POLITECNICO DI TORINO

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Master of Science in Production Engineering

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Integration between Supply Chain and Last Mile Logistics

M2Log Business Case

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Summary

Introduction

In the recent years, companies' attention towards the last phase of the distribution chain (the so-called *last mile*) has exponentially grown given the great economic impact that this phase entails on the entire chain. On the other side, the service offered to the final consumers, new delivery methods and business models especially connected to online channels has been arising more and more frequently enabled by ICT technologies and digitalization of processes. The new trends of *same day delivery* and the general reduction in waiting times, for instance, are representing huge challenges that today's companies are facing and try to solve in order to possibly obtain new competitive advantages within their reference industry.

These two elements together are consequently requiring a greater support in order to reach the set targets from the entire supply chain. In order to effectively offer new services to the final consumers, a strong integration of all levels of the supply chain in fact is required, and a particular attention to the last part of the supply chain must be devoted, adapting the entire chain operations to a last mile perspective and creating an adequate framework to support innovative distribution processes.

Furthermore, the increasing attention to environmental sustainability by the final consumers introduces new elements of complexity that often require major companies to adapt their operational structure consequently. The adoption of *lean manufacturing* techniques not only at production level, but also within their distribution channels allow companies to achieve a substantial reduction in waste, which practically means less capital invested, and greater *brand visibility* with respect to their competitors.

In this challenging context, the fast fashion industry distinguishes for its peculiarities, such as shortened lead times, faster inventory turnovers and high order fulfillment rates for customer demand at its peak points. The industry is highly competitive and is intensively oriented to costs, besides the ability to offer the newest possible trend to the customers. this requires a high degree of responsiveness and efficiency at the same time.

The project of the DIGEP department of *Politecnico di Torino* was born in collaboration with the Miroglio Group, an Italian company that produces and distributes ready-to-wear clothing and fabrics. The Miroglio Group is basically divided into two separate and autonomous divisions: *Miroglio Textile*, for the production of fabrics, and *Miroglio Fashion*, which takes

care of the necessary phases for the production and sales of garments. In particular, the Fashion division includes the *fast fashion* segment, with 1,100 branded stores (Fiorella Rubino, Motivi, Oltre) all over the world. The logistic service of Miroglio Group is managed by the subsidiary M2Log in order to optimize the current supply chain operations. Currently, M2Log has a single central warehouse located near Pollenzo (CN), which distributes the totality of items from the various production plants to the stores.

The aim of the project was to find and analyze several solutions that could improve the overall inventory management performance of the company in Italy with a focus on the final section of the supply chain, evaluating the impacts on the adopted forecasting models as well.

In order to design the solutions, as first step an initial analysis on the current Miroglio Fashion's situation has been performed thanks to *Fiorella Rubino*'s data on the whole season Spring 2017. Through a deep data analysis, it was possible to clearly understand the garments' movements across the Italian territory and fix a reliable starting point used then as benchmark. Besides, some interviews were organized and conducted with the main stakeholders within the fashion industry supply chain (i.e. internal commercial department of Miroglio Fashion, store managers, other external companies and express couriers) in order to identify the main *needs* to be converted in the subsequent design *requirements* to structure viable alternatives in line with the requests of the market. These identified needs, merged with a meticulous literature review, led to the generation of four different alternatives, of which the most promising one in accordance with the company, was analyzed from an economic point of view in order to understand the real effectiveness of the solution itself.

The thesis in divided in 5 sections. The first chapter aims at identifying the main features of the last mile step of the supply chain, its stakeholders and new emerging concepts and trends in this final phase of items' distribution. Moreover, most updated projects and new solutions in this field of research are presented with a particular focus on those supported by worldwide universities. Then, the second chapter analyzes the new emerging trend of same day delivery and its pre-requisites for a sustainable implementation to conclude with a wrap up on the main companies *must have* for competing in the future environment of distribution industry. After an introduction on the fast fashion supply chain management and its intrinsic features, Chapter 3 introduces the M2Log business case first of all explaining the current adopted management procedures across the store network, with a deep AS IS analysis developed using

data provided by the company. Following Chapter 4 reports the results obtained by the needs and requirements analysis thanks to the conducted interviews, whereas the last Chapter 5 shows all the design generated alternatives for the implementation of a new logistic service and lastly the economic analysis of the selected one with the consequent implications. Finally, some conclusive remarks, limits and possible future steps of work are discussed.

1. Last Mile Logistics

1.1. Last-mile delivery processes

Today's business environment has become increasingly competitive. This causes enormous pressure for many companies in many industries. In such environment, companies need to continuously search for ways to design and manufacture new products, and distribute these items in an efficient and effective fashion. For many years, companies focused their efforts on reducing costs occurring in the manufacturing processes as well as other operations., but now there are an increasing number of companies looking at distribution and recognizing it as the last frontier for cost reduction (Yang, 2013); for instance, nowadays, logistics costs constituted about 30% of the cost of the products sold in the United States (Eskigun *et al*., 2005), which still represent a large share of the total costs. In addition, distribution is a major driver of profitability in a company also because it has a direct impact on the *customer experience* (Chopra, 2003) and therefore a good design of a distribution network is essential to achieve some logistics and supply chain goals, ranging from low operational cost to high customer service level.

In this complex scenario, the Last Mile (LM) is becoming more and more relevant. It can be considered as the last step of the supply chain process, where the goods finally reach the final recipient (which could be intended as the final consumer or the last step of the value chain, namely stores). Although the name implies, it is the final mile delivery, actual LM delivery can range from a few blocks to 50 or 100 miles. Moreover, it usually entails the use of parcel or small package carriers to deliver products. According to McKinsey (Joerss *et al*., 2015), parcel shipment are valued at more than $83 billion, and the growing e-commerce market will double in value in roughly 10 years in mature market. Many scholars have agreed that last-mile distribution constitute one of the most expensive (Goodman, 2005), least efficient (European Commission, 2011) and polluting portion of supply chains (Filippi *et al*., 2010) , making up the 28% of a shipment total cost on average. This is due to multiple reasons, ranging from the fragmented nature of last-mile deliveries (Edwards *et al.,* 2010), loss of efficiency from road congestion and the use of polluting vehicles and less than optimal routing optimization by small transportation companies which account for a large share of last-mile deliveries (Danielis *et al.*, 2010).

Basically, the delivery process is composed by activities connected to receiving, processing, and fulfilling customer orders, including the validation, packaging, invoicing, and shipping of items to the final customer (Supply Chain Council, 2012). From a purely logistics point of view, activities of the last-mile delivery process comprise the consolidation of items ordered by different customers, their warehouse management in terms of receiving, handling and storing (Sink *et al.*, 1996), the loading of vehicles and delivery scheduling throughout optimal vehicle routing algorithms (Balcik *et al.*, 2008), and lastly the selection of the carriers.

1.2. Last-mile general stakeholders

As far as the general stakeholders involved in the last mile section of the supply chain, it is possible to generally recognize two main actors, namely third-party logistics service provides and retailers. Of course, the following paragraphs represent an initial presentation of their main features just to have a general and shared understanding of them. It is advisable that in practical business cases, such as the one presented in Chapter 3, to analyze the situation at hand each time with a more focused approach, in order to clarify operational details and characteristics to avoid mistakes due to lack of a comprehensive understanding.

As introduced, last-mile delivery is often outsourced to *third-party logistics service providers*. According to some industry surveys the most outsourced services to 3PL are direct transportation services, warehouse management, shipment consolidation and carrier selection (Lieb and Miller, 2002). With the rapid increase of the e-commerce, it has become more challenging for 3PLs to achieve profitability and at the same time maintain a high level of service (Lai *et al.*, 2004). Hence, successfully designing and implementing an efficient a last-mile distribution has become a new operational competitive advantage in the market. In this context, logistics companies are trying to achieve operational efficiency, especially in terms of warehouse efficiency (Hamdan and Rogers, 2008). This operational efficiency is usually assessed by measuring the operational outcomes in terms of tons transported, distance travelled per year, and space utilization in relationship with the inputs and resources of the logistics system such as fleet size, number of employees, labor hours (Boccia *et al.*, 2010). The higher the efficiency of a 3PL, the higher its productivity in terms of the amount of customers' request it can fulfill, which is a key ingredient of 3PL's profitability and therefore their ability to stay in the market. Productivity of a 3PL is thus a measure of service efficiency and the level of customer satisfaction achieved (Ehmke *et al*., 2012).

Regarding retailers, from a logistics point of view, they are looking for a reliable and lean delivery process to fulfill their orders without hindering their daily operations (Macharis *et al.*, 2012). In particular, the operations of loading, unloading and controlling inbound items should be lean and fast, avoiding that stores' personnel waste too much time in that store preparation rather than help customers in their purchasing process. Therefore, retailers usually establish strict delivery time windows for receiving the goods (den Boer *et al.*, 2017), which has proven to be a difficult and expensive challenge.

As previously mentioned, last-mile distribution generates negative externalities that local administrations aims at minimizing by introducing new policies restricting the access to polluting vehicles or supporting more eco-friendly behaviors (Danielis *et al.*, 2010), by for instance consolidating goods from different 3PLs in urban consolidation centers (Browne *et al.*, 2005).

1.3. Inventory management and last-mile

Taking into account that the whole delivery process is basically finalized to meet the customers' desires and enhance their overall satisfaction, the importance of retailers is surely high, since they represent the last step of the value chain at hand and the real interface with the customers. Therefore, the delivery process tries generally to shape itself in accordance with their needs and requirements, in order to provide a logistic service that is suitable for each desired ordering policy in order to place the stock on the shelves at the right moment. For these reasons, inventory management is another critical activity of supply chain management, which has in particular a significant impact on the last-mile.

As a matter of fact, store managers try to have enough items on the shelves to attract customers and provide at the same time a large variety of assortment which implies an increase the inventory level. However, retailers rent expensive locals inside the city centers and shopping malls, which of course leads to a reduction of storage space. This emerging trade off is really tricky since it entails a high level of optimization of the inventory level in order to fulfill the customers' requests, controlling at the same time costs and resources' waste.

Inventory management procedures hence need to be carefully designed since the cost for misplaced orders is quite in particular high for small retailers (D'Andrea *et al.*, 2006). In particular, across the wide variety of existing goods, fast-moving items are surely those which

are the more interested in the adoption of a frequent and reliable ordering policy (which implies smaller volumes) due to the risk of stock out. As a consequence, the logic behind B2B deliveries is becoming increasingly similar to the one used for B2C deliveries, adding further complexity the last-mile logistics activities and increase the need for efficiency and optimization.

Online retailers on the other hand exploit economies of scale by storing a wide selection of items in large warehouses located outside the city centers, which allows to have a lower number of stored units and extremely lower rental cost for space. Consequentially, in the future, the real challenge is represented by the complete and effective integration of the online and physical channel in order to optimize the logistic operations and at the same time provide an omni-channel experience to the final customers.

1.4. City Logistics concepts

City Logistics emerged in the end of 90's as a comprehensive concept incorporating both research and practice in the effort for optimizing last mile activities to achieve operational benefits and reducing the negative externalities that such activities generate (Behrends, 2016).

Among the city logistics concepts that received the deepest attention consolidation centers, micro-consolidation centers, electric delivery vehicles and automated parcel lockers station are the most relevant that have been identified.

Urban consolidation centers (UCC) are warehouses where goods are delivered by different suppliers or 3PLs and are later managed and loaded for the last step of journey inside the city center, for the final delivery to local retailers (Fig.1). The objective is to centrally manage the last mile so to consolidate the deliveries using a lower number of vehicles to reduce the total amount of vehicle trips in urban areas, increasing efficiency and reducing also traffic congestion, which is nowadays a common feature of large cities. Most of these UCCs were initially built by public authorities who later on outsourced operations to specialized 3PL which are more profit oriented and focuses on higher productivity targets. However, it happens that sometimes independent companies also establish a own network of UCCs (Van Rooijen & Quak, 2010). Usually UCCs target local retailers providing them fewer deliveries per day and a more pleasant business environment, but also by offering buffer storage to decrease inventory costs in stores.

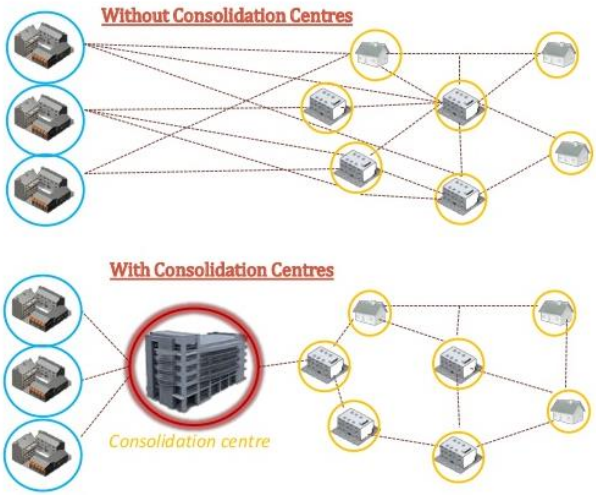


Figure 1 Last-mile delivery with UCCs.

To maintain the goods consolidation goal of UCCs and further decrease the negative impacts of freight vehicles, goods are being delivered by traditional or electric vans to smaller warehouses, called terminal satellites or *micro-consolidation centers* (MCC), located inside the city centers (see Fig. 2). Thanks to the proximity to the final delivery points, delivery lead time are extremely reduced (even if the large construction investments of these facilities represents an actual challenge despite the positive return from an efficiency and environmental sustainability point of view) and goods are transshipped to lighter and smaller vehicles for the final phase of the delivery. In some cases, this system has proved to have positive impacts in reducing total distance travelled and CO_2 emissions (Schliwa *et al.*, 2015).

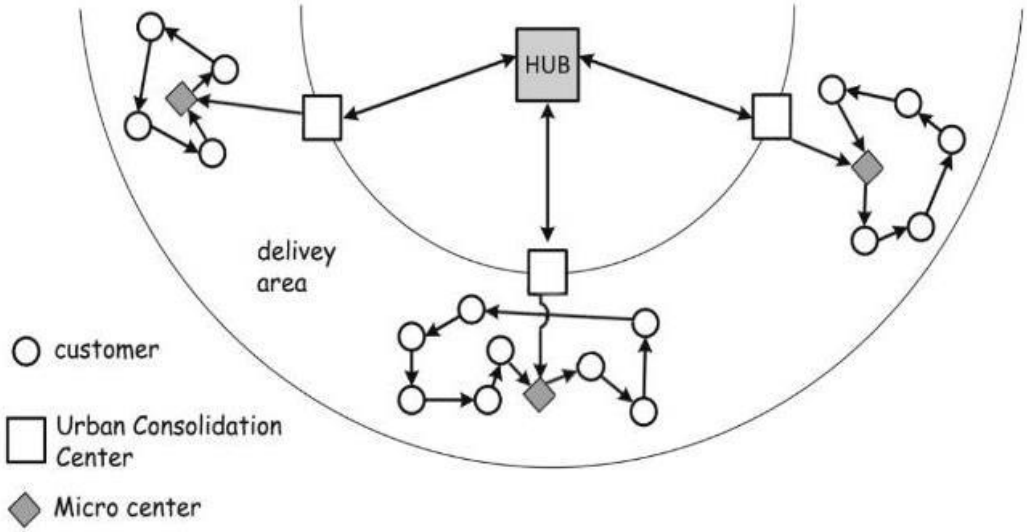


Figure 2 Delivery with micro-consolidation centers

However, these MCC must be located in strategic positions and since the requested space is not extremely huge they can be used for the requalification of unused buildings, decreasing the rent/purchase expenses, which represent one of the largest offender of the total costs. On the other hand, a consolidation center usually carries out complex activities, such as the preparation of bundles, storage and re-stocking of the inventory in order to promptly react to an unforeseen increasing demand; whereas in a MCC the number of activities is lower and therefore more lean and easier.

Regarding the introduction of *electric delivery vehicles* in the last mile delivery, this is a recent phenomenon that is becoming more and more popular in the industry. Several start-ups base their business on these activities (such as Pony Zero) and therefore the interest on this topic is continuing to grow also from a research point of view. Surely, the relatively low fuel autonomy of such vehicles makes them more suitable for short distance delivery trips than for long distance freight transportation, but several constraints must be taken into account also as far as the load capacity is concerned, since these vehicles have a definitely lower capacity in comparison with the more traditional truck, hindering the possibility to achieve a good profitability (Van Duin *et al.*, 2013).

Automated parcel lockers station are composed by modules with several lockers where parcels are shipped and retained until the customers autonomously pick them up. They aim at solving the well-known problem of first-delivery failure of B2C deliveries, when the customer is not at home and therefore the driver needs to take the parcel back to the distribution center, reducing profitability and worsening operations optimization. For instance, Amazon launched few years ago the service Amazon Locker which substantially used this methodologies to solve this problem (in November 2017 Amazon launched also the service Amazon Key, which is still in its early stages) and also other several actors are trying to enter in this new market sector, such as InPost, Bringme or MyPUP. Basically, these companies build network of parcel locker stations and rent them out to 3PLs to solve the first-attempt failure. In any case, parcel locker station are installed in easily accessible and popular places, such as office buildings, service stations or shopping malls (Janjevic *et al.*, 2013). On the other hand, there are also some negative aspects, since, for instance, this easy accessibility entails high rent expenditures and therefore, in order to reduce space needed, these lockers are also capacity constrained, since they can contain only small-medium sized parcels.

From another point of view, it emerges that parcels lockers do not really appeal to customers despite the possibility of picking up 24/7. Indeed, according to McKinsey survey, only if home delivery were cost EUR 3 more than a pickup at the parcel locker, about 50 percent of respondents would prefer to use parcel lockers, emphasizing again the high value consumers assign to home delivery. Since costs for parcel-locker delivery are often not significantly below regular parcel delivery costs, due to the aforementioned high real estate prices, it is reasonable to assume that this form of delivery is unlikely to have a large impact in the market. However, the ability of a company to send certain items to a parcel locker clearly increase the value proposition offered to final customers which usually appreciate the variety of delivery options since it adds flexibility in accordance to their daily needs.

1.4.1. The effect of CL projects on last-mile processes

The reported introduction on CL concept and its main features allow to define a first initial background on techniques and emerging trends to support the current distribution optimization problem. Nowadays, the operations research field investigates the joint problem of optimizing the storage location and the vehicle routing in order to model an efficient distribution system with satellite terminals (Boccia *et al.*, 2010). Those simulations highlight that setting up consolidation centers near to large distribution center, locating them outside of the city center might reduce the total distribution cost.

However, nowadays, it is no more an optimization problem since more variables should now taken into account. For instance, it is necessary to remind that warehouses in city centers are characterized by a limited availability (that fact is usually not taken into account in software simulations). Moreover, new requirements are emerging such as reduction of emitted pollutant and reduction of cities' traffic congestions and on the other hand also more constraints are now put by public authorities on the freight operations. Therefore, it is necessary that all those variables were taken into account and reliably evaluated to assess correctly the possible impact of new delivery procedures. In the following paragraphs, some analyses are reported to highlight main initial findings in that field of research.

For instance, Figliozzi (2007) evaluated the potential effects of three public policies, namely the limitations in vehicle dimensions, the prohibition of trucks passage in some areas of urban road network and lastly the restrictions on loading–unloading areas. Main findings emerged are that restricting loading–unloading zones definitely increase the time to serve a customer

and the average tour length, hence increasing overall distribution costs. In addition, a decrease in shipment size will obviously generate a higher delivery frequency which usually results in more inefficient routing as a consequence.

Iannò, Polimeni and Vitetta (2013) proposed a vehicle routing problem with optimized road network and reserved lanes for city logistics distribution, showing that this policy might reduce the freight transportation costs. Dynamic and time-dependent routing algorithms have been proposed to exploit ICT infrastructures that provides real-time information on the traffic to optimize the operations of freight carriers (Ehmke et al., 2012).

From a retailer's perspective, a UCC may offer buffer storage services to increase their stock capacity (Van Rooijen & Quak, 2010), and therefore affecting their ordering policy and changing their stock location. In conclusion, most of these works are theoretical or descriptive in scope, and more empirical efforts are needed in order to understand the issue and provide more insights into the effect of CL innovation on last-mile processes.

1.5. First Initiatives and New Solutions

1.5.1. University Support

Despite the increasing importance of LM and the adoption of delivery methodologies in accordance with it, companies and public entities usually do not have exactly the idea of the overall complexity about the LM logistics data. For this reasons, some universities have started to develop projects on these topics, which aim to better understand the mentioned complexity in order to share the acquired knowledge and to sensitize institutions and private entities. For instance, *LastMile* is an initiative from the MIT Megacity Logistics Lab which is born with the described intention of providing interesting information on the urban logistics, with a detailed focus on megacities. Indeed, according to Edgar Blanco (Blanco, 2013), megacities are the major urban areas with populations over 10 mln inhabitants with densities in emerging markets like Mumbai that can be as high as 20,000 inhabitants per km^2.

Most megacities are commonly located in developing nations and rapidly emerging markets. These cities continue to expand both in population and surface and 31 of them around the world represent almost 15% of the global GDP and are expected to increase to 20% of the global GDP in the next 10 years. Usually, that implies an overloaded transportation network, which is not designed and structured to support both the mobilization of people and the items

distribution the same time. Moreover, another major limitation of those logistics is the lack of adequate information systems to support an effective achievement of operations. Many urban logistics networks rely only on trucks, drivers, and mobile phones without any other technological support. This provides a very little information exchange among the actors involved in the distribution process (i.e. the distribution center, the driver and the receiving customers). Therefore, given these aforementioned challenges, the Megacities Logistics Lab developed two platforms that could help both businesses and policymakers in a better visualization of the distribution data of the whole supply chain of course with a particular focus on the last mile phase, in order to make better decisions in real time operations, logistic plans, as well as long term urban planning.

The first platform, called *Km2*, aims to display key information for km^2 areas in large cities around the world. The visualization provides representations of each km^2 through freight deliveries, road traffic flow, and characterization of stores, which could enhance operations' real-time decisions not only in emerging markets' megacities, but also in smaller urban centers in more developed countries, more interested not only in setting a well-developed network (which is already existing) but also in reducing negative externalities optimizing the delivery process itself. Indeed, Km2 began with nine cities (Beijing, Bogotá, Boston, Kuala Lumpur, Madrid, Mexico City, Santiago de Chile, São Paulo, and Rio de Janeiro) but is planned to be expanded to include other major cities around the world.

The second platform, called *Loopa*, is more focused on providing companies key performance indicators (KPI) based on the large amounts of urban delivery data through an intuitive and user friendly geographical navigation. Actually, the platform is already in an embryonic phase, since is based only on one single company (candy distribution company) in Bogotá and it needs a large amount of data to be effectively implemented (e.g. customers, products, and quantities ordered, exact location of each customer). The platform allows to display the information geographically; it means that the urban area is divided into several quadrants and distribution data are mapped to each km^2 and summarized in a set of KPI, for instance customer per km^2 (or per month/week), product per km^2 (or per month/week. The next Fig. 3 shows the user-friendly display of Loopa, which provides (from left to right) the map of customers, income, orders in this case on a monthly base.

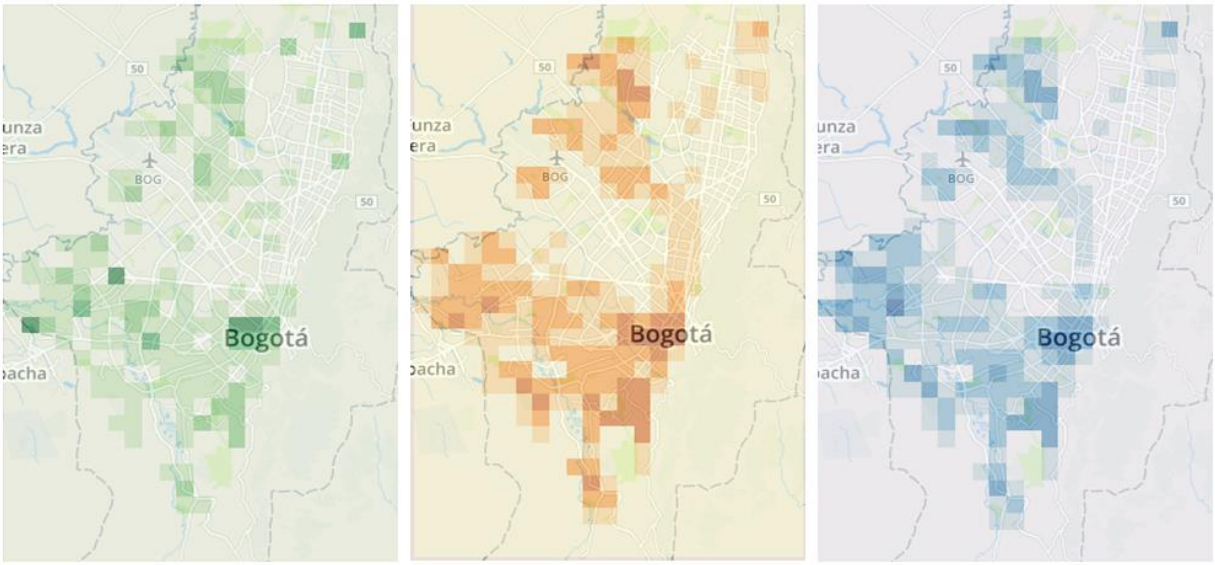


Figure 3 Three possible different Loopa's screen

Moreover, Loopa can provide more information about each urban quadrant in addition to the previous mentioned ones, including list of customers inside the selected area, income generated by customer through time (e.g. monthly base) for each individual customer inside the quadrant. Surely, it seems evident the possible huge contribution that a further development of this platform could provide for the implementation of LM driven operations' methodologies, developing an information network on large scale around the world, which could be deployed by companies to better plan their deliveries, to tailor their local urban demand patterns, but also to manage in a better way the variability along the entire distribution chain, guaranteeing consequentially more reliable data to the production planners in the initial phases of the production process.

In conclusion, in these first initial phases of process development, the support provided by the universities could become fundamental, since companies usually could not afford to use large amount of money in developing new processes, while on the other hand institutions' interests are not strictly related to profitability, but rather in promoting the scientific research, to create an integrated scientific community, spreading knowledge in the society, which is represented, in this case, by the interest in the widespread circulation of the importance of last mile logistics. This support allows also to overcome a *market failure* due to the private sector's behavior, which usually avoids to fund projects in this upstream and risky stage (Cantamessa & Montagna, 2016).

1.5.2. New Technologies

Surely, the LM logistics is one of the most increasing market in the world and it is not surprisingly that new technologies are rising around it. In the following paragraphs, the most valuable emerging solutions are presented in order to give some information about the possible future trends.

AGVs with lockers

Automated guided vehicles (AGV) are probably one of the most promising technologies that are emerging in the distribution industry, which could practically reshape the parcels delivery concept in the future. Indeed, according to McKinsey, due to the cost advantages of a roughly 40% over today's conventional LM delivery, assuming labor costs around EUR 20 per hour (this assumption is valid for approximately the entire developed world), it is forecasted that AGVs with parcel lockers are replace current forms of regular parcel delivery.

From an economic point of view, a 40% saving in delivery costs would imply a 15% increase in profit margin or, since price is the key driver in this market segment, a 15% reduction of prices. In an industry with margins ranging between 2% and 5%, this would lead to a disruptive business opportunity, without considering the fact that at the same time last mile delivery is going to become more intensive, favoring the consolidation of volumes and therefore economies of scale. Of course, it is evident that consolidation of volumes, which could be mapped throughout a *drop density* indicator, i.e. the number of delivery addresses for shipments within a specific area, plays a key role in these new delivery models in addition to the IT infrastructure needed to guide the AGVs.

AGVs with lockers could also enable the service providers to create larger value for customers from new services, such as the overnight pickup, i.e. parcels that could not be delivered during the day could park in their delivery districts and serve as regular parcel lockers, which would also allow parcel service providers to save on the aforementioned high real estate cost of today's lockers. Considering these possible future possibilities, most major automakers, as well as technology companies including Google, Apple, and Uber, are working on autonomous driving technologies of varying degrees. Google is testing a fully autonomous prototype that replaces completely the driver, while several manufacturers, including Volvo, Tesla, General Motors, Nissan, and Renault, have recently introduced advanced levels of autonomous functionality in their vehicles. Others, including Mercedes-

Benz, Audi, BMW, Daimler, and Honda, have already developed and presented prototypes of self-driving cars or are testing their fully autonomous vehicles, confirming this increasing trend in the autonomous guided technology. However, cautious expectation must be take regarding the publicly availability of these vehicles, which could become realistic after 2025 (Hars, 2015).

Drones

So far, only urban areas have been considered in the analysis, but also rural area represents an hard challenge for the new fast-delivery business models, since in these areas it is extremely costly to offer delivery within a specified time window or on the same day with any kind of driving vehicle due to the large distances that need to be covered (larger than the usual 5-10 km). Luckily, with some limitations and constraints, drones could offer a valid solution (Airborne Drone, 2015); nowadays the main constraints are the limited transportable weight (max 5 kg) and the dimension (drones are very big, especially those designed to fly long distances at low cost, and would therefore require landing areas of at least 2 m^2), which though become less restrictive if adopted for delivering small parcels in rural areas (about 13% of the total parcels); for instance, it is estimated that around 20% of Amazon's orders meet these criteria and could be served by the Amazon Prime Air service (Lavars, 2013).

Nowadays, most drones developed by Google, Amazon, and DHL only use batteries. However, a startup named Top Flight Technologies has designed a hybrid gas-electric aircraft that uses both batteries and gasoline, significantly improving the performance. Specifically, this drone has a maximum carrying capacity of 10 kg, a maximum flying distance of 160 km, top speed of 65 km per hour, and a maximum flying altitude higher than 150 m. Of course, several solutions have been developed to better improve also the safety usage of drones and technological progress is trying to reduce the current issues. As said before, IT infrastructure and also specialized operators are strongly required also with this kind of technology, without considering also the emerging legal implications based on the needed authorizations issued by the local public institutions (*"Drone technology is not going to be the long pole. The long pole is going to be regulatory"* - Jeff Bezos, CEO, Amazon) and also their the public acceptance (Lee *et al*., 2016).

Advanced Algorithms and Analytics

Last mile innovations do not include only the aforementioned vehicles used to B2B and B2C deliveries, but especially focusing on online orders and home deliveries, several innovations are related to software that could enhance the current efficiency level for established delivery companies as well as new entrants in the market, offering improved services that better address customer expectations.

First of all, in order to understand the functionalities of these software, it is better to clearly subdivide the order and delivery process in several phases, each of them is supported by a different software technology. Essentially, this process is spitted in five steps: initially the customer places an order and after that a specific deliverer is selected; then the items are picked from the warehouse/store indicated and subsequently delivered to the final customer. Of course, the last step is the receiving of the product which finally arrives to the customer.

The first initial step could be already fundamental; indeed retailers typically hold inventories in numerous locations, including distribution centers and stores. In the past, most retailers managed inventories for online orders separately from store inventories. But it is evident that they could provide a higher service level using platforms that provide integrated inventory management, making inventory in all locations available to all customers. With such a platform in place, retailers could provide customers with more accurate information regarding product availability and expected delivery time, fulfilling in addition an order from a closest possible location consequentially reducing delivery time itself. Furthermore, another additional advantage carries out by a tighter collaboration among different stages of the supply chain could be a dynamic connection with inventory management systems of other business partners, such as manufacturers or distributors, allowing retailers to have customer orders directly fulfilled from the manufacturer or the distributor's warehouse, reducing steps and also allowing a better visibility on the real customers' demand, which drastically reduce variability used in forecasting models.

Going ahead in the previously described steps, after the placing of an order, a deliverer must be selected; new algorithm of task-courier matching identifies the best person to carry out a specific delivery task (Setzke *et al.*, 2017). Once a delivery task is created, the task is matched to a courier based on some criteria, such as pickup and drop-off locations, requested delivery time and price. This methodology requires a *centralized assignment mechanism* using high-

quality matching algorithm. In this phase the determination of delivery price could strongly affect the selection; for this reason some delivery companies allow shipping prices to change from order to order, to more accurately reflect delivery costs (e.g. per-mile price) and risk level.

Phase three and four could be substantially considered similar, they only differ for the communication with customers performed in the fourth step, but the main transportation activities are the same. Indeed, both phases required a well-performing *routing algorithm*, which could be static or dynamic: once a static route has been determined, it does not change until it is completed (this method is of course the less updated one) but, nowadays, changes in delivery requirements and traffic information may be used to modify dynamically a pre-established route in real time, allowing delivery companies to better respond to evolving requirements and constraints. Surely, it requires an accurate IT system and advanced optimization algorithms, but it enables greater flexibility and helps delivery providers better respond to customers' requests, such as a change in the scheduled delivery time (i.e. drivers are informed in advance when they can skip a delivery location).

Surely, to make it feasible, the communication with customers must be tight and effective; nowadays several tools allow to retailers and delivery providers to update customers on their order status, which increase in a sensible way the offered value proposition. For instance, retailers can alert customers when their order has been shipped and delivery providers can provide information regarding expected delivery date and time window and whether a customer signature is required or not. Alternatively, they can notify customers when a package is available for pickup if a parcel locker service is used. Moreover, this tight relationship could entail a better data-driven demand forecast also for delivery providers that could use advanced analytics to better predict in advance demand for their delivery services, and share those order predictions with their retail partners to better respond to fluctuating demand, reducing variability and number of resources needed.

Lastly, in the final phase consumers are constantly increasing their power, since they are encouraged to provide feedbacks regarding their overall experience as well as issues such as lateness or damaged/missing items. The rating system motivates deliverers to provide better service and allows to build trust between customers and 3PLs and on the other hand it is helpful for customers which can choose the most reliable deliverer.

These new methodologies and approaches could be applied by traditional firms as well as new entrants, which can access the last-mile delivery market quickly using these tools, often with relatively low upfront investment and low operating costs, especially for those companies that rely on crowd sourcing drivers (e.g. UberRUSH) and avoid to operate with their own fleet of delivery vehicles (in 2015, venture capital investments in supply chain and logistics start-ups was more than four times higher than in 2014, roughly $1,202 million vs. $388 million). In addition, task-courier and routing optimization generally entail an easier implementation of these aforementioned instant and same-day delivery services. In conclusion, these algorithms increase economical opportunities and probably they are going to revolutionize the current delivery process, allowing the appearance of a new distribution paradigm on the market.

2. New Trends in Distribution world

2.1. Same Day delivery

The main reason that is leading this change in the delivery service methods described in the previous Chapter 1 is surely due to the new customers' requirements, which are driving companies to find more effective services that are more suitable with those emerging needs. Especially, with the rise of e-commerce, consumer attention has moved more and more to the quality and variety of the delivery service, as shown in Fig. 4, leading large companies as well as several start-ups to identify the LM service as a key differentiating factor against their competitors, providing their customers the best possible *purchasing experience*, in particular by improving delivery times.

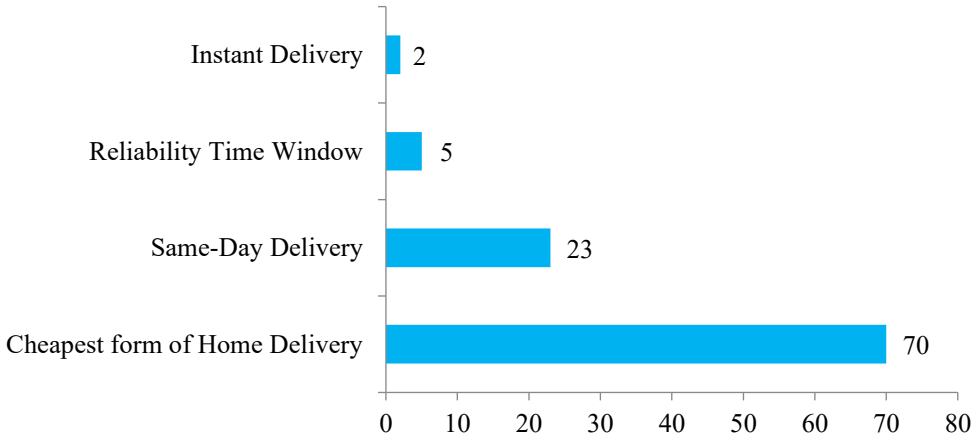


Figure 4 Share of consumers choosing different delivery options (McKinsey, 2015)

Indeed, as the graph shows (which is the result of a comprehensive survey conducted with more than 4,700 respondents in China, Germany, and USA), *same day* delivery and *instant* delivery are increasing their total share, and customers that selected these options are also willing to pay higher prices up to EUR 3, RMB 20, and USD 3 in the respective region. Therefore, in recent years, an increasing number of companies have started piloting and operating new models of same-day delivery, including incumbent logistics providers such as DHL, DPD, FedEx, and UPS to support retailers (Netzer *et al.*, 2014). Indeed, same-day delivery combines the convenience of online shopping with the immediate product access of stationary retail, and world's largest retailers, including Amazon and Walmart, are experimenting with this innovative delivery concept.

Nowadays, next-day or two-day delivery is the industry standard in all developed countries, but the next evolutionary step would be probably the same-day delivery; start-ups such as Kozmo and Webvan identified same-day delivery as an opportunity, but failed to build a sustainable business model around it. Indeed, this market is undoubtedly connected by economic macro-trends, such as GDP per capita, e-commerce adoption, degree of urbanization, and new consumer expectations; indeed a critical mass of consumers with sufficient financial resources is required, i.e. substantially a high level of e-commerce adoption is a fundamental prerequisite for same-day delivery to become the industry standard. As shown in the following Fig. 5, the share of online retail in Western Europe will almost double from 6 to 11% between 2012 and 2020 (survey based on 1,016 interviewed from UK, France, Germany and Sweden in June 2013 by Datamonitor), increasing consequentially the B2C shipments, of which a share is likely to be delivered by same-day delivery option. The availability of same-day delivery is actually expected to further support e-commerce adoption and drive the online sale of product categories not yet bought online on a large scale, such as groceries (e.g. the acquisition of Whole Food by Amazon, which is likely direct to integrate the local and already established km-0 supply chain with the a LM home delivery service, using the 454 stores as a temporary delivery stations).

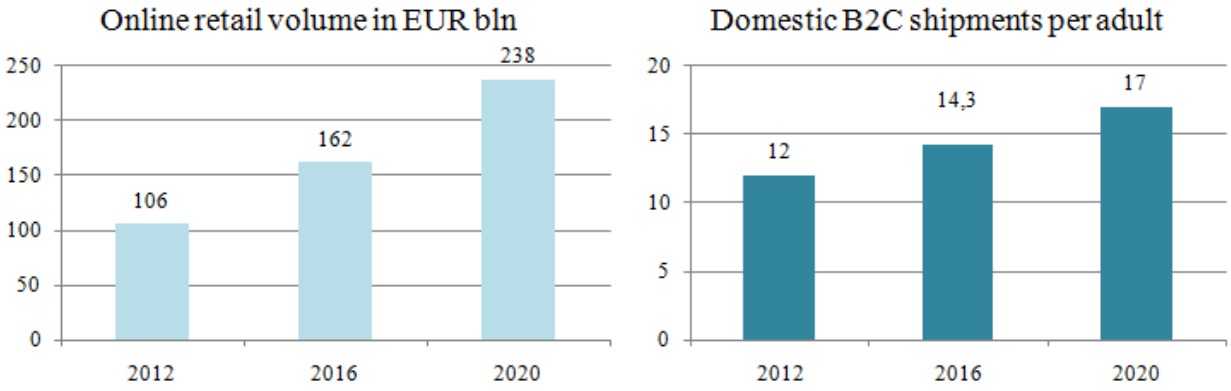


Figure 5 Increasing e-commerce drives demand for new delivery options in Western Europe

As stated by the founder and CEO of Shutl (a London-based technology start-up offering a rapid fulfillment service by connecting online retailers with local same-day couriers, which is actually acquired by eBay), "*once consumers have experienced a superior service level, they are usually reluctant to return to the previous inferior level"* and paying attention to different generations, especially younger generations (e.g. Millennials) are those more interested and willing to pay for this kind of *convenience*, which is perceived as very effective and attractive.

Surely, same-day delivery represents a large economic opportunity for all retailers to improve their service level, but requires a high degree of sophistication, especially related to the creation and then management of a wide network, which implies competences in the most updated IT systems and application. Indeed, major challenges, deeply analyzed in the next paragraph, such as real-time product visibility across warehouses, very short fulfillment lead-times and flexible LM delivery, have to be overcome, decreasing cost until they reach an acceptable and affordable level and increasing consequentially the share of consumers who select this delivery option, creating therefore a virtuous cycle.

Moreover, one of the main challenges is not only related to the delivery to the final customers, but also related to the ability of the supply chain to promptly responds to internal request of products with a same day delivery service, especially in the most downstream phases. Indeed, from a lean management point of view, today retailer's stores are requiring a lower value of inventory, with the possibility of constant refurbishment from warehouses, decreasing in that way inventory costs (which are usually one of the costs' top offenders for retailers) and allowing a easier management of the store itself. Therefore, as it will be analyzed in the following Miroglio Fashion practical business case presented in Chapter 3, last mile logistics solutions aim also at improving the overall cost of the whole supply chain, proving in addition a better value proposition not only for the final customer but also for the most downstream steps of the distribution channel.

2.1.1. Same-Day Delivery Prerequisites

As it is noticeable from the previous introductive paragraph on this new emerging trend, the complex challenge of processing, fulfilling, and delivering an order (to final customer or store) within a few hours requires definitely new types of distribution networks. The current processes used by logistics providers are not suited to same-day delivery on a larger scale, and more flexible city couriers, on the other hand, are too small to deal with large retailer volumes, highlighting the capacity constraint already mentioned before, which is surely not negligible since large shipment volumes are crucial because they can reduce costs significantly. Countries with a high share of inhabitants living in densely populated areas, such as the United Kingdom, provide favorable conditions for establishing first LM oriented networks which provides same-day delivery option, as more deliveries can be carried out per km^2. In the current market environment, before considering factors related mainly to

economies of scale, some more basic prerequisites need to be fulfilled by companies to enable same-day delivery, namely product availability, real-time product visibility, fulfillment capacity and of course the LM oriented capabilities, of which some insights and features are provided below.

As far as the product availability is concerned, it is common that multichannel retailer have local stock of items in urbanized cities since they maintain a network of stores. As a consequence, same-day delivery is a service limited to urbanized areas, and is rarely available to the entire population of a country, since only in that aforementioned areas retailers already have items that could be delivered in an acceptable time span in order to avoid a reduction of the service level. Hence, the first prerequisite to develop a LM network is the presence of a high density of population in the area.

Regarding real-time product visibility, surely retailers need to have a real-time overview of their inventories across their warehouses and outlets to provide the best possible service to the final customers and first of all because otherwise it is not possible to determine whether and which goods are available for same-day delivery. Many retailers still struggle with this warehouse management integration, which requires larger investment in their IT infrastructures. In addition, another limitation comes from the fact that successful delivery requires multiple participants in the supply chain to transact and collaborate. Nowadays, the common practice used by retailers is to maintain separate vertical systems and databases, hindering the effectively integration of the critical demand, supply, and logistics data that delivery requires. The result is lack of visibility and the inability to plan and coordinate actions with the third-party delivery partners (One Network Enterprices, 2015).

The last two prerequisites could be practically merged in one single factor since the last mile management capabilities usually cannot be developed without having the adequate tools to acquire also a sufficient fulfillment capacity. Indeed, the picking and packing processes need to be fast, and sometimes also fast-tracked over regular orders if necessary. Experience at Amazon has shown that significant investments in the logistics infrastructure is necessary to reduce lead time, but however it is important to notice that retailers, which are planning to ship from their stores directly to the final customers, must be first of all develop the capability to efficiently fulfill the orders to the stores (the introduction of click and collect serves as a presage to the introduction of same-day delivery) and then the next step could be feasible.

Moreover, last mile delivery needs to be flexible enough to fulfill orders once or multiple times throughout the day and therefore, the design and development of a fast fulfillment process is required, but even more importantly, the logistics center needs to be close to the recipients to allow that kind of service.

2.1.2. Same-Day Delivery future expectations

As said before, same-day delivery is likely to become available at most retailers with an online channel on a broad scale in urbanized areas in countries with dense metropolitan areas. Surely, standard next-day delivery is partially cannibalized by the higher customer's value proposition offered, but the broad availability of same-day delivery further propels the adoption of e-commerce, installing a virtuous cycle that would lead to an increase in the total market size. On the other hand, in countries with fewer metropolitan areas and slower e-commerce adoption, such as Spain or Italy, same-day delivery will likely remain an expensive option only offered by a few select retailers in major metropolitan areas. It is advisable that before offering this kind of service, the whole supply chain has to be design in order to promptly respond to final customers' request. As said before, also stores, which represent the last important physical step of the supply chain must have the possibility of a constant supply, shortening lead time to provide a better service as a whole.

In conclusion, another important aspect from the final consumer perspective is that despite the increasing customer demand for same-day and instant delivery, more than 50% of consumers currently choose delivery options merely based on price while another 20% prefer the cheapest available option of home delivery (this means that *price* remains the key decision criterion for the large number of customers), as reported by the previous Figure 4, but however, according to McKinsey&Company, the market for same-day delivery is expected to grow to about EUR 3 billion in Western Europe by 2020 with a demand predominantly driven by fashion and electronics product categories, suggesting that e-commerce players would be unwise to neglect this segment and his future growing opportunities. Surely, this new disruptive trend has changed the relative weights among the phases of the traditional supply chain, leading to a more customer oriented approach which entails a redefinition of the adopted management procedures in order to integrate the first actors in the distribution process with the last mile.

2.2. Supply Chain Re-design possibilities

The analysis presented in the previous Chapter 1 aimed at creating a first initial background about the increasing relevance of the last mile topic in the world both from a B2C and a B2B perspective. Because of the rise of e-commerce and omni-channel retailing, the traditional supply chain requires a change in order to meet the new consumers' expectations, which are now oriented towards factors such as speed and convenience, making the last-haul distribution a new central *moment of truth* in the purchasing experience. On the other hand, the increasing competition on whatever market leads companies to pay more attention to their expenses and efficiency degree, also in accordance with the institutional authorities' regulations, which require a lower environmental impact of urban freight distribution.

Many of today's retails supply chains are simply not set up to handle this demand for speed and convenience in a cost-effective way. For these reasons, the following paragraph tries to summarize all the features emerged from literature analysis that companies *Must Have* in order to re-design their operations processes, allowing a better integration between the traditional supply chain with the last mile.

2.2.1. Companies *Must Have*

First of all, from a consumer point of view, the possibility of choosing between several shipping methods represents one of the most desired feature, therefore, same-day deliveries and high service levels in general are becoming dominant. On the other hand, an agile process and more city warehouses are needed in order to consolidating orders into truckloads and moving goods closer to final distribution points for de-consolidation and delivery. It is also necessary to change the concept of shop as simple selling point, which could carry out a fulfillment role (e.g. Whole Food stores after Amazon acquisition in 2017), leading to an higher geographical market penetration of the company itself. At the same time, the whole supply chain should become more flexible not only in the final delivery to the customers but at least in the most downstream stages of it, allowing more frequent inventory refurbishments to better adapt stores' offer to customers desires and decreasing operations costs.

Substantially, companies should try to be more close to their final consumers and installing a tight relationship with them. As said before, constant communication would allow to avoid current real issues such as the first-delivery failure and, on the other hand, would create more

trust between the actors involved. Moreover, consumer's habits, feedbacks and preferences could be helpful in improving provided services throughout the large number of information collected. Furthermore, the more granular level of detail available (information per km^2, per client, per product, per brand, etc.) could surely enhance the personalization degree of the service and, as far the planning activities are concerned, the forecasting demand could be more accurate, reducing waste and inventory level. Indeed, nowadays, in processes characterized by large variability and at the same time by the necessity of fast response, the performance of general adopted rolling horizon models are often unsatisfactory; therefore, the chance to better plan the production schedule according to detailed customer information could represent a good opportunity to reduce variability and batch size, saving financial resources and time. Of course, re-shaping operational planning habits requires long times due to the high degree of complexity involved although the decision have a very short term impact. Moreover, the initial changes should start from the tactical and strategic level in a top-down approach, taking decisions in a long run perspective (production and storage capacity, procurement of resources, number of facilities in which operate, etc.).

However, to efficiently manage this large number of data, well integrated IT platforms are going to be fundamental, in order to guarantee also a clear and total visibility of products in real time along the overall supply chain. For instance, Integrated Inventory Management tools are now necessary to implement the aforementioned integration, merging together all the company's inventories (today often keep separated) and making them available to all customers, improving service level and reducing stock-outs. In addition, especially for total vertically integrated companies, also the management of raw materials cover a key role. In order to avoid a large amount of invested capital (i.e. large warehouse facilities and materials), it should be better to have local suppliers with procurement lead time as short as possible and flexible contractual policies in order to guarantee a competitive response lead time in case of unforeseeable demand peak.

As far as the final distribution is concerned, there are new possibility to reach an higher optimization level; indeed crowd sourcing and new technologies allows to provide the better service at the right time and place, improving the overall purchasing experience and reducing companies expenses. Moreover, collaboration between operators could lead positive effects with supply chain pooling, reducing transportation cost and environmental impact (which is always more associated to companies' brand image).

Lastly, especially in fashion industry, a well-operating supply chain must be able to absorb the flow of returned products, i.e. the so called *reverse logistics*, which can add considerably expenses to LM operations. Indeed, about 30% of European consumers return back products twice a year on average, while a further 25% more than three times. The 46% of the interviewed people affirm that the main motivation is related to the satisfaction of the items received, whereas another 16% states that purchase many products with already the intention of returning some of them (especially in mature markets), increasing the trend of the *serial returner*, whose identification is becoming a key factor for companies (Lazzarin, 2016).

Table 1 summarizes in a brief way all the main aforementioned characteristics that, in general, companies should implement in their own business model in order to be consistent with the new emerging last mile logistics. Surely, it is noticeable that this Table 1 provides an initial starting point and it requires a further deeper investigation to add more precise features.

Table 1 Companies' Must Have

Companies *Must Have*	**Description**	**Benefits**
Delivery Methods	Availability of several free shipping services	Higher Service Levels
		Higher Consumer Satisfaction
Integrated Warehouse Management	Integration of all the inventories of the company. Also physical stores should be intended as temporary warehouses.	Faster Fulfillment of Orders
		Higher Service Level
		Accurate information on product availability and delivery time
Collaboration in the SC	A tight collaboration among different stages of the Supply Chain	Less Variability
		Better Production Planning
		Less Waste of Resources
Communication with final consumers	A tight relationship with final consumers thanks to the modern devices and connected environment	Real-Time Information
		Personalized Service
		Better Production Planning
		Less First-Delivery Failure
IT Infrastructures	A well developed IT infrastructure is needed to manage SC integration	More Flexibility
		Real-time Product Visibility
Granular Level of Detail	Info per km^2, per client, per product, per brand, etc.	More personalized Service
		Less Waste of Resources
		Better Production Planning

In conclusion, this first part aimed at providing some useful initial information about the current situation and integration of the LM logistics in the real world and the possible future challenges and implementation. Surely, it is only a starting point for creating a shared understanding of the current scenario and for supporting the next steps of the project, which will be based on realistic and updated data provided by Miroglio Group, allowing to make also numerical consideration about the issued emerged.

3. M2Log - Miroglio Group: Business Case

Miroglio Group is an Italian company specialized in the manufacture and distribution of ready-to-wear clothing and fabrics that has already collaborated in the past with the *Politecnico di Torino*. In particular, the aim of this project is to find and analyze several solutions that could enhance the overall inventory management performance of the company, with a focus on the final section of the supply chain (i.e. Last Mile), and if these solutions could have possible impacts on the adopted forecasting models.

In order to provide that outcome, as first step an initial analysis of the fast fashion supply chain's practices is needed with a particular focus on the current Miroglio Group's processes and situation. Indeed, after having depicted the clear and reliable starting situation used as initial benchmark, it will be possible to design new scenarios in accordance with the methodological path explained in the following Chapter 4.

3.1. Supply Chain Management in Fast Fashion industry

Nowadays, the globalization is constantly increasing and functional distances between countries are definitely reducing day by day. This considerable factor has involved many countries which has lead to a tight cooperation of companies in a huge market (Stiglitz, 2007). Acting on an very broad scale has surely many positive aspects, but at the same time also the competition is now on a higher level, especially in fast evolving industries which are characterized by products with short life cycles and an unpredictable consumer demand that constantly change in a small amount of time (Sheridan *et al.*, 2006). In particular, one of the most globalized industry so far in the world is *fashion industry* which is a particular sector characterized by short product life cycles, high volatility and uncertainty of customers' demand and high impulse purchasing and it has a turnover every year of billions consequentially covering a leading role in the global growth. Information diffusion and brand visibility are most likely the main key success factors in this industry today, indeed throughout media, Internet and television it is become extremely easy to spread information towards the final customers which basically represent the last step of the value chain and a good communication channel could then really affect and change their expectations and desires and therefore their final demand (Barnes & Lea-Greenwood, 2010).

Surely, the fashion industry today is a extremely competitive in each different segment, with several aggressive companies with strong and organized operations management systems to respond in the fastest possible way to final consumers which have a constant need for latest trends (Christopher *et al.*, 2004). Moreover, nowadays *price* in no more the main and unique driver from the customer point of view to allow companies to win the competition through it against competitors, but on the other hand prompt managerial decisions are becoming crucial for fulfilling what consumers are demanding in a short time window. Therefore, the only way to be able to respond to those fast changes in the customers' product perception, is a strong relationships with suppliers, which they must be also able to understand this importance led by trend changes in the industry, making the new products available into the stores (Bruce *et al.*, 2004). Indeed, without a shared opinion, it is not possible to put in action a defined and effective strategy which could lead to the set target of profitability.

Today fashion consumers tend to buy fashion products on a more frequent basis and also more items at the same time, which is usually a drastic change if compared with the past habits. That fact represent a huge challenge for both retailers and suppliers because they have to be able to satisfy consumer demand offering not only several collections during the year, but also a large variety within the collections themselves (size, color, design, etc.) on a frequent base. Of course, as mentioned before, this is a challenge but, on the other hand, also a huge economic opportunity for fashion companies because it can lead to increased turnover. Surely, this represents a factor of pressure for companies, which have to design new procedures to act fast, efficient with a flexible supply chain to accommodate the customer demand (Hunter *et al.*, 2002). At the same time also the managerial risks increase drastically, especially related to the possibility of not sold inventory accumulation at the end of the season and high level of inventory stock during the season itself in the front end stores.

Taking into account that premises, the concept of *fast-fashion* has become probably one of the most relevant sector of today's international fashion companies. This concept could be basically represent by a model in which retailers change and literally shape their business strategies to be aligned with the latest trends, with the final objective of leading them into the stores in shortest possible way (Barnes & Lea-Greenwood, 2010). This sector is based on time reduction within the supply chain steps and increased consumer choice with constant replenishments with new and updated garments' collections. Surely, that increased demand leads also to short product life cycles, since companies constantly have to deliver new trends.

Initially, this concept was adopted only by few actors in the industry but so far its adoption has constantly grown within the industry itself. As far as the supply chain management is concerned, the fast fashion concept represents a *pull strategy* which is definitely different from the traditional *push strategy*, based on forecasting models and first of all on a organization which is surely cost efficient but not adequate to respond fast and promptly. Indeed, the fashion companies are nowadays adopting improved and more efficient supply chains to be more flexible to trend changes (Barnes & Lea-Greenwood, 2010). This aforementioned efficiency can be mainly obtained reducing lead-times and forecasting errors, thanks to a reduction of uncertainty on the future trends.

As a consequence, supply chain strategies (or at least basic concepts) such as *Quick response* and *Agile supply chains* have been built and adopted by fast fashion companies to compress lead-time and consequently keeping/increasing their market share (Hayes & Jones, 2006). As said before, nowadays having a temporal competitive advantage is the real key success factor in the fashion industry (Barnes & Lea-Greenwood, 2010). Hence, effective management of the supply chain has become a relevant part of success which has moved the current today competition at supply chain level rather than merely between companies as happened in the past. Indeed, suppliers and distributors are now looking for business partners to design and implement collaboration strategies, while in the past supply chains were usually complex and inflexible, leading to long buying cycles which are definitely not adequate for today fashion's consumers. In conclusion, time is now the most crucial aspect and reducing lead-times has become a relevant part of the fashion companies' strategy. To have a more detailed subdivision, three different lead-times have been identified, i.e. time to market, time to serve and lastly time to react, which are briefly described below.

The first one (*time to market*) is probably the most crucial one and it represents the main competitive advantage for the well-known company Zara. It comprehends all the time needed to identify a new fashion trend, subsequently design and produce the garments and then finally deliver them to the stores and make them accessible to final customers. The product life cycle within the fashion industry are really short which makes it important to catch each single opportunity on the market. Undoubtedly, it is easy to affirm that a shorter time to market increases the opportunity for these companies to copy the emerging trends and provide the product at the right time, avoiding the largest part of risk and uncertainty which is suffered by other companies with longer time to market (Bruce *et al*., 2004).

As far as the *time to serve* is concerned, it is basically the time from the order to delivery. Often this problem lies in supply chain characterized by multiple steps which surely increase this time span. Moreover, also this part of the total lead time is crucial, since if the delivery lead time is too long, risk of missing inventory at stores (*stock out*) definitely increases, especially in a fast moving industry. Furthermore, also the level of handling costs increases with longer supply chains (Bruce *et al.*, 2004).

Lastly, regarding *time to react* it represents the time to recognize changes in final customers' demand and then also the time necessary to effectively react to those changes. Suppliers often have problems to predict changes since they do not have visibility on the real demand, which is usually diluted by the high level of inventory. Possible solution, which is also the one more adopted in the industry, is to have as short as possible supply chain with in addition a tight and good collaboration and communication between partners in the chain itself to provide a constant and useful exchange of updated information (Fernie & Sparks, 2004).

Comparing the traditional supply chain with the fast fashion one, the former needs about 18 months to deliver for a new season, whereas the latter usually takes 3 to 8 weeks to bring a product in the store starting from the initial design phase. As mentioned before, the traditional supply chain has a characterized by a push approach, in which garments' production begins without any idea of what the customers are going to demand in the future (Krajewski et al. 2007). Companies that are applying this approach are often using mass production (often in low income countries) to spread costs on a wider basis, although on the other hand this leads to a high level of inventories and usually to a lower variety of products to show in the stores. Surely, an high level of inventory can work as security, but an high level of inventories could also have a negative affect because if the products become out of fashion the company has to definitely reduce the price of the remained items, causing large amount of economic losses. In conclusion, this strategy entails long lead times and low flexibility, reducing the ability to adapt promptly to the fast changing demand (eventually with too much delay). In conclusion, the traditional supply chain is definitely more supply oriented whereas these new kind of more flexible supply chains are more *demand orientated* (Jacobs, 2006). In the following section, the Quick Response concept and the agile supply chain are reported to explain the demand driven pull strategies typically used in the current fast fashion models, which are all mainly based on these concepts.

3.1.1. Quick Response Concept

As define by Sheridan (Sheridan *et al.*, 2006), Quick Response concept (QR) could be defined as *"a consumer driven business strategy of cooperative planning by supply chain partners, to ensure the right goods, are in the right place, at the right time, using IT and flexible manufacturing to eliminate inefficiencies from the entire supply chain"*. This concept was developed in the United States because local suppliers and retailers are struggling in competing with manufacturers from other foreign countries and it is basically the first different supply chain approach in comparison with the traditional practice and in addition it has become deeply associated with the textile and apparel supply chain, since it is used to achieve time compression, involving location of manufacturing, adopted technologies and supply chain internal and external relationships (Hayes & Jones, 2006).

Advanced information technology is the most relevant factor in QR. Capturing demand in an almost real time way and as close as possible to the ending consumer allows suppliers to be instantly and constantly informed of inventory changes. This reduce a lot the necessary lead time compared to traditional methods, when information is mainly based purchase orders (Sheridan et al, 2006). Indeed, supply chains based on QR concept are based on demand and consequentially driven on sales information rather than on historical forecasts (Barnes & Lea-Greenwood, 2006). Therefore, as mentioned before, integration and collaboration are the main factors of QR, which is become the best existing weapon for fashions companies that are willing to regain competitive advantage from other companies which are supplied by low cost overseas manufacturers (Barnes & Lea-Greenwood, 2006).

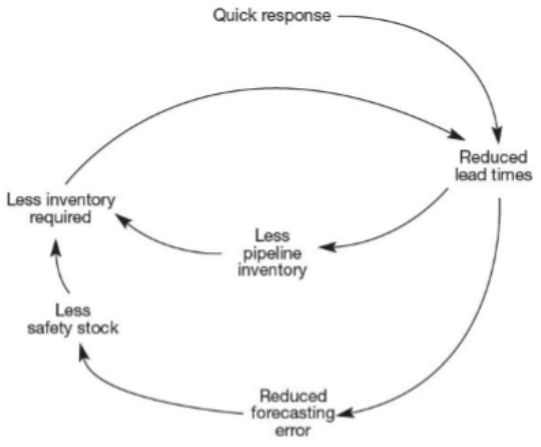


Figure 6 Quick Response system may trigger a "virtuous circle" in logistics (Christopher, 2011)

Although effective, this strategy is not easy to effectively design and adopt, since a tight collaboration between retailers and suppliers along the supply chain substantially mean that they have to share confidential information. However, usually the expected results are so advantageous for both parties that the collaboration, if well structured and planned, represents a common desire, since it produces shorter distribution cycle, reduces handling and distributions costs. It also take advantages regarding the specificity of the deliveries and in-stock real time situations sensibly reducing the time between sales and refill. In conclusion, QR concept try to minimize pre-season ordering and increase speed and flexibility of the whole supply chain. This is obtainable by placing small and more frequent orders during the season, creating a win/win environment between retailers and suppliers (Sheridan, 2006).

3.1.2. Agile Supply Chain

This kind of supply chain is mainly characterized by a strong demand driven approach, based on flexibility and real time information sharing between companies in the supply chain itself, which allows to be more responsive to variation in consumer demand.

Aforementioned benefits positively affect not only the actors in the supply chain, but also designers, who can use the most updated information to create new market-driven trends. New communication technology can, with the support of computer aided design (CAD) and data exchange, reduce lead-times (Barnes & Lea-Greenwood, 2006), which is highly required by the extreme volatility and unpredictability of customers' requests.

According to Christopher (Christopher *et al.*, 2004), agile supply chains are characterized by four main factors, namely a good market sensitivity, an effective virtual integration, a widespread network based and a correct process alignment between actors, which are briefly explained below.

Regarding market sensitivity, it basically requires that supply chain and customers should be strictly connected in order to determine what replacement are required, analyzing data as point-of-sales on a daily frequency. The data is also used to analyze trends because the point-of-sales data is based on consumers' preferences and requirements. For that reasons, according with that point of view, the stores are becoming more and more important as point of contact with the consumers, and next paragraph 3.2 provides a deep analysis on that factor.

Moving towards the other previous step of the supply chain, virtual integration refers to the virtual sharing of information between partners in the supply chain. As already mentioned in the QR concept paragraph, this results in a closer connection between the partners, obtaining a higher number of products availability on the stores' shelves and less inventory to manage.

Then the last two features are intrinsic connected, since a network based supply chain basically means that desired flexibility is obtained exploiting all the specific strengths of players involved in the process. Surely, cooperation is relevant but on the other hand requires a lot of work and efforts, trust and openness within the network, whom is required to change in accordance with the market needs. And at the same time an effective and correct process alignment is a key milestone, since all the different actors must have clearly understood which are their specific tasks and their importance, in order to avoid delays caused by hand-offs or buffers within the intermediate level of the chain.

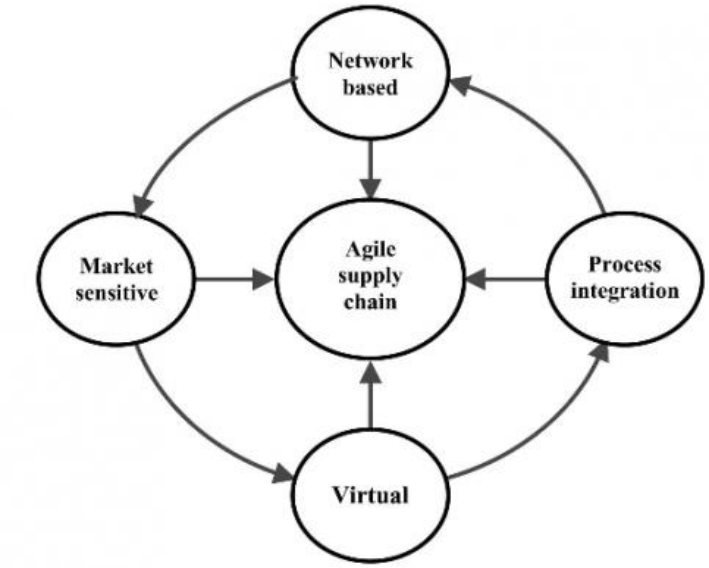


Figure 7 Agile supply chain developed by Harrison, (Christopher et al., 2004)

In conclusion, this brief introduction aimed at providing an initial background on the main challenges that the fashion industry is facing in relation to the supply chain management topic but also several methods that have been adopted to satisfy the current customer needs. In the following paragraphs, some reflections on the importance of a correct brand strategy and a wise store management are presented and then, after an introduction on Miroglio Group and its organizational structure, a fast fashion competitive context is presented, showing different possible strategic application of the aforementioned new supply chain methodologies.

3.2. Brand Strategy in Fast Fashion Industry

As far as companies operating in the fashion industry are concerned, the brand has always been considered as one of the most relevant competitive lever to keep and increase the position of the company itself. Indeed, it is not unusual that fashion companies try to constantly valorize their own brands; in this regard, Zara emphasizes how the brand concept is based on three main components: *identification*, referred to the brand recognition system (name, logo, colors, etc.), an *affective association*, evocating an immaterial perceptive connection to the affective brand in the customer's mind and lastly a *trust* component linked to the expectations and perceptions generated in the customer (Gheri, 2005).

Therefore, the brand has a real value as a strategic resource with which the company ensures a lasting competitive advantage over its competitors and consequently increases the possibility of securing future profits; a careful brand management policy coupled with an accurate positioning strategy, makes it possible to differentiate from competitors and, at the same time, obtain *consumer loyalty*. Especially in the fashion industry, where the symbolic and evocative elements often prevail over the technical-functional ones. Since the single product change frequently in this kind of industry, this ambition of relational continuity cannot therefore be based on the product itself, but it needs a long-lasting factor, which could be identified in a strong brand identity, which therefore constitutes a durable asset for the company itself.

For a long time the creation of notoriety was based on impersonal forms of communication such as advertising, but in recent years the new mission of communication consists in knowing how to "represent" the product by creating a relationship between company and its customers, no longer based only on the visibility and notoriety of the brand. Hence, *stores* play a fundamental strategic *role* in this sense as *differentiation factor*, and not only from a merely view point of vertical integration and faster supply chain. In the past, the commercial offer was essentially represented by the logistics function of the commercial intermediary whose main task was the space-time connection between production and consumption. So the choice of the sales point and the shopping behavior were mainly rational activities whose purpose was essentially to satisfy functional needs. Today, "the product" offered by a commercial enterprise is increasingly enriched with contents both in terms of quantity (variety of items) and in relation to the services offered to customers, trying to change their needs, expectations and feelings in the store for extending the relationship with the customer itself.

The shopping activity itself becomes decisive in the formation of consumers' purchasing behavior patterns, increasingly looking for engaging shopping experiences. Recently, the term *Retailtainment* is increasingly used, meaning that companies try to make the customer feel as the protagonist in the store. Therefore, in last years it is common to talk about a new fundamental competitive factor, i.e. *retail loyalty*, which lead the customer to come back to the same store due to the good feelings perceived there (Aiello & Donvito, 2005).

Even if the online and the omni-channel phenomenon is increasing, the store is still extremely relevant. According to McKinsey (Berg *et al.*, 2015) the majority of consumers purchase either offline (74%) or online (19%), with only a residual 7% that purchase at an individual retailer through both channels, as shown in Fig. 8. Moreover, even the store visit data shows that when it comes to an individual retailer, only 15% of consumers visit both channels to inform their purchases, while the totality is dominated by the offline channel with an outstanding 69%. Surely, online-only consumers are an important category for retailers, since they are usually loyal consumers who know well enough what they want to order online without going to store and in addition, these consumers are especially young people. Around 28% of 18-24 year olds buy fashion products only via online, whereas only 10% of the 46-65 age group do the same. So, it is evident to conclude that online channels are likely to become more popular in the future, but however physical stores are still going to remain a key touch point in the following years for the fashion industry.

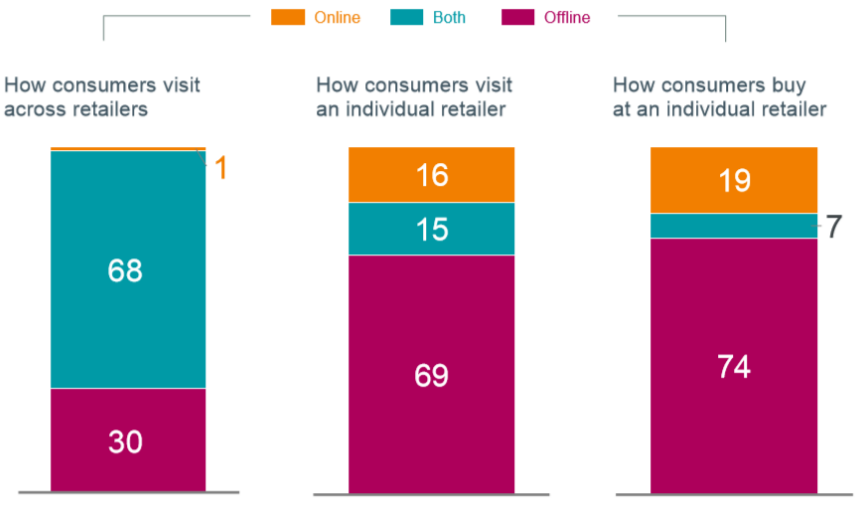


Figure 8 Percentage of survey respondents by channels visited or purchased from. (Berg et al., 2015)

3.3. Miroglio Group

Miroglio Group is an Italian firm founded in 1947 and specialized in the manufacture and distribution of ready-to-wear clothing and fabrics. The headquarter is located in Alba (Italy), while the whole company has 37 business operations in 22 countries with more than 1,100 single-branded stores. Since 2009 the group has been divided in two separated and autonomous divisions:

- *Miroglio Textile*: it is undoubtedly at the forefront for the production of natural, artificial and synthetic fabrics. Founded in 1981 with a production exclusively aimed at internal needs, over the years it has rapidly established itself on the external market, with an export quota of about 80% of production. Created for classic women's wear, Miroglio Textile products have conquered alternative commercial market segment, such as casual/sportive wear and even furniture. The success is mainly due to a high level of automation, in addition to a constant research of new products. The system includes all phases, from design to the finished product, with a production that takes place in nine production plants.
- *Miroglio Fashion*: it takes care and optimizes all the phases necessary for the production and sale of the garment, in order to guarantee an integrated service. Miroglio Fashion includes the fast fashion segment of the whole Miroglio Group, with 1,100 branded stores and 2,300 multi-brand outlets with 12 women's fashion brands (included joint ventures) in order to adopt a differentiation strategy and capture different market segments. Especially the proprietary retail stores are those that are more suitable for a fast fashion strategy application with a *time to market* of 6/8 weeks. The most famous brand of the Group are Motivi, Oltre and Fiorella Rubino.

Generally, the Group sells garments that are typically divided into two categories, in accordance with the required handling methods: *capi appesi*, namely the ones that must remain on the clothes hanger from the exit of the factory to the store and therefore they must always be moved in a vertical position, and *capi stesi*, namely those clothes that are placed on stores' shelves and not require a specific transportation position as the former type. In addition to clothes, Miroglio Group sells also women's outfit *accessories*, such as scarf, bags and hats.

3.3.1. Miroglio Logistics: M2Log

The logistics of Miroglio Group operates transversely across the two aforementioned divisions. Textile Logistics is located in Castagnole delle Lanze whereas Fashion Logistics is based in Pollenzo. In past years the two logistics departments had to respond to a dual authority: product managers of the divisions and logistics manager. Today, the situation is completely different since Fashion Logistics and Textile Logistics have undergone organizational changes due to the foundation of the new company M2Log S.r.l. and after that the two business units became both customers of the internal NewCo.

M2Log was founded to meet various needs coming from the Miroglio Group itself and from other companies on the market, to which it offers its services. The motivations behind this strategic choice can be summarized essentially in the need for supply chain optimization and in the attempt to develop a new competitive factor for the Miroglio Group. The first concept refers to the fact that current volumes do not allow the saturation of logistic poles, leading to inefficiencies due to the high transport costs. As far as the development of a new competitive advantage is concerned, the idea is to take advantage of the fact that the service fully covers the supply chain with both distributive and productive logistics with a wide geographical coverage. The internal advantages deriving from this choice concern the reduction of the logistic cost that was sustained by each individual division, trying to exploit economies of scale, and the possibility of becoming a revenue center, thanks to the possible acquisition of new customers. M2Log is not the only NewCo that is born as a service company from the detachment of an previously internal business branch. Other companies have opted for an organizational reorganization of this type, such as Benetton and Geox in the same sector Miroglio and Granarolo in the food sector.

In the following paragraphs, organizational structure and process functions are described in order to have an initial idea of the company's processes and how they are work. It is noticeable that only Miroglio Fashion is taken into account since the focus of the project is on the fast fashion industry; moreover, it is relevant to define that the following information have been collected with initial meetings with the company.

3.3.2. M2Log: Distribution system in the Miroglio Fashion network

As previously mentioned, the distribution for Miroglio Fashion is carried out by the central warehouse located in Pollenzo (CN). The whole production is received and stocked, and then prepared and sent to the served markets. The distribution strategies are aimed at the different needs of the numerous markets, according to three different distribution logics: Retail, Trade and Outlet.

The project aims at improving the *Retail* logistic system and for that reason it will deeply explained in the following section; however, even if the *Trade* and *Outlet* logistic methods are out of the project' scope, a brief description is provided at the end of the paragraph just to allow a broader and more comprehensive understanding of the Miroglio Group's business.

Retail Logistics

This type of distribution uses "single-brand" stores in Italy and around the world: about 70% is owned by Miroglio Fashion, while the remaining 30% is represented by franchised stores, a formula widely used in countries with high political or commercial risk (e.g. opening a first store in a still unexplored market).

Miroglio Fashion deals directly with all the phases of the process without the presence of intermediaries, deciding the fashion *Themes* to be presented to the public in every period, both at the beginning of the season and during it, imposing the style that must be adopted in the store and taking care of advertising for brand promotion. As mentioned before, the required time to set up a *Retail* collection, its production and its distribution is about 6/8 weeks (*time to market*). Deliveries to the stores are generally entrusted to an express courier (e.g. DHL, TNT, etc.), because of the speed and frequency required by this kind of industry and because store warehouses are small and need to be entered a little at a time, to allow the products to be sold and leave room for new items.

The product provision to stores is based on two different moments: the first is the one in which a new Theme is launched (items enter the stores every 15 days with their own stylistic coherence and set-up). On average, 90% of a Theme is immediately distributed in the network as a *first allocation*, while the remaining 10% remains in Pollenzo for future re-stocking. A couple of themes are usually already sent in December to allow the initial setting up of the area for the new collection in the shop, since in January, in parallel with the sales of the

autumn/winter season, 3/4 themes of the new spring/summer season begin to be exhibited. The product supply is continuous in the shop, but the average life of a theme is about 8 weeks, in which each garment periodically changes its location to always provide a renewed image of the store. For the first 2/3 weeks it is exposed in the area of greater visibility, in the following 2/3 weeks it is moved to make room for the new introduced Theme and finally, in the last 2/3 weeks it ends its life cycle. At this point, after 8 weeks there is no more physical space in the store to expose these models because in the meantime other items have arrived and then the remaining items are placed in the store warehouse, where they remain until the end-of-season sales. The last unsold items are then transported to Pollenzo as end-season returns.

The second moment of product provision takes place with weekly supplies throughout the course of the season, adopting the so-called *"borsino"* algorithm (usually started each week on the night between Sunday and Monday). As well as working on the stock in the Pollenzo's warehouse, the *borsino* also works on the stock of all stores in the network. On a weekly basis, each store can in fact introduce a so-called *"prenotazione capi"* into the system. This reservation generates a need that can be satisfied by generating a shipment from the central warehouse or with a horizontal transfer from other stores via express courier, since the items must be delivered quickly (on average depending on the distance between the stores the item is transferred in maximum three days). These horizontal transfers represent today the 30% of total re-allocations.

The concept of *borsino* basically acts as a sale between stores, in fact each store manager has a determined purchasing budget. Deciding to sell a product that is not successful in that store to another store, which is actually requiring it, allows to have more budget to then "buy" the most requested products in the area. For the purpose of an incentive, the company considers the satisfaction of an order of other stores as a normal sale counted to achieve the monthly target. As a result, stores are stimulated to use this mechanism.

Obviously, the store manager can request a re-stocking only when one or more models are almost all sold out (this threshold level is not established a priori but depends on a number of factors, such as the location of that particular store, the frequency of visitors and it is at the discretion of the store manager). Furthermore, the budget constraint is aimed at avoiding excessive re-allocation and a transfer is allowed only if the total value of the transfer itself exceed 150€ (multi-items of smaller values or just one more expensive item), however if the

item is requested as a *guaranteed sale* that economic constraint is not taken into account. There are also some geographical limitations based on the islands of jurisdiction of the various *District Managers* (DM), which manage 15/20 stores in adjacent areas. Hence, the *default* algorithm looks for the nearest availability and then expands the range to the national scale. Lastly, the transfer between stores is not allowed in the first two weeks of a new Theme because each store must have a certain amount of time to sell the item before transferring it.

In conclusion, as far as the online sales is concerned, they are becoming an ever-increasing component with a current percentage of turnover between 3% and 5%. Each retailer brand of Miroglio Group has an online website where consumers could buy garments. The online channel is fully integrated with the stores channel and is considered today as a real physical store. Once the customer orders a garment online, if this is available in Pollenzo, it is immediately assigned and shipped, otherwise it is required to the stores network. The garment can be received at home, by paying the shipping cost, or at a selected store for free.

Trade Logistics

This is the most classic type of distribution used in the clothing industry. In this case, the Company presents itself as a supplier of a shop managed by third parties that sells to the end customers also products of other brands. The possibility of purchase is given during the *"sales campaign"*. Basically, there are two campaigns during the year, one per season. In this period of time, sales agents personally reach the various customers (shops) and collect their orders. The vertical separation present in the Trade channel definitely increases the time to market which becomes about 6/8 months.

Outlet Logistics

Outlets are points of sale located near the company and owned by Miroglio Fashion, which offer one or more brands to the end customers. In these shops, all unsold items coming from the previous season are exhibited to be sold off. From an operational point of view, these garments are collected at the end of the season and stored in the central warehouse where the collections are recomposed, even if incomplete. During the corresponding season of the following year, the past assortments are sent to the individual outlets, with the same logic used in the Retail world.

3.4. Competitive context and main competitors

After a brief and general presentation of Miroglio Group and a more detailed explanation about the distribution logic in its stores' network, the following paragraph wants to describe which is the competitive context which Miroglio is currently facing first of all from a general point of view and then analyzing the two leading and well-known companies in the fast fashion industry.

The fashion industry is strongly determined by the changes in society in terms of lifestyle and it is surely affected by the recessionary phases of the economy, but however it remains in any case a active sector. Despite the economic crisis, the fashion industry's performance over the previous decade saw an industry grow of 5.5% annually according to the McKinsey Global Fashion Index, with an overall estimated value of USD 2.4 trillion in 2016 (Berg *et al.*, 2017). This industry is characterized by a wide range of tastes, styles and periodic trends, moreover similar assortments are commercialized by different brands and distributors and consumers change considerably from one country to another in terms of tastes, purchasing frequency and purchasing power. For these reasons, this industry is highly competitive with a plethora of companies that try to adapt in the best possible way in accordance with the different market's features they are facing in a specific area. During years, several trends have been identified across the whole fashion industry's supply chain and hence the next paragraphs analyze each step aiming at explain those aforementioned trends from a competitive point of view.

As far as production is concerned, there is a high *fragmentation*, indeed most of actors in this stage are small or medium-sized companies. Furthermore, production continues today to be *labor-intensive*. In order to produce garments, excessive investments in machinery or plants are not necessary, since many production phases are carried out manually by the operators. For that reason, a massive shift towards the developing countries has been registered. However, transportation costs must be taken into account to bring the finished items back quickly. Therefore, another phenomenon is the *regionalization* of the production areas. For instance, Turkey, North Africa and Eastern Europe have become major EU suppliers, whereas Mexico and Central America are big suppliers of the USA, while Japan imports in particular from China. On the contrary, the distribution phase in the western countries is dominated by a strong *concentration*. Many independent shops have been supplanted by large chains, which

can be found in cities and even in small towns. However, even if this could be a pain point for the industry, these distributors plays an important role. By increasing their bargaining power w.r.t. manufacturers, they allowed to reduce their response lead time leading to the fast fashion achievement (Ghemawat & Nueno, 2003).

Since the project is focalized on the fast fashion, next paragraphs describe the leading companies in that field, trying to point out in a clear way their strengths and weaknesses. Surely, despite the numerous firms on the market, the main global competitors are represented by Zara (Inditex Group) and Hennes & Mauritz.

3.4.1. Zara (Inditex Group)

Zara is the most widespread and most important brand of Inditex Group (Industria de Diseño Textil). After a rapid rise in Spanish territory, in the '90s Zara entered the international markets, opening stores first in Europe, then in America, in the Middle and Far East. Currently the brand (# 46 Forbes' ranking) has an estimated value of USD 13 bln with more than 2,200 proprietary stores in 96 countries. Moreover, with an annual turnover of USD 18.9 bln (in 2017) it represents the 70% of Inditex's total revenues (Forbes, 2017). Although in continuous expansion, the key success factors of Zara could be recognized essentially in two main elements: supply chain speed and stores.

Thanks to its *speed*, the strategy adopted by Zara is to produce small volumes of each model to be extremely flexible to demand's changes and at the same time almost eliminating the problem of inventories. Moreover, the customer is aware of the fact that Zara often changes the assortment, so she visit the store knowing that new items are exhibited on the shelves. Miroglio Fashion introduces around 1,600 design per year, H&M around 2,000/4,000 compared to approximately 11,000 new designs introduced annually at Zara. Consequently, stores traffic flows indicates that Zara customers visit the store on average 11 times a year, compared to 4 of the competitors (Stevenson, 2012).

This approach creates the feeling of "scarcity and opportunity" in the client's mind (Vona, 2003), since the company gets the customers to feel that if they do not buy an item when they see it, it might be likely missed the next time they visit the store. Therefore, it generates an impulsive purchasing behavior supported by the affordable low prices. In a four week time window, usually 75% of all garments in the store are replaced by new products (Moreover,

average inventory at Zara is 6 days compared to 52 days at H&M) (Mcafee et al, 2004). This very high speed of change limits also the risk of stock-out, because often customers enter in stores without having a precise idea of which items they want, falling then in a serendipity condition looking at what the store offers in that moment. Lastly, this strategy allows to Zara to have high margins and decrease the price promotion. The usual percentage of cut downs in the fashion industry is 35-40%, however Zara only has price reduction on 18% of their clothes.

That outstanding speed is possible to a strong *vertical integration* of supply chain's phases, but also at the same time to a good *localization*. As said before, many fashion companies today outsource their production to developing countries, however Zara has 80% of its production within Europe. To keep high flexibility and control, approximately 60% of all the garments are produced in plants owned by Zara, in which the goal is not to get economic of scale, but rather produce in small batches. Of course, this accounts for new products with high fashion content, whereas some products such as men's shirts are not demanding such short lead-times since they have a more constant demand and therefore they are outsourced. Zara owns two fulfillment centers, both in Spain, providing a very short delivery lead time (24 hours within Spain and 72 hours within Europe) also thanks to the huge bargaining power w.r.t. the smaller service suppliers. Thanks to all these elements together, Zara is able to modify an existing model and distribute it in two weeks, whereas for a new design, the average time to market is 4/5 weeks, which represents the real final outcome of its strategy.

However, there are some drawbacks. Surely, low-inventories fail to accommodate high demand for a specific product in a short time frame, leading unavoidably to lost profits. Lastly, also High product replacement, although it is the key successful factor at Zara, could carry the risk of product cannibalization, i.e. the introduction of a new product may limit the success of another items (Stevenson, 2012).

With reference to the initial section of Chapter 3, Zara is applying the Quick Response concept throughout an agile supply chain. Indeed, tight communication within the company departments and production of a small number of items at a time are the key concepts of QR philosophy, which aims at minimizing pre-season orders, deploying the improved speed and flexibility of the supply chain.

The second Zara's key success factor is the surely the widespread network of proprietary stores, which have other additional functions besides the classic ones of simple point of sale. As said in the previous paragraph 3.2, stores play a fundamental strategic role as *differentiation factor*, and in particular it is used by Zara as a magnifying glass to study the evolution of the market, collecting information on customers' expectations. Moreover, Zara is definitely aware of the fact that the store is one of the main lever to build a strong customer loyalty and therefore it is subject to a continuous development and improvement in order to integrate new innovative technologies that could enhance the overall *customer journey*.

Recently, Zara has launched its first online focused *pop-up store* in London, with the purpose of creating a new concept for the next store generation with easy payment system via Zara's app and product recommendation system (using RFID technology). Customers will be able to scan a product to receive more information on it, including suggestions of combination with other items in the store, with a complete *personalization* of the in-store experience. Moreover, as introduced before, knowing that the importance of online segment is growing the new store has a dedicated fully automated online order collection point, in which shoppers can pick up purchases made online at a suitable time for them. Lastly, since the long run strategy of the whole Inditex Group is to reduce the CO_2 emissions, the new flagship store is equipped with smart systems to reduce pollution and save energy in accordance with that eco-efficient store program regulations which surely increase the brand visibility of the Group (Hendriksz, 2018)

3.4.2. Hennes & Mauritz (H&M)

Hennes & Mauritz (H&M) is a Swedish multinational clothing-retail company known for its fast fashion clothing for women, men, teenagers and children. Today, H&M is operating in 62 countries, with 4,500 stores with an annual turnover in 2017 of USD 23.7 bln. The philosophy of the company is to offer fashion and quality at affordable prices (Forbes, 2017).

Although it is the main competitor of Zara in the fast fashion field, the two supply chain work in a totally different way. First of all, production is outsourced to 700 independent suppliers, located in Asia or in Eastern Europe, since H&M does not own any production plant. Hence, production offices are constantly in contact with suppliers. They are responsible for placing orders to suppliers and getting a good price, checking at the same time that the quality and the deadlines are respected. Similarly to Zara, H&M controls their distribution centers to be able

to guarantee the smooth delivery of products. However, those centers are not centralized but spread in each regional market to be as close as possible to the stores and in this way the distribution of the products becomes more effective. The stores do not have back up stocks so they get refill directly from the warehouse. When a product is sold directly a request for replenishment is sent, definitely in harmony with the QR concept and agile supply chain management discussed before. With that practice, H&M stores receive items every day. Lastly, a crucial difference with Zara is that H&M does not own the stores, which are rented, even if the positioning strategy is the same (i.e. city centers and in streets with high traffic rate). This has been their strategy since the foundation of the company to achieve a more flexible control. Generally, this kind of strategy demands a high level of planning and organization along the supply chain. Of course, as for Zara, clothing line with a constant demand (e.g. baby clothing) are planned in advance.

Similarly to Zara, also H&M is running medium-long term programs of eco-sustainability of its supply chain to enhance its brand visibility. Indeed, H&M is trying to have the greenest transportation framework in the industry. For instance, so far 90% of all H&M's transports are completed via road, rail or sea, while the air freight is used only in particular and extreme cases.

In conclusion, there are several ways to achieve the required steady pace of fast fashion industry. The reason for why companies choose different behavior in their supply chain management is mainly connected to their vision and managerial capabilities.

3.5. M2Log: *Fiorella Rubino* current situation

As a first step for the design and study of new solution in the field of last mile logistics for the Miroglio Group, it is of primary importance to clearly define the starting situation of the company, in order to obtain a valid benchmark, which could be used for subsequent evaluations. Indeed, identifying the main cost centers it is possible to think at more targeted solutions also in accordance with the needs that are highlighted by the various actors in the supply chain, which are discussed in the next Chapter 4.

Among the main brands owned by Miroglio Fashion operating in the fast fashion industry, for the case study at hand the Fiorella Rubino brand is taken into consideration, since it is the only one fully vertically integrated and therefore allows maximum visibility of information along the supply chain thanks to RFID technology. As far as the operating functions is concerned, the logistic process adopted is the same previously explained in paragraph 3.3.1. in the section *Retail Logistics*.

The following section is divided into three paragraphs: first of all data and parameters collected with the support of Miroglio Fashion are presented and described, then the AS IS results are shown divided by cost center specifying all the assumptions that have been reasonably done, and lastly some initial considerations on the main emerged problems to tackle are discussed and marked as possible improvement points.

3.5.1. Data collection and parameters

As previously mentioned, in order to be able to effectively evaluate possible proposals for improvement of the current service offered, it is necessary to have initial data that allow to clearly outline the current situation. For that reasons, the company has provided data on the Italian Spring 2017 season of the Fiorella Rubino brand, which include information on:

1. Production data: including information on the garment's model, its variant and size, the day of arrival at the central warehouse in Pollenzo and the country of origin in which it was produced. Obviously, the total quantity of the relative production batch is also present.
2. Garments' flows: including all unit flows/movements of each individual item during the Spring 2017 season. In this case, the day in which the flow happens is indicated

with also the related invoice document and the type of item handled. Furthermore, the motivations for the item's movement can be multiple since it may be a transfer of goods from Pollenzo to a shop (ACI code) in the case of initial or subsequent re-supply, a sale to the final customer (VEN code), a return during or at the end of the season (REI or RFS code) or finally a transfer between stores (TRA code). Obviously, in the latter case both the shops belonging to the transaction are indicated. In general, attention must be paid on the arithmetic sign of such data (+1 or -1) depending on whether the item is entering (+1) or exiting (-1) the store.

3. Fiorella Rubino stores: including all the locations and the related identification codes of the 189 stores located throughout Italy, most of which are located in shopping centers.

These data so far allow us to have, if properly analyzed, a clear overview of the movements of Fiorella Rubinos' goods within the Italian territory, but it is necessary to point out that these data are not sufficient to make economic considerations on the supply chain in terms of production costs, inventory management in the central warehouse and in Italian stores, transport from warehouse to stores and lastly horizontal transfers between the stores themselves. For these reasons, it was necessary a subsequent data collection that would allow to have all the necessary economic parameters to make such considerations. In particular, the following Table 2 lists the required parameters with relative description.

Table 2 Miroglio Fashion: required parameters

Parameter	Value	Notes
Annual Inventory Cost - Warehouse	0.18 [€/item]	Estimated value used by Miroglio coming from the ratio between the general expenses of the warehouse and the average item quantity stored
Annual Cost of Capital (WACC)	12%	It is used by Miroglio Group to evaluate investments in general, but it could be used also as a proxy for accounting inventory cost in stores
Avg. Production Cost - Trouser	13 [€/item]	Parameters coming from the production plants, showing the average cost to produce Trousers, Jackets and Blouses of a Spring season.
Avg. Production Cost - Jacket	20 [€/item]	
Avg. Production Cost - Blouse	10 [€/item]	
Shipment Cost	7 [€/package]	Parameter coming from the contractual agreement that Miroglio has with DHL
Max. Capacity of 1 package	30 [item]	Maximum number of items that on average a package can contain when it is optimized
Shipment Cost from Warehouse	0.20 [€/item]	It is a proxy used by Miroglio to consider the shipment from Pollenzo to stores. The value per single item is low since in this cases the package is almost always optimized.

Thanks to the parameters described above, it is now possible to make complete economic evaluations, which will be shown in the following section. Before going on to present the current situation of Fiorella Rubino in Italy, it is noticeable, as can already be seen from the table above, that the analysis will consider only three product categories: Blouses, Jackets and Trousers. This choice was made to streamline the analysis without undermining the final validity of the results and furthermore it must be specified that the choice was not blind but it took into account that these three product categories together determine 57.3% of total volumes of sale of the brand Fiorella Rubino.

3.5.2. AS IS result

In order to provide a clear and straightforward explanation of the analysis made, the following State of Art of Fiorella Rubino is described following the order of supply chain's steps starting from production, then moving to the central warehouse with the relative shipments to stores, to finally analyze inventory management in stores and the horizontal transfers between them. To clarify, for this initial phase of context's determination and for the subsequent phases of definition and evaluation of the proposed scenarios, the focus is on unitary *macro* values without going into details of size and color of the product categories. Indeed, if some improvement chances are highlighted, the possibility of analyzing the situation with a greater degree of detail through appropriate managerial software can then be considered.

As far as total production is concerned, the following Table 3 shows where Fiorella Rubino produces its own items, using external suppliers. Most of them are produced in Asia (roughly 48%) or in the neighborhood of Italian territory (roughly 40%), while only the remaining 12% is produced directly in Italy.

Table 3 Fiorella Rubino Spring 2017 season overall production

Production Country	Jackets [# items]	Blouses [# items]	Trousers [# items]	Total Production [# items]
BANGLADESH	-	-	52,624	52,624
CHINA	33,280	66,730	158,865	257,665
INDIA	3,265	-	-	3,265
ITALY	33,256	4,331	38,254	75,841
MOROCCO	14,806	-	22,848	37,654
MOLDOVA	12,260	-	5,119	17,379
TURKEY	182,242	-	26,759	209,001
Total Production	**279,109**	**71,061**	**304,469**	**653,429**

Once that these items have been produced, they are sent to the central warehouse of Pollenzo, which periodically sends them to the stores. As can be expected from the information collected from Miroglio management and reported in the previous *Retail Logistics* section, the central warehouse will have an initial peak phase (at the end of the year) in which it collects the new season's garments coming from the production plants, without the possibility to start distributing them since the market is still widely in the Winter season. Only at the beginning

of the new solar year the first Themes begin to be distributed, decreasing consequently the stock in Pollenzo. Other local peaks could then be verified later, as the new product Themes continue to arrive during the first phase of the Spring season and every two weeks distributed within the stores' network.

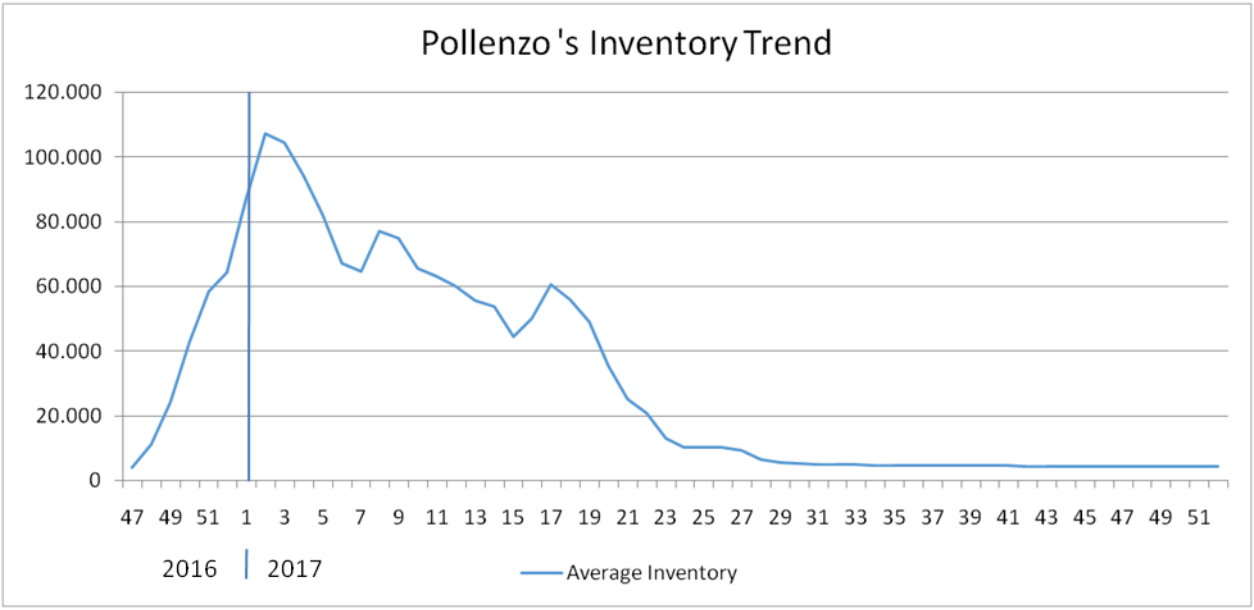


Figure 9 Inventory Trend in Pollenzo's central warehouse

The previous Fig. 9 confirms the expectations since, as it is noticeable, there is a high stock peak at the end of 2016 which is then quickly distributed in the first weeks of 2017 and then tends to zero after that all the Themes of the season have been delivered to stores.

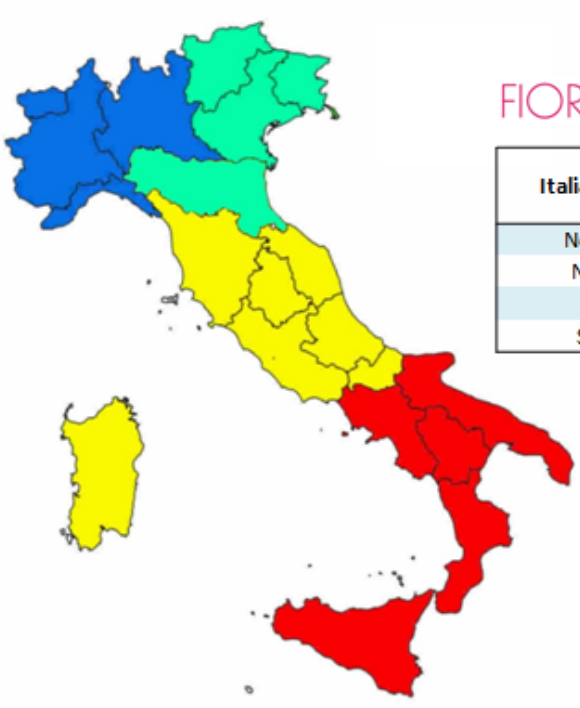
Regarding the calculation of the related inventory costs, some reasonable assumptions and simplifications have been made. Indeed, considering that it is useless to focus the attention on daily specific data, these information have been aggregated on a weekly basis to have a more easily manageable data set. Subsequently, the average weekly stock was calculated according to the formula below:

$$\frac{(Mg_t + Mg_{t-1})}{2}$$

where the variable Mg_t indicates the total value of the warehouse stock at the end of the week *t*. By repeating this operation throughout the period considered and finally multiplying by the cost parameter presented previously (appropriately converted on a weekly basis), it is now possible to obtain the total cost of inventory in Pollenzo, which amounts to € 6,130. This

value is absolutely in line with expectations, since usually the management costs in the central warehouses have a very low value, due to their low managerial costs and the relatively short transit period of the goods within them.

As said before, once the items arrive at the central warehouse, they are distributed within the stores' network. To have a more clear idea of the distribution of the stores in Italy and the differences between them the following Fig. 10 provides some useful data.



FIORELLARUBINO

Italian Macro Regions	Store Distribution [# stores]		Sales [# items]
North-West Italy	61	32%	36%
North-East Italy	35	19%	20%
Central Italy	48	25%	24%
Southern Italy	45	24%	20%

Figure 10 Italian stores distribution

As it is noticeable from the data in the table, it could be affirmed that the distribution of stores is quite uniform on the Italian territory, with the largest concentration of stores in the North-West of the country. Also with regard to sales, the situation is similar, with a slight imbalance between the North-West and the South, since the first shows a higher concentration of sales while on the contrary the latter has a lower density. However, ignoring these slight differences, this scenario indirectly allows to detect that the 189 stores within the network can be considered similar. This assumption will be helpful in the subsequent design phases presented in the next Chapters.

After the initial identification of the distribution of the stores on the Italian territory, it is relevant to know as starting Key Performance Indicator the cost borne by Fiorella Rubino to allow such stores to receive the garments which will be displayed on the shelves. It should be reminded that the packages transferred from Pollenzo to the stores are often optimized thanks to the large quantities shipped at the same time, so it is unlikely that new solutions or methodologies will be able to be applied to this part of the distribution process. Hence, considering the quantities shipped shown in the following Table 4 and the parameter provided by the company, the total transportation cost of the items shipped from the central warehouse to the stores amounts to approximately € 129,000 during the Spring 2017 season.

Table 4 Total number of items shipped to stores in Spring 2017 season

Total Units Shipped to stores	
Jacket	277,732
Trouser	296,761
Blouse	70,851

Going ahead along the various steps of the supply chain, after being shipped from the central warehouse, the items arrive at the stores where they have to be stored and then exposed to customers. Generally, since stores are located in areas with high visibility, the costs of maintaining these stores are definitely high, and consequently this leads to high costs allocated to stocks. The procedure used to calculate these costs is completely similar to the one previously applied for the central warehouse's inventory. In this case, however, as already previously specified in Table 2, the company *weighted average cost of capital* (WACC) is used as an approximation of the inventory cost rate and considered equal among all the Italian stores. Moreover, in order to define a *State of Art* as realistic as possible, this time the trend of the three considered product categories is shown separately in the following Fig. 11. Since the aim is to give an economic macro evaluation, this Fig. 11 represents the cumulative trend of all 189 Italian stores considered in the analysis, since focusing on a specific one would not bring any added value to the analysis.

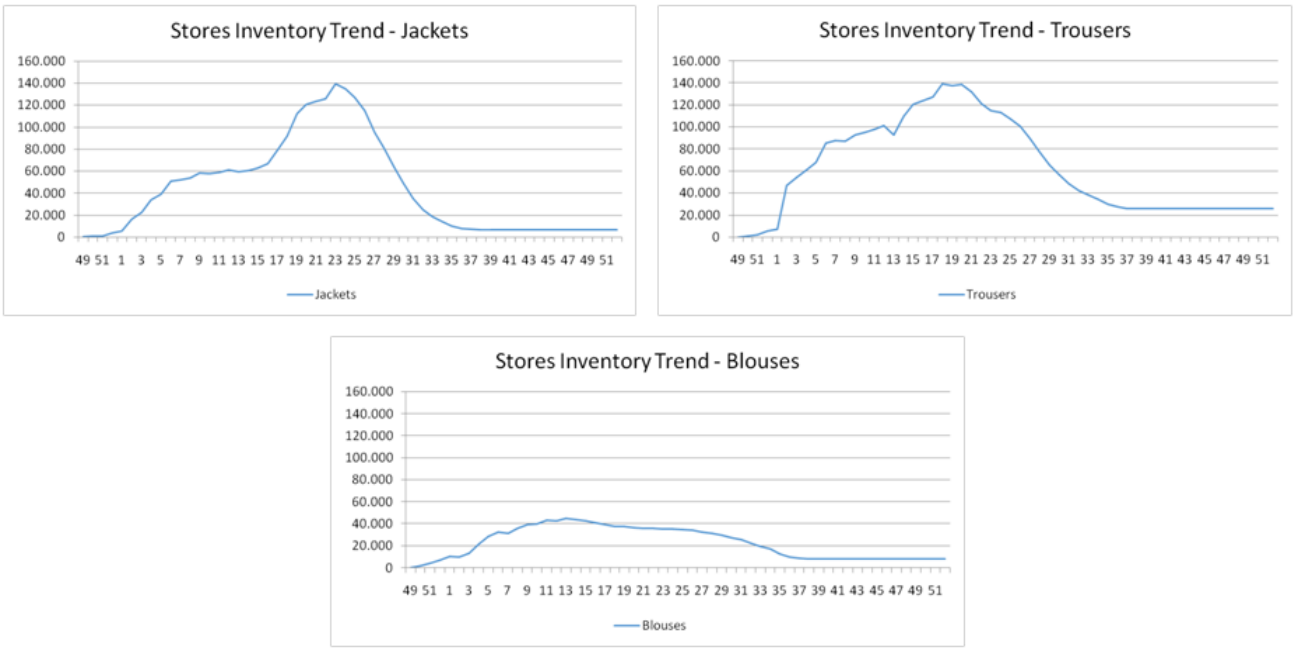


Figure 11 Inventory Trend divided by product category

The assumptions made to calculate the average stock level in each week for each product category and the resulting total cost of maintaining stocks in the stores are entirely similar to those made previously. During the Spring 2017 season, the brand has incurred costs amounting to a total of € 246,100, which are currently the main cost center found.

Lastly, much attention should be paid to the horizontal transfers between stores allowed by the algorithm of the *borsino* explained above. To analyze this particular mechanism generally adopted by the whole Miroglio Fashion, it is first of all necessary to give a dimension to these transfers and to identify the main garments' flows at national level. The following Table 5 and Table 6 show the number of items transferred in relation to the number of items sold during the entire season and the percentages of transfers between the various macro-regions.

Table 5 Relation between items transferred and sold

Season Spring 2017	
# sold items	603,662
# transferred items	131,665

Table 6 Stores' transfers between Italian regions

Horizontal Stores Transfers		To			
		C	NE	NW	S
From	C	6%	4%	8%	4%
	NE	5%	5%	7%	5%
	NW	8%	6%	15%	7%
	S	4%	5%	7%	5%

Table 5 shows that 21.8% of the garments sold during the season were previously transferred from one store to another, a definitely important percentage for the redistribution of items within the Italian network. Table 6 instead provides a greater degree of detail on redistribution not only at numerical level, but at territorial level. As can be seen from the same Table, the transfers are equally divided between the various macro regions, with a higher density within the North-West area of the country. Both these last statements are a confirmation of what was previously found on the similarity of the stores and on the greater weight of the Italian North-West. In order to quantify the total number of transfers made (later broken down to present the previous Table) some assumptions were made. It should be recalled that the total number of transfers is very different from the total number of items transported, since each single package transported could contain an average maximum number of 30 items. For this reason, the next Table 7 allows to understand the average quantity of garments for each transfer, highlighting the level of current optimization.

Table 7 Number of horizontal transfers in season Spring 2017

# items for each Transfer	Total # invoice	# package needed	Total Package	% Package
1	6,661	1	6,661	29,1%
2	3,975	1	3,975	17,4%
3	2,688	1	2,688	11,7%
4	1,611	1	1,611	7,0%
5	1,094	1	1,094	4,8%
6	861	1	861	3,8%
7	638	1	638	2,8%
8	545	1	545	2,4%
9	448	1	448	2,0%
10	365	1	365	1,6%
11-20	1,948	1	1,948	8,5%
21-30	512	1	512	2,2%
31-50	330	2	661	2,9%
51-100	235	3	705	3,1%
101-150	29	4	116	0,5%
151-200	4	7	25	0,1%
201-250	2	9	21	0,1%
251-300	-	10	-	-
301-350	1	12	14	0,1%
351-400	1	14	16	0,1%
Total	21,949	-	**22,904**	-

After checking that each unique invoice number corresponded to a single unique relationship between two stores, it was possible to extrapolate the number of items transferred for each invoice. Assuming that, as mentioned, the maximum number for each package is about 30 pieces it was possible to obtain the number of packages necessary for each invoice and consequently the number of total packages transferred during the season. Paying particular attention to percentage data, it is noticeable that 93.2% of horizontal transfers necessitated a single package and that most of them are not definitely optimized, since about 29% of packages have only one item inside. As a result, the high number of transfers and their low optimization result in a total cost of € 160,300 since each single package transferred involves a charge of € 7 regardless of the place of departure and the final destination.

In conclusion, some brief consideration should also be given to end-of-season returns which are shipped to the central warehouse in Pollenzo and then reconditioned and sent to the Outlet channel. As can be understood from the following Table 8, the number of items is quite small compared to the total production. For the return shipping the optimization of the package is assumed, resulting in a total cost of € 4,800.

Table 8 Garments Final season returns

Final Season Returns	# items	%
Jackets	6,708	2,4%
Trousers	12,739	4,3%
Blouses	4,865	6,9%

3.5.3. M2Log Supply Chain Improvement Ambition

As previously mentioned, in order to propose new solutions that can make real improvements, a complete analysis of the current situation was necessary. Summarizing this study, it led to the following results shown in Table 9, which reports the macroeconomic operating results of Fiorella Rubino in Spring 2017.

Table 9 Season Spring 2017: total Italian operating costs

Operating Costs season Spring 2017	Value [€]
Shipment Cost - Stores' Transfers	160,300
Shipment Cost - Warehouse to stores	129,000
Shipment Cost - Final Season Returns	4,800
Inventory Cost - Stores	246,100
Inventory Cost - Central Warehouse	6,130

From this initial analysis, some opportunities could be already found on the reduction of inventory costs in the stores and in the optimization of transfers, which are also the main top offenders for the total operating costs. The following analyses presented in Chapter 4 have the objective to research the main needs perceived by the various actors within the supply chain that may or may not confirm these initial opportunities identified.

4. Needs and Requirements Analysis

In order to design logistic solutions in the last-mile field that could bring efficient solutions, it is first necessary to understand what are the main needs of the actors who will then use or will be part of the new service. Indeed, the customer information, also called the Voice of Customer (VoC) (Clausing, 1994) represents one key point of the subsequent analysis. In literature, it can be categorized in three ways in accordance with the degree of customer involvement in the design development process (Kaulio, 1998):

1. design process *for customer*, in which the customer is not directly involved;
2. design process *with customer*, in which the customer is involved in the evaluation of solutions;
3. design process *by customers*, in which the innovation process is performed outside the company (this approach is more common in product design instead of service one).

In product development literature, The VoC is interchangeably described by different terms, e.g. *needs* and *requirements*, which are sometimes used interchangeably with the meaning of demands, wants, desires and wishes. But in reality, a relevant difference between these two terms exists, therefore before going ahead it could be a good effort to elaborate a more precise distinction on these terms, which could be helpful to avoid misunderstanding in the following paragraphs.

Generally, needs are more often unconscious than conscious, embedded in routines and difficult to explain and articulate. Basically, they can be also perceived as a problematic situation to which it seems impossible to find a solution. Therefore, needs are usually context dependent and to find them, an accurate search is needed to avoid also misunderstanding. In addition, due to this unconscious peculiarity, the approaches are mainly based on *qualitative* methods. According to Ulrich and Eppinger (Ulrich & Eppinger, 2008), a traditional way is by asking questions about, for instance, features and preferences of an existing product/service throughout structured brainstorming workshops, interviews and questionnaires, which allow to collect the desired initial information. After that first step, two separated contexts become discernable. The first one is the customers' context where values and needs are perceived by the users and then the second one of the product developers', where requirements and specifications are designed by the development team.

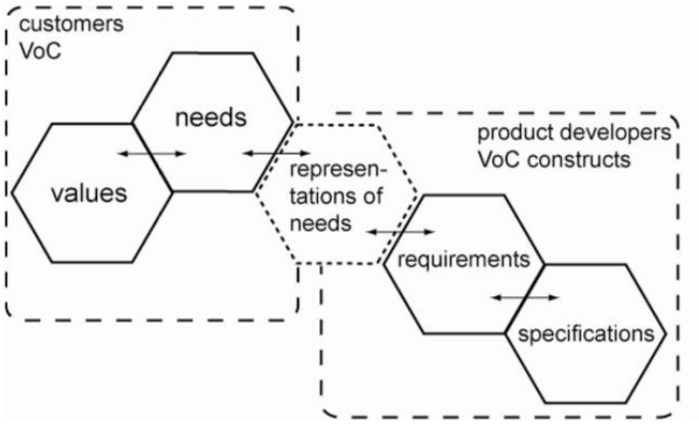


Figure 12 Double context of design process activity

Representations of needs, which basically represent an interface between customers and developers, can be really helpful, to find the main functions which provide added value (Pahl et al., 2012). A possible approach is the one suggested by Ulrich and Eppinger (Ulrich & Eppinger., 2008), in which collected information should be interpreted into written statements that define what the solutions have to do, not how it might do it. Once the VoC is translated into these representing statements, the subsequent design's effort is to define formally measurable requirements, which allow to highlight from a technical viewpoint the main tradeoffs and contradictions and represent the real basis for the final specification definition.

From an engineering design perspective, a service is developed to enhance the goods in the eyes of the customer, but when moving from B2C (Business-to-Consumer) to B2B (Business-to-Business) markets, the definition of customer requirements becomes a complex problem to solve. Indeed, in B2B, multiple stakeholders are involved, mutually influencing each other. Therefore, a new service/product will be successful only if all of these stakeholders will favorably support its introduction (Cantamessa & Montagna, 2016). For that reason, since in the business case at hand multiple stakeholders are involved along the whole supply chain, after the next section that aims at giving a brief overview of the adopted methodological approach, a more detailed focus on different stakeholders is reported.

In conclusion, although supported by a large theoretical literature, the process of needs and requirements identification leaves room to many possible personal interpretations accordingly to the designer's experience and ability. Hence, the scope of this brief introduction was not to explain procedural and defined steps to follow in the design activity, but rather to provide at least a basic knowledge on the existing difference in this field between two terms which are usually interchangeably used.

4.1. Introduction to the methodological approach

The final objective of the following paragraphs and next Chapters is to design possible alternatives that could, each with its strengths and weaknesses, meet the needs of the various actors in the supply chain. To achieve this result, it is first of all necessary understand which are these needs throughout the use of existing literature, as done in the previous Chapter 2, but also through direct contact with actors involved. To this end, thanks to the availability of some companies that will be better presented later, some interviews were conducted with the intent of identifying possible needs perceived by them that could be replaced in the future by a new logistics service, especially focused on the last-mile of the supply chain. Lastly, some of these alternatives are then economically evaluated to have some feedback on their validity.

4.2. Supply Chain Stakeholders

As mentioned during the AS IS analysis of the Fiorella Rubino's current situation, several steps of the supply chain are indirectly involved in the project. Therefore, before going ahead, a brief description of each one is necessary. Each of these stakeholders operates according to a set of specific needs and gives different weights to these needs. Needs can emerge from the actor itself (native needs) or can be the result of a mutual influence among actors (reported needs). Surely, requirements must take into account stakeholder needs in such a way that all actors who are involved in the adoption decision see their needs being met at a acceptable degree.

Following the supply chain's steps, main stakeholders are:

- *Garments producers*, as Miroglio Fashion acquires the production capacity externally, this category is affected only if the proposed solutions are able to reduce the quantity of clothes ordered initially. Logistic processes in this process phase are definitely outside the project objectives and therefore this stakeholder will not be taken into consideration.
- *Internal commercial department of Miroglio Fashion*, this department decides, as said before, the quantity to be entered in each single store at the beginning of the season and directly manages the functioning of the weekly *borsino* for horizontal transfers between stores. The interest of this stakeholder in the project is certainly high.

- *Express couriers*, they are the external suppliers of logistic transportation service that allow the handling of garments on the national territory. They generally have opposite interests to those of Miroglio Fashion, which would like a maximum optimization of the transported packages in order to reduce the total cost. Obviously this category is definitely relevant within the Miroglio Fashion business model and the analysis of its needs cannot be excluded from the project.
- *Possible new customers of the new logistic service*, they are external companies operating in the fashion segment that currently do not use the logistics service provided by M2Log. At the moment they represent a category not directly involved in the project, but since M2Log would like to offer the possibility to use the new logistics service (in order to consequently increase volumes and achieve greater optimization) collect a pool of the needs of other companies in the fashion world represents a decisive factor for the design phase.
- *Store managers*, They are responsible of the stores and see directly on the field all the impacts of the management policy made in the upstream phases of supply chain. They perform a key function within the current business model having the ability to request horizontal transfers and directly managing the store inventory.
- *Final customers*, are obviously the final category that must be met by Miroglio Fashion's offer, but external to the design of new logistics services and for this only marginally considered, trying with the new proposals to guarantee the same levels of service.

In conclusion, main stakeholders involved in the project are the internal commercial department of Miroglio Fashion, the store managers, the express couriers and other companies in the fashion industry. In the following paragraphs, these four categories are divided in two different sections. Indeed, in relation to the company, the first two categories belong to the *internal stakeholders* while the remaining two are considered as *external stakeholders*. Several interviews have been conducted to highlight the different needs of each category in order to have a good basis for the following design of alternatives.

4.3. Interviews to internal Miroglio stakeholders

Interviews with Miroglio's internal customers (see Appendix) were the first ones to have been made during the design phase as they also allowed to obtain a greater amount of information on the functioning of the internal processes of the company and at the same time to understand the main critical points that they could be improved. Three interviews were made, two of them to store managers in the stores located in the shopping centers of Beinasco and Grugliasco (both in the province of Turin), and the last one to the Sales manager and the Logistics manager for Fiorella Rubino.

As far as store managers are concerned, both have independently expressed the same needs, therefore giving greater validity to the analysis made, as disagreed opinions would certainly have represented a problem that could be caused by misunderstandings occurred during the interview. The following Table 10 summarizes the main critical elements and the resulting expressed needs, with the addition of the related design requirements.

Table 10 Store manager: needs and requirements

NEEDS	REQUIREMENTS
More space in the store's backroom	Decrease the amount of security stocks in the stores
No accumulated boxes in the store during the weekend	More frequent delivery for planned replenishment
Customer should wait less for an order	Daily replenishment service on demand
Know exactly when deliveries arrive	Have pre-established days for planned replenishment
Know exactly when the transfers arrive	Increased system visibility and parcel tracking

Analyzing these different needs it is noticeable that many of them can collimate, indeed for instance, decreasing the amount of stocks immediately sent to the stores (as mentioned above, 90% of the new Theme is immediately sent from Pollenzo to the stores in a single shipment) it would be possible to have a store and its backroom much more lean to manage, avoiding accumulation of products still packaged in the store during the days of greater turnout of customers, giving customers themselves a better image of brand organization and its general quality of service. Obviously this certainly represents a trade-off for the management of

shipments and in the following proposed alternatives the right levers to be touched must be carefully evaluated. Unfortunately, some needs, such as the last one concerning the request of increase visibility along the supply chain is out of the scope of the project since it implies also new investments in IT system and technology. Surely, those needs could be only qualitatively considered and represent a possibility of improvement for next steps of the project itself.

On the other hand, as far as Fiorella Rubino's commercial department is concerned, the most national and top-level vision involves a series of needs that are totally different from those of store managers, who obviously have the main interest in the efficient management of their store and the achievement of the set monthly target. On the contrary, the commercial department is driven by interests more focused on improving the overall service offered in the various regions of Italy and reducing waste along the supply chain in order to optimize the level of investment necessary for the business to work. The following Table 11 summarizes the main needs emerged from the interview to the commercial department.

Table 11 Commercial Department: needs and requirements

NEEDS	REQUIREMENTS
Lean management of replenishment	Decrease the number of stock immediately allocated to stores and provide a more frequent replenishment
Reduce over-production	Reducing the security stock maintaining a similar service level
Reducing lead time in Southern Italy	System separation between North and Southern Italy
Higher Brand visibility in the industry	New Last-mile logistics services in bigger cities
Enhance integration between SCM used software	Unique and integrate IT system

As previously mentioned, the needs are definitely of a higher level and take into account aspects of greater amplitude throughout the entire supply chain. Also in this case, similarly to what happened for store managers one of the main needs requires the restructuring of the information system that needs greater integration between the various phases of the supply chain.

4.4. Interviews to external stakeholders

As previously introduced, M2Log would like to try to sell its logistic service not only to brands within Miroglio Group, but also to other companies operating in the fashion industry. For this reason, conducting interviews with other external actors in order to feel the main needs required today in the industry certainly allows to have a broader vision, consequently allowing a better design of alternatives capable of responding better to market needs. Thanks to the support of the Engineering and Management department, at least two companies accepted to be interviewed: Loro Piana and Lanieri (see Appendix). Although these two companies are not properly in the fast fashion segment, which means that their basic needs are focused on other priorities, the two interviews have been extremely useful to understand needs of fashion industry in general and in particular, thanks to Lanieri, have a deep insight on the online world. For these reason, next Table 12 summarizes the overall needs and requirements emerged.

Table 12 Companies in the fashion industry: needs and requirements

NEEDS	REQUIREMENTS
As fast as possible replenishment of stores	Same day replenishment
Better usage of store's backroom	Decrease of amount of stock in store
Brand visibility in the industry	Eco-friendly logistic solutions
Reliability of delivery	Guaranteed lead time of delivery
Reduction of horizontal transfer	Optimization of packages shipped between stores
Customer can have all shipping information from the website	IT system integration with carrier's one (Application Programming Interface)

The main needs emerged from the interviews seem in part similar to those emerging from previous interviews made to internal stakeholders, confirming them. It is noticeable that in the fashion industry as in others, the need is now to have logistic services that are increasingly rapid but at the same time sustainable from an environmental point of view, in order to improve not only their operations, but also their brand visibility which is became a powerful competitive tool. Moreover, taking into account the final customer's perspective and the

online world, many companies require that all the supply chain's phases are well integrated to allow perfect visibility to the package shipped.

In order to have a comprehensive analysis, the FedEx company, one of the largest suppliers of logistics services in the world (including express delivery via express courier) with the main hub in Milano Malpensa and 34 delivery station on the Italian territory, was also interviewed. This interview was carried out not only in order to collect the main needs related to express delivery, but also to have a clearer idea of what may be the constraints of this fundamental actor in the supply chain and which are the main features/services that companies are more willing to pay to a logistic service provider. As before, the following Table 13 resumes the main findings emerged from the interview.

Table 13 Express Courier: needs and requirements

NEEDS	REQUIREMENTS
Constantly offer up to date logistic services	Efficient last mile solutions and same day deliveries
Brand visibility in the courier industry	Eco-friendly service and efficient last mile solutions
Well planned time schedule	Fixed time table to pick up the products
Offer a more reliable service	Increase the service level offered

Moreover, apart from the analysis of needs and requirements, from the interview has emerged that *customer loyalty* is one of the first objective that a logistics service provider should try to obtain. In general, companies are more willing to pay to have a reliable service, giving to express carriers a great bargaining power in the price setting.

In conclusion, many needs and related requirements were collected during the interviews conducted, highlighting some common points but also trade-offs and different points of views among the various actors in the supply chain. Taking into account these results, in the next Chapter 5 some alternatives to the current logistic service provided by M2Log will be presented and among these, in agreement with the Company, the most promising one will be developed to have an initial macroeconomic idea of the effectiveness of the proposed alternative.

5. Alternatives Generation and Evaluation

Following the methodological process described above, after having firstly analyzed the current situation of Fiorella Rubino and having initially identified some improvement possibilities, various interviews were structured for different actors within the fashion industry's fashion supply chain in order to obtain information regarding their needs and expectations for the logistic services of the future. Once this phase of framework analysis is completed, it is now possible to generate some scenarios that in whole or in part satisfy the identified needs, always taking into account that often in this phase many trade-offs emerge due to the disadvantages and advantages carried out by scenarios themselves. In particular, as regards the Fiorella Rubino's business case, four different scenarios were generated, which are described in the following paragraphs. As anticipated before, one of these will be then macro-economically analyzed to evaluate the impacts of the solution itself.

5.1. Consolidation Centers in Turin, Milan and Rome

The first designed scenario is based on the creation of 3 delocalized consolidation centers or *hub* in Turin, Milan, Rome to provide a last mile logistic service to the stores in that areas (6 stores in Turin, 11 in Milan and 8 in Rome). These areas represent roughly the 15% of the turnover of Fiorella Rubino but first of all they are the areas of major visibility for the brand. Moreover, there is the largest concentration of stores within a limited surface and therefore these areas are the only ones in which last mile logistic initiative could be effectively implemented.

The idea is to reduce the security stock in the stores, creating a lower consolidated allocation of stock in the hub (*risk pooling effect*). Stores in the area are constantly refilled by a *milk run* twice a day in pre-established time windows (5 days per week - Sunday and Monday excluded). The express couriers, that M2Log actually uses, are in charge to deliver the garments to the local hub, then the urban path is done by local transportation companies, which provide the daily service at a lower price per delivery also due to the lower bargaining power w.r.t. M2Log. Before going ahead, basic knowledge on *milk run* method is provided to guarantee the same shared understanding of the scenario at hand.

The concept of *milk run logistics* originates from the dairy industry and then in a Lean Thinking view (*Just in Time)* it was applied also to other industries and especially in internal plant logistics to transport raw material, finished goods or also waste within the plant from the warehouse (Baudin, 2005). This method works within a specific transportation network where all material requirements (both input and output) of several stations (in the case at hand stores) are covered by one vehicle that visits all the stations according to a pre-defined schedule. This transportation concept is economical when the volume of each single station is essentially smaller than a truckload. Moreover, delivering small batches it allows to reduce inventory costs and correlated risks. This system leads to a reduction in cost of transportation, travelling path and fuel consumption in comparison with the standard delivery method shown in Fig. 13, with also positive externalities on traffic condition and environmental impact due to CO_2 emissions and therefore highly promoted from the viewpoint of environmental policy (Brar & Saini, 2011)

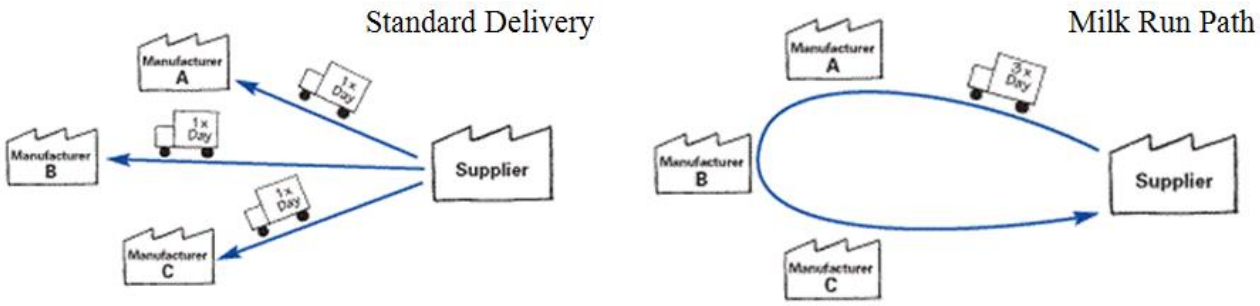


Figure 13 Standard delivery vs. Milk Run Logistics

Regarding the milk runs in the 3 areas, the next Fig. 14 allows to better visualize the paths.

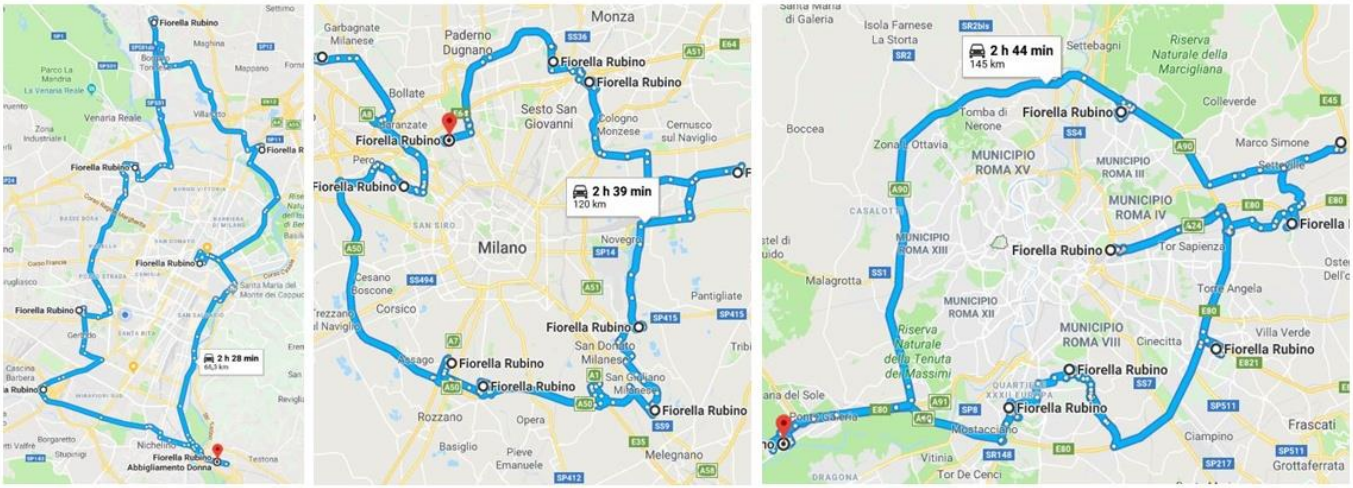


Figure 14 Milk runs in Turin, Milan and Rome

The value proposition offered throughout this first scenario is not only related to Fiorella Rubino's stores, indeed since the stores are located usually in shopping centers the idea is to sell the logistic service also to other companies that have stores in the same locations to share transportation costs within the network. Of course it could leads also to some positive cash flow for M2Log which could help to reduce the impact of additional transportation expenses to offer this daily service. Indeed, as mentioned before, some trade-offs must be considered and evaluated in each scenario.

As far as this scenario is concerned, some advantages rely in the possibility to decrease the store inventory quantity to allow an easier management of the store for the shop assistants and the store manager and a consequent decrease of the store inventory cost, which across the whole stores' Italian network is the main top offender for operating costs. Thanks to the *risk pooling effect* this scenario could provide advantages also for the production, which could be lowered providing the same service level to final customers. Moreover, a more frequent replenishment of stock allows to better address customers' expectations in each store and it allows also to avoid expensive single-item horizontal transfers within the area with a on demand service provided by express couriers. On the other hand, offering this new service twice a day for five days a week surely increases the transportation costs for the company; furthermore, the three consolidation centers are not currently M2Log's assets, which implies additional rental costs that the company has to charge. Lastly, three additional employees must be considered one in each hub, assuming that each hub is dimensioned to stock a number of garments that could be managed by a single person. This last point is probably the most nebulous, since some considerations could be done on the fact that with a more lean inventory store management some intern shop assistants (who are usually in charge of store backroom replenishment) could be superfluous, of course these considerations are definitely out of scope and therefore the previously cited assumption of one employee in each hub is adopted in the scenario.

5.2. Mobile Depot in Turin and Milan

The second scenario is probably the most futuristic and the one most focused on the idea of providing a last mile service with the lowest possible environmental impact. The idea is to use the so called *Mobile Depot,* i.e. particular trucks designed for Last mile delivery opportunities in big cities (Fig. 15). The mobile depot works as a mobile consolidation center equipped with an office room to be constantly integrated with the supply chain. This truck transports not only garments and products to be shipped, but also four electric cyclocargos that are used for the punctual replenishment of stores in the area and for the horizontal transfer between stores in a more eco-friendly way.

Figure 15 TNT Express: Mobile Depot

Mobile depot was developed by TNT Express as a response to the challenging urban working conditions characterized by narrow streets and frequent traffic congestion. In Italy, for instance, 88.5% of the freight vehicle fleet runs on diesel and 11.5% on petrol (Schoemaker *et al.*, 2006) and number of alternatively propelled or fuelled distribution vehicles is rather low. TNT Express has already tested in several cities, such as Brussels and positive results emerged with emissions reduction of 24% for CO_2 (Verlinde *et al*., 2014).

In the scenario at hand, regarding operational activities, each day (5 days per week) the mobile depot leaves the central warehouse of Pollenzo with a new and updated stock (according to daily sales data in the area). Once it arrives in the cities, electric vehicles start to deliver goods to the stores. This service, due to spatial distances from Pollenzo, could be adopted only in Milan and Turin. Next Fig. 16 provides a graphical support to better visualize the functionalities of the logistic service provided by this second scenario.

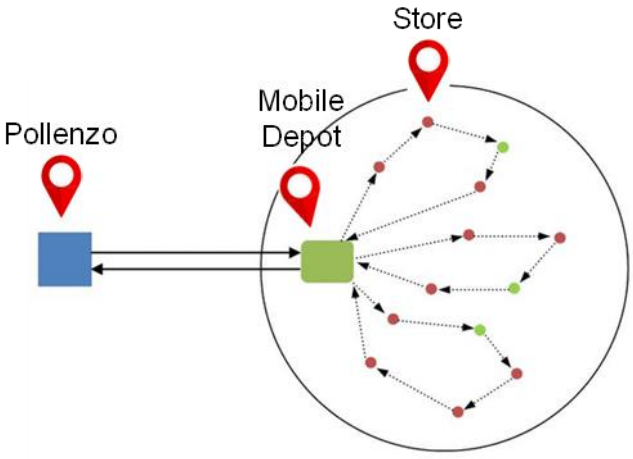


Figure 16 Operational function of mobile depot

Providing a daily service directly from Pollenzo, the inventory level in the stores could be lowered, basically exploiting the same risk pooling effect explained before, which therefore leads to a reduced production quantity. In addition, also in the case at hand the horizontal transfers in the area would be absorbed by the new service. In comparison with the aforementioned first scenario, this second alternative does not need of renting local warehouses, but on the other hand it requires a large initial investment for the two needed mobile depots and higher personnel costs (riders, etc.). Lastly, this scenario would be even more constrained than the first one, since it would be applicable only for the area of Turin and Milan (roughly 10% of Fiorella Rubino's turnover), leading to a limited impact.

5.3. Central Warehouse in Naples

In an attempt to present a plethora of different scenarios that could satisfy all the needs that emerged from the analysis of the interviews presented in the previous Chapter 4, following scenarios were not proposed either directly or completely in the context of last mile logistics. Surely, the idea is to propose solutions that could enhance the current situation described before, and create a positive environment that could lead to following evolutions of M2Log.

The following third scenario in fact provides for the adoption within the logistic network of M2Log of a second central warehouse, quite similar as regards its functionalities to the one currently located in Pollenzo. The location of this second logistic center would be near Naples and would be used to serve part of Central Italy and the whole Southern Italy, substantially dividing the Italian network into two separate sections.

The basic concept relies on the usual differences in garments requested by the Southern Italy's stores, the idea is to separate the aforementioned items in this new central warehouse. As introduced, this alternative is not properly last mile oriented but it could provide a better service on a broader area in comparison with the first two scenarios identified.

Figure 17 Conceptual separation of Italian Network

After the production phase, items are directly shipped in the new central warehouse. In that way a larger stock could be maintained in the new warehouse providing a reduced lead time of refurbishment for the stores in the area. Moreover, in that way, horizontal transfers between North and Southern Italy could be avoided and authorized only in exceptional cases, since actually lead times in those transfers are usually of three days and a reduction could provide a better customer experience in the store. On the other hand, a possible impact on the service level must be considered in relation to saved transportation cost avoiding those transfers. Surely, positive impact could be obtained on the reduction of inventory level in store thanks to the presence of a nearer warehouse that could deliver requested garments in a reduced lead time in comparison with the current Pollenzo's one. Lastly, a non negligible aspect is the initial large investment needed to put in action this third scenario. In the case of further economic evaluations, a *Net Present Value Analysis* should be necessarily considered to understand which is the expected return of the new investment and which could the time horizon needed to recover it.

5.4. Higher Frequency of Stores' Replenishment

Analyzing the needs emerged during the interview phase of the project, the reduction of inventory level in the stores and the more frequent refurbishment of them likely represent the two most desired features from the perspectives of all the actors involved in the process, since today fashion companies are more interested in a more lean approach in the management of their stores supported by a more frequent delivery service and at the same time couriers could take advantage from that situation obtaining a larger number of deliveries.

Therefore, in accordance with those reasons, the last proposed alternative is to verify the trade-off with an higher frequency of replenishment to stores. This solution does not change the basic M2Log operational functioning, but however could enhance several aspect not only related to the operative costs. Indeed, with more detailed and scheduled delivery time tables (refurbishment on a weekly basis), which currently lack, the accumulation of boxes in the store could be avoided, reducing the inventory level in the backroom. First of all, this could lead to a sensible reduction in inventory costs in stores but also in a better image of the brand, with stores always organized and ready to receive customers in the best possible environment, enhancing their store experience and affiliation with the brand itself.

On the other hand, this scenario of course has a negative impact on the transportation costs (first of all because a lower optimization of packages should be assumed), although a positive impact on the horizontal transfers could be registered, since a larger stock quantity in the central warehouse and more frequent deliveries could reduce the necessity of stores to issue garments' requests to other stores in the network. Lastly, also in this case, as in the previous one, a possible decrease of service level should be for sure taken into account and evaluated w.r.t. the possible obtained savings.

5.5. Scenario selection and evaluation

After the presentation of the four designed scenarios, each one characterized by some strengths and weaknesses, it is possible to notice the different innovative content degree across them. To summarize, the first two alternatives surely represent those with a higher propensity toward innovative solutions, taking into account new emerging trends of fast delivery and eco-sustainability of items distribution, whereas the third and fourth scenarios could improve the current situation fulfilling the emerged needs of shorter lead times though with more traditional practices.

Taking that starting point for granted, one of this four alternatives is selected to be evaluated not only in a qualitative way, as shown before, but also with a more quantitative perspective, allowing to have a first macro validation of the effectiveness of the scenario itself. Therefore, in accordance with the company, the first scenario *Consolidation centers in Turin, Milan and Rome* is the one selected for the following analysis and considerations. Indeed, taking into account also other selection criteria from the company perspective, the possibility to implement a new technique characterized by a strong lean approach that could enhance the current operations' optimization degree and, at the same time, increase the brand visibility of the company itself, surely represents a good opportunity of improvement even if the solution at hand is not applicable on the whole Italian stores' network.

Moreover, that alternative allows to have an higher penetration on the market not only with stores but directly with a more customer oriented distribution infrastructure. Indeed, although out of the scope of the project, those consolidation centers could not only have functionality related to store replenishments (with allows the better integration of the supply chain phases) but they could be also used in the future to provide services directly to final customers, widening the offered value proposition.

As far as the quantitative implication is concerned, in order to obtain valuable data some reasonable assumptions have been made and some other parameters have been requested to the company. Main assumption is related to the customers' demand, since for forecasting a possible future benefit of the solution, data related to the past season Spring 2017 have been used to understand the effectiveness of the solution itself. However, this is the common practice in logistic field and therefore it is intended to be reliable. Surely, extending in the future the adopted time horizon could be useful to enhance the robustness of the model. The

period considered is 40 weeks, i.e. the main period in which the garments are sold during the season. Lastly, other assumption is made upon the inventory cost per month in the consolidation centers which is considered equal to the one used for the central warehouse.

Regarding parameters, the following Table 14 provides a quick overview of the main parameters used; of course other used parameters to obtain the whole result of the analysis are those presented in the previous Chapter 3 and consequentially not reported here.

Table 14 Scenario evaluation parameters

Parameter	Value	Notes
Milk run path	2 [path/day]	Application frequency of the milk run path in the three considered areas
	5 [days/week]	
Point to point transportation cost	4 [€/delivery]	Cost per single movement from one store to another. It is lower to the one charged to DHL since it is not an on demand service
Hub dimensions - Turin	150 [m^2]	Considering the amount of items and the capacity of a single package the required inventory space could be much lower. However an office space and other functional spaces have been taken into account
Hub dimensions - Milan	200 [m^2]	
Hub dimensions - Rome	175 [m^2]	
Hub rental cost - Turin	4 [€/m^2]	Data provided by the company according to their experience and initial analysis about rental cost in the mentioned areas
Hub rental cost - Milan	5 [€/m^2]	
Hub rental cost - Rome	4 [€/m^2]	
Service Level	95%	This is roughly the service level currently provided by the company and the target is to maintain it constant
Employee Cost	2,000 [€/month]	Gross amount paid by the company for each employee hired

Thanks to those assumptions and parameters it is now possible to macro economically understand the effectiveness of the proposed solution, finding the new emerging costs to be compared with the possible savings and therefore draw the final considerations of the business case at hand.

In the following Table 15, a sort of As-Is and To-Be analysis is presented, reporting all the costs variations involved in the case at hand.

Table 15 Scenario results

Season Spring 2017	Turin		Milan		Rome	
	Before	After	Before	After	Before	After
Inventory Cost - Stores	6,000	4,655	11,000	8,755	8,015	6,395
Inventory Cost - Hub	-	30	-	40	-	30
Shipping Cost	2,000	9,600	3,400	17,600	1,500	12,800
Hub Rental Cost	-	6,000	-	10,000	-	7,000
Additional Employee Cost	-	20,000	-	20,000	-	20,000
Production Cost saved	-	-19,740	-	-26,800	-	-24,550
Total Cost	8,000	20,545	14,400	29,595	9,515	21,675
Net Result	**-12,545**		**-15,195**		**-12,160**	

As it is noticeable, the solution seems to be not profitable for the company, since in all the three cases the net result is surely negative. Indeed, the increased costs of transportation due to the milk run paths, the additional employees needed and the hub rental costs are not sufficiently balanced by the obtained economical benefits carry out by reduction in production and stores' inventory costs.

However, another relevant aspect has to be absolutely considered; indeed so far all the additional emerging costs (personnel, rent and transportation) are allocated completely to the brand Fiorella Rubino, while in a broader view it is reasonable to assume that all Miroglio Fashion's brands would benefit of the new consolidation centers in the areas. Moreover, as mentioned before, M2Log is absolutely intentioned in selling the service to other companies in the market, which could be interested in the new same day replenishment value proposition offered by the service at hand. Therefore, all the aforementioned costs should be shared and allocated to several entities, totally reshaping the results presented before.

First of all, before reporting these new results, some further assumptions have to be made and explained to assure a comprehensive understanding of the results themselves. Regarding transportation cost of the milk run paths, this cost could be easily shared since the considered store are usually located in large shopping centers, in which there are several other fashion brands. Instead, regarding personnel and rental costs, these should be theoretically shared in accordance with the volume of garments that each brand has in the consolidation centers. In conclusion, the following Table 16 provide two different sub-scenarios in which the milk run transportation cost are allocated only for the 50% (and 33%) to Fiorella Rubino, which basically means that for each point to point movement there are at least two (and three) brands involved; with the same logic also the volume in the warehouse is assumed to be only for the 50% (and 33%) related to Fiorella Rubino's garments and the remaining part to other brands. All the other costs/savings are kept constant according to the previous Table 15 as they are related only to Fiorella Rubino.

Table 16 Sub-scenarios results

Fiorella Rubino (Cost allocation)	Net Results [€]			
	Turin	Milan	Rome	**Total**
50%	5,255	8,605	7,740	**21,600**
33%	11,188	16,538	14,373	**42,100**

As it is noticeable from Table 16, sharing costs between different brands allows to obtain profitable results in both operative cases shown. Of course these are macro evaluation supported by reasonable assumptions and real results could vary remaining theoretically in the described boundaries. However, these assumptions should be validated by a more sophisticated managerial simulation model, which allows to have a more detailed understanding of the problem at hand, taking into account also other variables such as the size and the color of the garments, which have been excluded, as mentioned before, from this initial design analysis. Surely the depicted scenario shows what in literature is deeply suggested to achieve a smart logistic service in large urban cities throughout a better consolidation of transported items thanks to a the concept of a sharing economy across different brands and companies.

Conclusions

Fashion industry is highly competitive and characterized by a lot of pressure not only on costs, but also on the ability of each company to provide the newest possible trend to the final customers. To achieve that results an effective supply chain management and a tight integration along all the steps in the supply chain is required to obtain to reach a high level of optimization.

The project aimed at investigating several solutions to improve the overall inventory management performance of a company in Italy, the Miroglio Group, whose particular focus is at the moment on the last mile performances. The project had to evaluate also the impact of the generated solutions on the adopted forecasting models.

To achieve the aim of the project, a specific and defined path has been followed: a literature review and an initial data analysis of garments movements within the Italian territory allowed to define a preliminary state of the art. Then, several interviews were conducted to the main supply chain's stakeholders to identify needs and requirements useful to generate possible alternatives. Then, in accordance with the company, the most valuable scenario were economically evaluated.

Actually, the outcome in term of economic impact on the whole cost could not be entirely highlighted by the analysis, since this thesis unfortunately focused only on the Fiorella Rubino brand, and the available data were limited. Moreover, the selected areas roughly covered the 15% of the Fiorella Rubino's turnover, while the items taken into account (trousers, jackets and blouses) represented the 57% of the brands' total garments movements. The chosen alternative could lead to valuable and profitable results when the new offered logistic service would be adopted more widely by the Miroglio’s brands at the same time, consolidating items' transportation and therefore sharing the operational logistic costs. Moreover, the investigated solution would result surely compatible and more valuable in term of costs, if Miroglio decided to foster the lean approach that they are gradually introducing. Lastly, even if the profitability results limited at the moment, the possibility to start establishing a well-developed and functional logistic infrastructure on the Italian territory could be a valid option also for the other stakeholders involved (e.g. M2Log) that could pursue that just roughly developed alternative. Fast home delivery service, in fact, is going to become the future trend in the distribution industry and companies should anticipate it,

building their asset network in advance to be prepared on time and be able to fulfill the customers' requirements. For the companies involved in the project, the consolidation centers in Turin, Milan and Rome could be extremely useful in the following years to provide also additional and more customer oriented services, such as same day and instant delivery. Since those services cannot be easily implemented and the related logistic capabilities require time to be enabled and prepared, the initial implementation suggested by the analyzed scenario could represent a first step in this direction. However, it is noticeable that the current not integrated IT system should be improved addressing investments in that direction to provide a valid support for the implementation of these new services.

Moreover, the new service would also imply positive externalities that do not have direct monetary implications and which are consequentially difficult to be evaluated, although they undoubtedly lead to some relevant benefits. For instance, the milk run path would allow the reduction of stock in the stores, avoiding accumulation of garments' boxes in the selling points during the most visited periods of the week and improving the customer experience in store. This would simultaneously increase the customers' perception of the brand, especially because adopted in the more relevant and visible areas of the territory. Moreover, adding new and more frequent replenishment service could represent a differentiation factor in the current fashion industry, which surely increase the brand visibility against competitors.

As mentioned above, the main limit of this thesis is represented by data availability, since they are limited to one single season of products and related to only one single brand. However, other improvements in the model could be object of study, such as the possibility to further add in the future a home delivery service from these aforementioned consolidation centers. Of course, this requires a definitely new and more customer oriented approach to understand the feasibility of that further offered service. Moreover concerning M2Log, an additional and more detailed analysis provided by the managerial software, would allow to understand the specific expected economic return of the investigated alternative but, at the same time, M2Log itself must understand also if there could be companies, with adequate product volumes within the three considered areas (beyond the other Miroglio Fashion's brands), which are willing to adopt the aforementioned new service to share transportation and warehouse costs. Indeed, as revealed by the analysis, without that sharing support between companies, the service would implies a negative economic result for the company and consequently hindering its real implementation in the future.

Appendix

Interview to Miroglio Fashion Commercial Department

1. What kind of re-order policy is currently adopted?
    - Re-order policies differ between various products classes (fast/slow movers)?
        - Is there a differentiated target Service Level for the various classes?
2. How is the quantity of *primo immesso* determined? And that of the replenishments?
3. How often are the replenishments made and who decides what to sent?
4. What are the lead times along the whole supply chain step by step?
    - And especially from central warehouse to stores?
5. Would you need a more flexible service on the last mile step?
6. What is the impact of the out of stock on sales and on customer satisfaction?
    - Have you computed a percentage of sales impact due to the out of stock?
    - What percentage of customers come back to store if the item is not immediately not available?
    - Is there the possibility for the customer who wants a garment that is not available in the store to order it from central warehouse or transferred from another store?
        - If YES how long are they willing to wait on average?
        - and how many customers are making similar requests?
7. Who and how decide transfers between stores?
    - And how often can a transfer be requested?
        - Are there dates agreed with couriers or can it be a on-demand request?
    - How much do the transfers affect the normal re-allocation of garments?
        - Are there any min/max volume constraints per transfer? Which?
        - Are there geographical constraints per transfer?
    - Is the general re-order policy modified taking into account transfers?
    - How are stores' stocks and transfers monitored?
8. How are the garments' returns managed?
    - Are they shipped back to central warehouse?
    - How much does the returns management cost to the company?
        - Which factor mainly affects this cost?

9. How is the online channel managed?
    - Which is the shape of online revenues on the total company's turnover?
    - The delivery of the garment is aggregated to the delivery to be done at the nearest store and then sorted lated on or is it completely separate?
    - How much does the shipping cost from warehouse affect an online sale?
    - Is it possible to buy a garment online and have it delivered at home directly from the store?
    - How is the online returns managed within the supply chain?
10. In your opinion, what are the critical points of the current supply chain?
    - Which are the main needs perceived by M2Log to compete in the market?
    - What services should M2Log offer to attract other external customers?

Interview to Fiorella Rubino's Store Managers

1. Which is the degree of flexibility granted to the store manager in the re-ordering process?
    - Is a part of the planning activities carried out by the store manager or the order arrive from the higher level of th supply chain?
    - Are there conflicts between store managers and commercials regarding the type/quantity of garments to be received?
    - Does the store manager have complete visibility of the stock in his store?
    - Would you change the re-order policy if you had the chance? In which way?
2. Which is the impact of the management of incoming items in terms of time?
    - How often does the replenishment take place?
    - Would you need a more frequent and less voluminous replenishment?
        - Would you need extra shop assistants to manage the incoming items?
        - Are there pre-established times and days?
        - What are the times of the day/week where would you like to have the delivery?
    - In your opinion, what could be the main critical points in the delivery process of replenishments?
3. How much does the management of the backroom impact in terms of time?
    - Is it easy to manage and look for a garment when the customer requests it?
    - What do you think about a possible down-sizing of the backroom?
    - Garments on the shelves or in the backroom: who decides?
4. Who and how decides the transfers between stores?
    - Is it possible to to request a transfer only to receive goods or even to send goods (maybe due to the obligation of garments rotation and contemporary full backroom)?
    - How often can a transfer be requested?
        - Are there dates agreed with couriers or can it be a on-demand request?
        - Which is the average lead time to receive an item from another store?
    - How many items are moved on average for each transfer?
        - Are there any min/max volume constraints per transfer? Which?
        - Are there geographical constraints per transfer?

- How are inventory adjustments communicated to the headquarter after the transfer?
- In your opinion, how could the transfer process be improved?

5. How are the garments' returns managed?
6. How does the online channel currently affect the individual store?
    - Can the individual store give real-time visibility of stock to the final consumer for an online purchase?
        - If NO, would you find it a valuable service to offer to consumers?

Interview to FedEx

1. Which services do you offer and which ones are the most requested?
2. Do you offer the possibility of integrating your IT system with that of your client?
3. In which time slots do you pick up the goods from your clients?
4. What flexibility of delivery do you offer to the final customers (desired time slots)?
5. What is your service level?
    - What are the operational key points to get it?
6. In your opinion, nowadays what does it take to get new customers?
7. How much are the clients loyal to FedEx service?
    - Could you indicate a level of retention rate?
8. What are the pain points to offer a same day delivery service? Especially at B2B level.
9. What are the needs that your clients (i.e. companies) have most?
    - Which one cannot you satisfy? Why?
10. On which factors is a Logistic Service Provider chosen and evaluated by a company?

Interview to Loro Piana (and Lanieri)

1. Do you currently use a Logistic Service Provider or manage the logistics internally?
2. Which are the main factors in choosing a Logistic Service Provider?
3. How many stores do you have in total on the Italian territory?
4. What is currently the flexibility in terms of delivered volumes and frequency of delivery?
    - Would you like to reduce the spaced used through a more frequent delivery?
    - What are your needs in terms of flexibility?
5. Do you receive the garments in specific time slots?
    - Would you like to change these time slots?
6. Is the *service cost* (i.e. the total logistic cost including loading, handling, sortation and final transportation) a decisive factor with respect to punctuality of delivery, accuracy and delivery time?
7. Do you consider the use of low environmental impact vehicles to deliver items (increase of brand visibility)?
8. Quali tipo di politica di riordino è adottata attualmente?
    - Le politiche di riordino si differenziano tra vari prodotti/classi di domanda?
    - Vi è un Livello di Servizio target differenziato per le varie classi?
9. What is the lead time for an order?
    - What is the lead time for stores' orders?
    - What is the lead time for online orders?
10. Which are the most important areas in Italy in terms of market share?
11. What are the steps in your supply chain? Do you have only one central warehouse or do you have decentralized hubs in the most strategic areas?
12. Have you ever try to exploit the stores as micro-consolidation urban centers?
13. Do you currently use RFID and have complete traceability on the movements of your garments?
14. Which is your degree of vertical integration?
15. Do you currently make transfers between different stores?
    - If YES, which is the frequency and which are the constraints?
16. Is your online channel currently managed separately from the physical one or are already integrated together in a single re-order policy?

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