It is yet considered a strategic differentiator”.

Although the green supply chain strategy involves a large investment and uncertain economic payoffs in the short term, organizations should be willing to adopt the green supply chain strategy for development in the long term. Today’s rising energy costs, and global concern about greenhouse gases and climate change are driving the world’s largest companies to pressure suppliers to go green and to focus on environmental and social issues.

In the last two years, green freight has gained significant momentum. With new tools to support them, carriers, forwarders, and shippers are increasingly utilizing new technology, optimizing process and encouraging green freight. From being the outsiders of the Paris Agreement, players in the freight industry are now set on making a difference.

A side of logistics optimization that remains to be explored for companies is the integration of small logistics firms into a larger corporate-scale business. For the moment, smaller-scale enterprises consider only local needs and are excluded from big organizations’ efficiencies.

Another relatively unexplored area for the application of logistics optimization is the area of recovery from disruptions and disasters. The goal would be to create a method to rapidly determine the best way to move necessary items with available transportation links after hurricanes, earthquakes, fires, acts of terrorism, or other catastrophic events.

Optimization would necessarily play a major role in the in the most efficient recovery of the logistics function.

An additional new force is also driving change in the industry: venture capital funds are interested in the logistics market. For many investors this is quite a change from their previous focus on consumer internet technologies, such as social networks. Investments in logistics has exploded, starting with $1.5 billion dollars of investments in 2015 alone and rising even more in the following years.
Market need and available funding has driven an increase in logistics startups. Online platforms, like Convoy, have proliferated, attempting to replicate sharing economy successes from other industries.

Logistics shows an intense and diversified evolution that will not slow down in the coming years. Globalization of goods movements and of transport and logistics networks, outsourcing of a wider range of services to third-account providers, digitalization of logistics management, automation of warehousing and of vehicle driving, changes in manufacturing, trade, distribution and consumption patterns, search for a “green” mobility of goods, are all key components of the “new logistics”. Freight transportation is changing considerably and will face huge growth and sustainability challenges. According to the International Transport Forum, “growth in the world road and rail freight volumes to 2050 ranges from 230% to 420% depending on freight intensity of the future GNP growth and international trade related CO2 emissions will grow by a factor of 3.9”.

An important outcome is that in the future logistics companies will need to focus on updated technology, cost efficiency and innovation if they want to meet changing expectations. Building and refining those capabilities and then bringing them to scale across the enterprise will be a key factor.
Technology can be viewed as a change driver, but it is also important as a facilitator of change that will lead to improved efficiency and effectiveness. The challenge is to evaluate and successfully implement the technology to make the improvements desired. The approach necessary is to analyse and adjust or change processes, educate

the people involved, and the select and implement the technology to facilitate the changes in the processes.

Moreover, the results obtained from the application of the taxonomy to the sample of firms highlight that collaboration between firms is fundamental and necessary in order to increase efficiency and to innovate in order to ensure the development of this industry.

Index of figures

Index of tables

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