Institut National des Sciences Appliquées Lyon

Master's degree in Industrial Engineering

Politecnico di Torino

Master's degree in Ingegneria Gestionale

Analysis of logistics in Fashion & Luxury market

Case study: Golden Lady

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Academic year 2021 – 2022

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

AGV - Automatic Guided Vehicle

LGV - Laser Guided Vehicle

VNA - Very Narrow Aisle

GTM - Go to market

AMR - Autonomous Mobile Robot

SKU - Stock keeping unit

ABSTRACT

The paper aims to analyze the supply chain in the fashion & luxury sector, in particular the warehouse solutions that can be adopted by companies, from more manual to more automated solutions, and the KPIs that need to be managed in the storage and transportation phases, going on to point out what are the differences between companies in this sector and how logistics will evolve in the future. This analysis was also made possible through the study of a real company that manages different brands internally, this made possible an analysis of the way different brands are managed according to the characteristics of the products. The purpose of the thesis can be summarized as: analysis of the different logistics solutions implemented by the various companies, what are the projects of the future that will allow the company to remain competitive in the market, and what are the new technological trends to keep an eye on because they could impact company logistics in the future, trying to make a suggestion in this regard.

Thesis purpose:

Study of the luxury fashion sector, in particular on stock logistic and transport logistic. Analysis of performance indicators to optimise warehouse management and transport times.

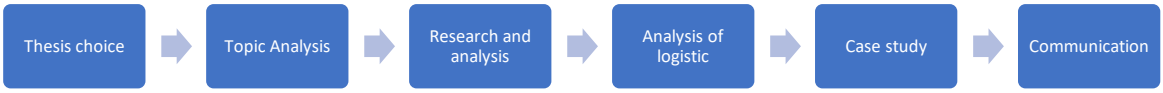
Objectives:

The following table lists the (sub)objectives that breakdown from the main purpose

Objectives	**Method/Tool**
Analysis of the luxury sector	Research
Analysis of logistics in the luxury market in particular	Research
Analysis of omnichannel strategies	Research
Analysis of inventory management, comparison between manual and automated warehouse solutions	Research/ webinar, company visit
Study of KPIs on warehouse and outbound logistics, particularly for luxury markets	Research/ webinar, company visit

RESEARCH PLAN

The following table shows the timetable of activities carried out during these months for the writing of the thesis.
The activities are divided into:



- **Thesis choice**, this activity refers to the time spent on choosing the topic of the thesis and possible related topics.
  After the choice of the topic, the next activity was to identify the topics to be covered. This process was carried out from October to January, that is until topics related to the thesis subject were identified and analysed.
- **Topic Analysis**, once the topic and main topics were chosen, research and analysis of these topics started as early as October with the industry analysis and from November both the logistics and omnichannel strategy analysis started at the same time.

- **Research and Analysis**, this part started simultaneously with the analysis of the various topics. This part includes the research of previous articles, studies or material dealing with the same topic or part of it, and the analysis and understanding of these.
- **Analysis of logistic**, includes researching and studying books and articles on logistics and performance indicators, as well as attending various seminars on efficient fashion & luxury logistics and warehouse and transport logistics KPIs.
- **Case study,** includes the search for the company to be analyzed and then a visit to the company with the plant director.
- **Communication**, this activity includes the hours spent during the various months on communication and analysis of the work carried out with the professors who supervised the thesis project, as well as the periodic meetings, Dr. Julien Fondrevelle and Professor Carlo Rafele.

INTRODUCTION

The market for high fashion goods is unique compared to traditional markets in other sectors.
In addition to constantly gauging demand and protecting brand prestige while maintaining high product quality, manufacturers of luxury goods have to operate in an increasingly complex and competitive global market.
The country in which the luxury brand decides to concentrate its production significantly affects the sense of prestige that buyers have about those products.
The importance of Made in Italy in the world is due to a series of excellent products that stand out for the high quality of the materials used, refined style, innovation, attention to detail, imaginative solutions adopted and the ability to last.
Italian luxury brands continue to maintain their position even among millennials in America.
According to 30% of American customers, Italy is the country whose production is considered to be of most value, for 22% of buyers in America it is France, for 11% the United States of America, 10% Switzerland and finally for 7% Germany. (exportusa.us, 2019)
This shows how important it is for luxury brands to produce in Italy or France, so they only maintain one main site for production and then they have to put these products on the world market.
The following thesis aims to study an optimal model that allows luxury companies, in other words companies that sell products with a high value, to transport products from one country to another minimizing the time and cost factor even when the product has already been placed on the market in another country.

1. LUXURY MARKET

1.1 INDUSTRY OVERVIEW

The luxury market is one of the richest and most profitable sectors in any economy.
The world's 100 largest luxury goods companies generated sales of $281 billion in 2019, up $15 billion from the previous year[1].
The objective of companies in this sector is to obtain a high level of customer loyalty and to do this, they must differentiate themselves from other companies and provide the end consumer with something more than material goods, which is why luxury

[1] https://www2.deloitte.com/global/en/pages/consumer-business/articles/gx-cb-global-powers-of-luxury-goods.html

companies offer their customers an experience. They also provide intangible benefits, in the form of prestige, customer satisfaction and give an experience to the customer that only large luxury companies can confer.
Traditionally, the main attraction for customers in the luxury market is not the product itself but more the exclusivity they perceive.
In the last decade, we have experienced epochal changes that have also marked luxury companies, changing their values, the way they sell and advertise their products.
The Internet, social media and online shopping have expanded the confines of this market, making it globally accessible and seductive. Sales and advertising constantly follow the rhythms and changing times, diversifying according to where and how its consumers live. Today, by advertising their products, companies are able to propose a way of being before the material good, encouraging the buyer to identify with the brand.
During Covid-19, online sales increased during the first half of the year, reaching a peak in April of +209% globally compared to the previous year, pushing many brands to accelerate their digitalization process and provide e-commerce solutions. For example, Prada collaborated with Tmail, Alibaba's online business channel, and Dolce & Gabbana launched its own video boutiques[2].
The 100 largest luxury goods companies in the world generated sales of $281 billion in 2019. For the third year consecutively, the top players in this market remain LVMH, Kering, Estée Lauder and Richemont. France with 9 companies in the ranking achieved the best growth in sales of luxury products, but, as in previous years, Made in Italy confirms its leadership in the sector with 22 companies of the 100 that make up the ranking of the seventh edition of Global Powers of Luxury Goods, Deloitte's annual study[3].
This ranking includes a classification of the 100 top players in the fashion & luxury industry globally, based on consolidated sales in the fiscal year. Approximately two-thirds of the companies in the ranking operate in the apparel and footwear sector, while 23% belong to the handbags and accessories category.

According to a study conducted by Bain & Company, one of the world's Big Three strategic consultancies in terms of turnover, in 2020 online sales of luxury products reached almost 50 billion euros, representing around 25% of the entire luxury market. Compared to the previous year, this represents a growth of almost 50%.

[2] https://www2.deloitte.com/global/en/pages/consumer-business/articles/gx-cb-global-powers-of-luxury-goods.html
[3] https://www2.deloitte.com/global/en/pages/consumer-business/articles/gx-cb-global-powers-of-luxury-goods.html

Despite the fact that the online channel has doubled its weight, the pandemic has also hit this type of market, which is usually more resilient than others during economic crises, hard.

In 2020, the luxury market closed with a decrease of around 20%/22%, contracting for the first time in 10 years.

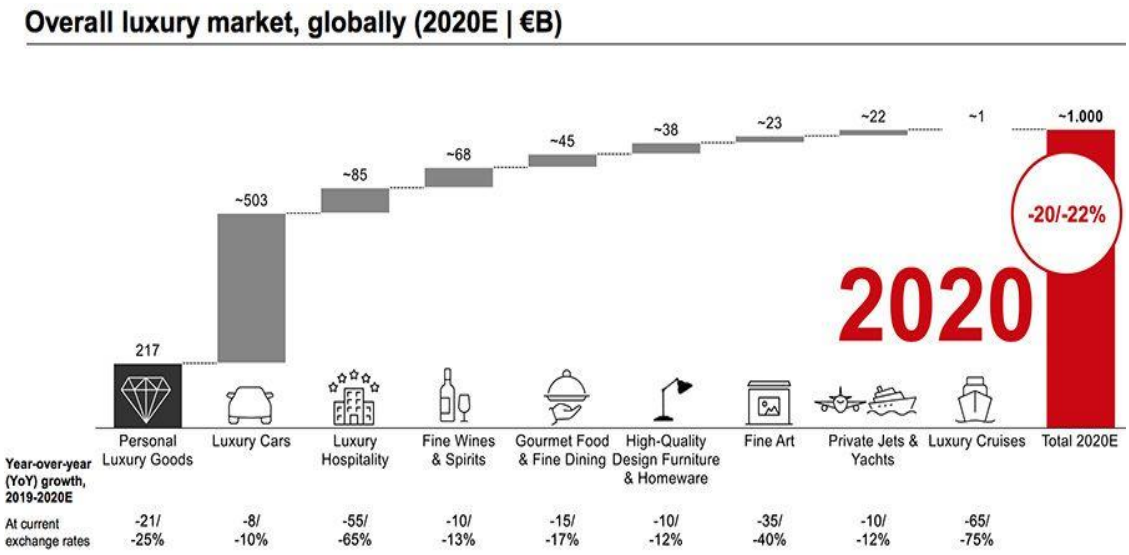


Figure 1: Worldwide luxury market[4]

The last time this market experienced a slowdown in growth was during the great crisis of 2008.

Luxury goods were also bought by consumers in the middle of the population, although not on a regular basis, these were the main players affected by the crisis. For these shoppers, their wealth was determined by their employment status, not their social status, so during 2008, when consumers saw their purchasing power decrease due to unemployment and higher taxes, these middle-class shoppers had to change their purchasing patterns and adapt to their new income, and they certainly could no longer indulge in the occasional luxury items.

On the other hand, wealthy consumers, who are in the upper income bracket, represent the majority of customers for luxury brands, and they did not suffer any loss of purchasing power during the economic crisis of 2008, so their purchasing behaviour did not change.

The fact that these more affluent customers continued to shop, meant that there was no deflation in the price of products in this market and therefore the feeling of the product not being accessible to all, the value of luxury did not change. In this way brands were

[4] https://www.bain.com/insights/the-future-of-luxury-bouncing-back-from-covid-19/

able to achieve real success and somehow "control" the slowdown in sales even during the crisis.

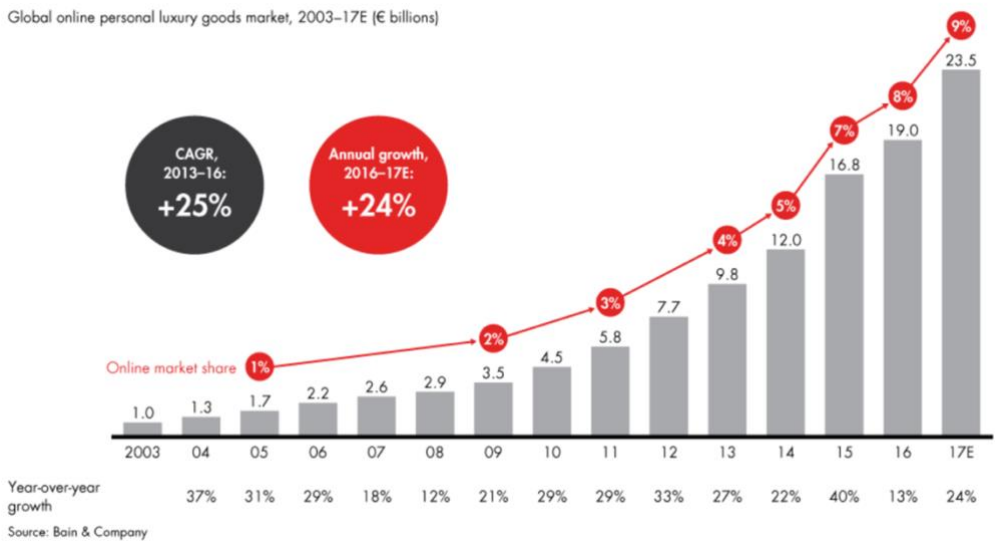


Figure 2: Luxury goods worldwide market study[5]

Globally, in 2020, the most relevant geographical areas are divided according to the following chart

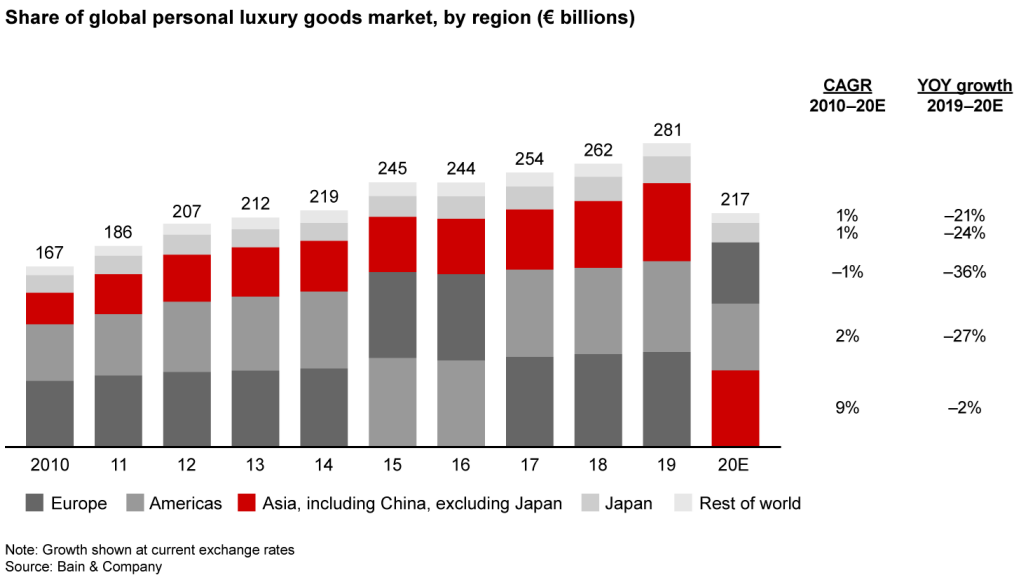


Figure 3: Share of global personal luxury goods market, by region[6]

Until 2019, the largest regions for luxury sales were Europe and America, but in 2020, Asia became the top region for luxury sales.

[5] https://www.bain.com/insights/luxury-goods-worldwide-market-study-fall-winter-2017/
[6] https://www.bain.com/insights/the-future-of-luxury-bouncing-back-from-covid-19/

In Europe, demand fell by 36% at current exchange rates, to €57 billion. In the second quarter, it was the worst performing region globally, due to a lack of tourism and lockout measures. However, purchases by European customers fell by only 10%-15%. Local consumption shifted to affluent areas and showed the largest shift to the online channel globally.

In the first quarter of 2021, the revenues of many luxury companies returned to growth after the crisis of 2020, with consumption recovering in China, Korea, the Middle East and Canada.
The products most purchased by customers, after months of lockdown, are scarves, bags, jewellers and top-quality designer shoes.
The highest revenues were recorded by Hermès, 2.08 billion revenues between January and March, +38% on the previous year, and LVMH, 13.9 billion revenues in the first quarter, +32%.
The optimism of this new post-pandemic year can also be seen by looking at the mergers and acquisitions that have taken place as, in addition to luxury consumers, companies also need to recover from this period of stop: Lvmh has risen to 10% of Tods', Renzo Rosso has added Jil Sander to the portfolio of his Otb brands.
For the Kering group (+21.4% in the first quarter to 3.9 billion), Italian brands account for almost two thirds of the maison's turnover: Gucci, Bottega Veneta, Pomellato, Ginori and Brioni[7].
Even Giorgio Armani does not rule out a luxury partner in the future, perhaps from another industry than fashion.
Finally, the pandemic has brought back the desire to team up in a very individualistic industry like fashion: companies have taken to the field to sew gowns and masks instead of clothes and have made donations.
In addition, designers have pooled their energies: Gucci has walked the runway with Balenciaga, Versace has created clothes and shows in collaboration with Fendi, "Fendace", during Milan Fashion Week 2021.

[7]https://www.repubblica.it/economia/2021/04/27/news/un_2021_effervescente_per_le_griffe_di_altagamma_piu_shopping_anche_di_marchi_piu_utili_e_piu_e_commerce-298365356/

Figure 4: Fashion show Gucci & Balenciaga 2021[8]

Figure 5: Collection: "Fendace" 2021[9]

[8] https://www.iodonna.it/moda/news/2021/04/15/gucci-balenciaga-alessandro-michele-aria-sfilata-kering/
[9] https://www.versace.com/it/it-it/world-of-versace/stories/sfilate/the-swap-donatella-versace-kim-jones.html

The stock market has a specific index for the luxury sector, the S&P Global Luxury Goods (abbreviated to SPGLGUP), which tracks the performance and growth of the major stocks in the sector.
The S&P Global Luxury Goods comprises the 80 largest publicly traded companies engaged in the production or distribution of luxury goods, including companies such as: Tesla, LVMH, Estee Lauder Cos.A, Kering, Compagnie financiere Richemont SA, Daimler AG, Hermes Intl, NIKE Inc B, Diageo Plc, Pernod-Ricard.

The weighted average price of the 80 stocks in the index is $4,443.52.

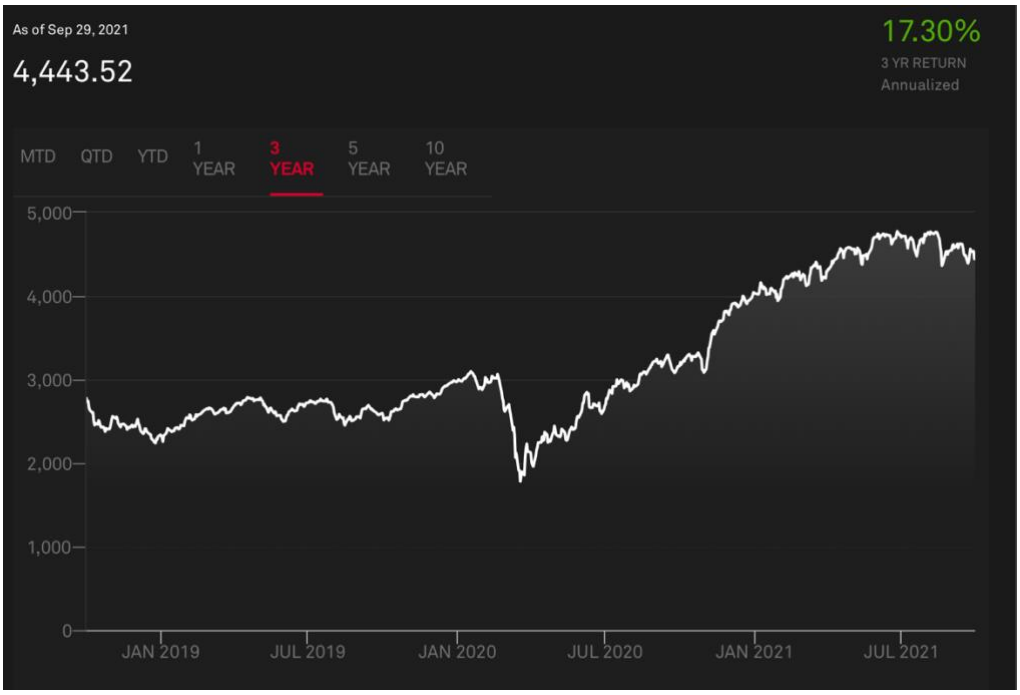


Figure 6: S&P Global Luxury Goods Index[10]

According to the survey by Deloitte, 100% of investors are still considering making an investment in the luxury market in 2021[11].
The most attractive sectors in this market are Apparel & Accessories - manufacturing (67%), Cosmetics & Fragrances (42%), Apparel & Accessories - retail (30%) and Furniture (30%).
This study of the most attractive sectors reflects expected market trends over the next few years, with the personal luxury goods and furniture sectors growing, and sectors such as hotels, private jets, cars and cruises stable or declining.

[10] https://www.spglobal.com/spdji/en/indices/equity/sp-global-luxury-index/#overview
[11] https://www2.deloitte.com/content/dam/Deloitte/it/Documents/finance/CS_%202021DeloitteGlobalPEFashionLuxurySurvey.pdf

Figure 7: Expected fashion-luxury trends for the next 3 years, Deloitte

1.2 HISTORY OF LUXURY

The idea of luxury has been around since the appearance of the major civilisations of the past.
It is possible to understand the highly hierarchical structure of peoples, such as the ancient Egyptians or Mesopotamians, by studying the objects found in their tombs.
Only a few people could afford the lavish objects of luxury, only the king, his wife, the priest and a select few others.
The idea of luxury has evolved over time until today when we are living in the period of the democratisation of luxury.
While in the past luxury was considered an unnecessary extravagance by some people, as the majority of the population lived in extreme poverty, others saw in these rich objects devices capable of creating the conditions for the occurrence of artistic innovations and the conception of manufacturing techniques.
The radical transformation that took place in Western society during the Age of Enlightenment (18th century) also profoundly changed the idea of luxury.
After the industrial revolution there was an increase in the quality of life, which meant that many more people had the resources to become consumers in the luxury market.

From an economic point of view, luxury goods are those goods that have a high-income elasticity of demand, which means that the demand for these goods increases more than proportionally to the increase in income.

We can consider luxury as a peacetime industry, as it is historically proven that luxury began to develop after the war.

The great French fashion houses (Louis Vuitton, Cartier, Hermès) were born at the beginning of the 20th century; during the inter-war period, perfumery was born (Chanel) and finally, after the Second World War, the luxury sector became an industry in its own right, appearing as a small industry in various specialist markets.

The concept of luxury is a cultural construction produced within societies. The concept of luxury, besides having a historical development and evident economic evidence, also shows the social status of that particular consumer, therefore it has a sociological dimension because it has to do with the social positions of the population and how wealth is distributed in that population.

However, it was at the end of the last century that the structure of brands changed radically. They evolved from small family businesses into more structured and consolidated companies.
Whereas before the production process was made up of small units, a purely family labour force, this changed over time to become a large-scale production process while still maintaining manual production and a high level of product quality and attention to detail.
These small companies which then expanded on a large scale led to the formation of true multinationals or conglomerates, such as LVMH (Moët Hennessy Louis Vuitton SE) which was created in 1987 with the merger of two companies, Louis Vuitton and Moët Hennessy, and today owns 70 brands (Christian Dior, Bulgari, DKNY, Fendi, Céline, Guerlain, Marc Jacobs, Givenchy, Kenzo, Loro Piana, Louis Vuitton, etc.) and its share value is worth approximately €624.80.

1.3 WHAT IS DEFINED AS LUXURY

"Ostentation of richness, magnificence; tendency (even habitual, as a standard of living) to superfluous, uncontrolled expenditure, for the purchase and use of objects which, either because of their quality or ornamentation, have no use corresponding to their price, and are intended to satisfy ambition and vanity rather than a real need[12]*"*
(definition of the term 'luxury' according to the Treccani dictionary).
The concept of luxury is difficult to define because a very subjective value is defined to the luxury object that differs from person to person.
Commonly, a luxury product is defined as such if it is an object of admiration and desire and its exchange value is extremely high.

[12] https://www.treccani.it/enciclopedia/lusso/

The fact that a product is expensive does not necessarily make it a luxury product; in fact, if we consider the Latin etymology of the term, we can observe that the word luxury derives from *lùxus*, this word has two different, almost opposite connotations, the negative connotation of the term describes luxury as something excessive or superfluous; the positive part instead indicates something wonderful.
Nowadays, the concept of luxury is combined with the concepts of uniqueness, sustainability and beauty.
Luxury is not defined on the basis of an objective and material good but more on a subjective and immaterial level, the thought must be placed on the value, the advantage and the feeling that luxury brands offer to their customers.
Of fundamental importance in this market is the "brand image" which sums up the positioning, personality and reputation of the brand itself.

1.4 PRODUCTS AND SERVICES

Luxury products are those that give customers a "prestige status", which are distinguished, compared to substitute goods, by a high quality, an exclusive and symbolic character and an emotional and involving component that accompanies the consumer throughout the period, from the moment of purchase to the moment of possession of the good.
While in the past luxury products were reserved for a restricted circle of people, today a "*democratisation of luxury*" is taking place, meaning that many people have the opportunity to become customers in this market.
In the last 20 years, the number of luxury consumers has increased from 90 million to 330 million[13].
Customers are increasingly international, the millennials are growing, connected and digital, dedicated to omnichannel shopping and always looking for original and exclusive products.
Luxury shops, in order to compete today and meet demand, are increasingly connected and digital, providing customers with a service that is always exclusive and with the aim of maximising customer satisfaction at the time of purchase.
Companies in this market are also focusing on omnichannel strategy, in other words, linking the physical shop with online shopping.
The democratisation of luxury, according to journalist Anna Wintour, *"means more people are going to get better fashion. And the more people who can have fashion, the better."*

[13] https://marketingtechnology.it/luxury-2-0-piramide-del-lusso/

The democratisation of luxury is a phenomenon that has involved several mid-range fashion brands, for example there was a collaboration between H&M and Versace in an autumn collection in 2011, so that all the fans of the Versace fashion house who would like to but cannot buy its products can afford designer clothes at an affordable price.[14]
The advantage of mid-level co-branding is obvious, by hiring the big names of fashion, they reinvent the brand and in a short time they can sell super desirable clothes. In addition, there is also an advantage for the big designers who, in order to strengthen their notoriety even more, target new market segments.
Despite this new phase of democratisation of luxury, there is still a clear difference between luxury and mass products.
As far as luxury goods and services are concerned, they have to be perceived as luxury in all respects, not only as expensive products, although the products of the luxury sector have this characteristic.
The goods, as well as the services offered by a luxury company must be of high quality, they must be considered excellent compared to the substitutes of mid-range competitors. The quality comes from the materials chosen for production, the attention to detail and the specialised workforce that these companies have.
Luxury products are mostly manufactured by skilled artisans and with the highest quality materials from all over the world, which makes the final product unique and special.
Another important feature is the fact that, for each season, they create "limited edition" products that will only remain on the market for a limited time and also create unique pieces. This increases even more the customers' desire to buy those limited products as wearing a unique piece increases the feeling of uniqueness in the product owner as well.
The customer experience does not end with the product, the customer must be accompanied during the choice and also after the purchase, the quality of service must be extremely high.
The winning strategy in luxury retail is to put the customer at the center. The main difference between mid-range and luxury brands is the type of shopping experience that sees the customer as the protagonist; while in lower-end shops the customer will have a solitary shopping experience, in luxury shops the customer is put at the center from the product launch, choosing the most popular influencers of the moment to advertise the product.
It is therefore important to ensure that the customer never feels abandoned by the big brands and to do this it is necessary to guarantee a careful shopping experience and assiduous assistance for any problem after the purchase.
The high fashion brand must sell experiences and not just objects.

[14] https://www.marketingweek.com/versace-to-design-hm-range/

1.5 LUXURY MARKET CUSTOMERS

As we have already said, while in the past luxury products were reserved for a restricted circle of people of a certain social prestige, today many more people have the opportunity to become customers of this prestigious market.
Today, customers in this market are increasingly well informed and attentive, thanks to the information they can easily obtain on the Internet. They can quickly compare prices, quality, and the satisfaction of previous buyers through reviews; in short, they can immediately compare various products from different brands.
The customer is becoming more and more an interested and selective customer who is looking for the right relationship between price and product value.
Luxury customers are consumers who shop all over the world, are immersed in the global and digital reality and always expect the best from the shopping experience.
In 2017, the growth of the luxury sector was driven by Generations Y and Z (i.e., those born between 1986 and 2003).
This increase in the target of buyers of luxury companies is also demonstrated by the birth of numerous "low cost" lines of products that maintain the high quality, prestige and value of the brand but with a lower cost and therefore more accessible to the middle class.
An example of this phenomenon can be found with the Love Moschino line created by the Moschino brand with the aim of involving a younger target group through these collections that are sold at a lower price.
In this way, companies are able to have a more diversified clientele, from young people who are starting to work and who, with their first income, can indulge in a luxury product at a lower and more accessible price, to loyal customers who have a much higher income and are attracted by limited edition pieces in order to be one step ahead in fashion and be unique.

In 2019, 64% of the target audience for luxury goods were people between the ages of 25 and 44, with the younger generation between 16 and 24, or Generation Z, representing another large share of the market[15].
Ordinary luxury buyers are customers who start to become part of this market when, by working and getting paid more and more, they start to get out of their initial inability to make certain types of purchases. Usually, these people start by buying functional goods such as cars.
After this first stage, these consumers start to have higher and higher possibilities and become true luxury customers as they will start to buy these products on a regular basis.

[15] https://mediaboom.com/news/target-audience-for-luxury-brands/

Those who manage to overcome this stage as well, because they continue to have economic growth, will begin to buy products, perhaps unnecessary and superfluous, but which give them the opportunity to show the world their wealth and, even if sometimes they are not functional, the consumer decides to buy them because of the uniqueness of these products.
Nowadays we also find a new niche of occasional customers, i.e. those customers who do not usually buy luxury goods but occasionally do so for themselves or to give as a gift to others.
These occasional customers are, however, customers who want to buy a high-quality, beautiful and durable product and, above all, buy the whole shopping experience that comes with it.
An interview by "Mediaboom", a digital marketing agency, shows that of the respondents belonging to Generation Z, 14% never buy luxury items, 19% do so rarely, another similarly sized group, 19% said they regularly buy these products, 25% do so occasionally and finally, the majority of respondents, 33%, say they buy them as gifts for others.
As for the Millennial group, while 16% have never purchased luxury goods, 18% do so rarely, 22% occasionally and 23% do so as gifts for others.
Finally, this interview showed that most buy these items for themselves, with 34% saying that they do so, so we can conclude that they are the biggest buyers in this market compared to Generation Z.
Also, from this interview, it was found that those who buy luxury goods occasionally, do so mainly by buying electronics, 53% and 34% occasionally indulge in more expensive and sought-after food items such as caviar and truffles.
As for the regular buyers of luxury goods, it was found that 36% buy airline tickets for themselves, another 36% buy furniture and household items and finally 26% buy cars or car products.

According to Bain & Company's 2014 report 'Lens on the Worldwide Luxury Consumer'[16] which identifies the substantial differences within the luxury market and the buyers in this market, we can divide consumers into 7 groups, the '7 profiles of the global luxury consumer'.
These are different consumer profiles that show divergences in tastes and purchasing behaviour, across countries and generations. The group comprises a heterogeneous mix of 330 million consumers who purchase €217 billion in luxury goods globally.

1. **The Omnivore**, account for 25 % of expenditure. These shoppers are newcomers to the luxury sector, are younger than shoppers in other groups and

[16] https://www.bain.com/migration/press-releases/2014/lens-on-the-worldwide-luxury-consumer/

have a willingness to experiment with different products and brands. These shoppers are inclined to buy high-priced items, especially jewellery and watches, and their level of loyalty is very low despite having a high propensity for luxury brands. They tend to shop on the move. These characteristics are common among Chinese consumers.

2. **The Opinionated**, are 20% of the expenditure. They are the highly educated Generation X (born between 1965 and 1980) and Y (born after 1981, often called Millennials). These shoppers are very informed and aware of the difference between brands, tend to shop in their city and are highly influenced by information from social networks. These characteristics are common among Chinese consumers but also in Western Europe and the United States.
3. **The Investor**, are 13% of the expenditure. They are very attentive to the quality and durability of the product, carefully evaluating the product with research and reviews from other consumers before purchase. We find these characteristics in buyers from Japan and the Middle East.
4. **The Hedonist**, 12% of expenditure. These consumers are attracted to luxury products and the experience of buying them, are very attached to the luxury brand as a brand and are highly influenced by advertisements. Despite this they show lower levels of support for brands, perhaps due to cognitive dissonance after purchase. This cluster is found in all nationalities and generations.
5. **The Conservative**, account for 16% of expenditure. They usually shop in multi-brand shops and are influenced by what their friends and family recommend. They are mainly present in mature markets but also in China.
6. **The Disillusioned**, account for 9% of expenditure. These are baby boomer shoppers who are looking for products that will last for more than one season and are not influenced by advertising or brand awareness. They tend to shop infrequently and prefer online shopping. This profile is mainly female and can be found mainly in the USA, Europe and Japan.
7. **The Wannabe**, 5% of expenditure. Also in this cluster, shoppers are predominantly female, looking for items in the beauty and shoes sector and evaluating products outside the luxury market. They are highly influenced by advertising and other consumers and are not brand loyal. They come from the global middle class, especially in the United States, Western Europe and new consumers in Eastern Europe.

1.6 BRAND IMAGINE

The brand of a company represents the unique and unrepeatable identity of this company on the market.

For companies, the brand is of fundamental importance because, even before being attracted by the product, customers are attracted by the brand and the notoriety it has in the market. Consumers have a very low attention capacity, so they will often make unconscious purchases based on first impressions.
The brand has the function of building customer loyalty, the customer will buy the products of that company because he knows that particular brand. In the luxury sector the brand plays an even more important role in creating a connection between the customer and the brand.
These luxury brands, in order to create a strong and identifying image, are formed by family names. For example, Armani, Gucci, Dolce & Gabbana, Chanel, etc., all these brands are originally family names.
It is not easy to create a luxury brand as these brands always have a long history behind them which is then used to create a better perception of their products.
For example, Gucci in its 90th anniversary created a black and white advertising campaign related to the company's first workshops. In this way, Gucci reinforced the corporate identity by making buyers feel that there are high standards of craftsmanship that have been passed down through generations.
Often a luxury brand also tends to be immediately associated with the country in which it was born, for example the Bulgari brand, the character used in the logo immediately brings to mind the world of ancient Rome.

Let's see below the values of the 10 most valued brands in the luxury market in 2021 and how they have changed since the previous year.

2021	2020	Logo	Name	Country	2021	2020	2021	2020
1 =	1		Porsche		$34,326M	$33,911M	AAA-	AAA-
2 =	2		GUCCI		$15,599M	$17,630M	AAA	AAA+
3 =	3	LOUIS VUITTON	Louis Vuitton		$14,858M	$16,479M	AAA-	AAA
4 ^	5	CHANEL	Chanel		$13,240M	$13,705M	AA+	AA+
5 v	4	Cartier	Cartier		$12,087M	$15,015M	AAA-	AAA-
6 =	6		Hermès		$11,656M	$11,909M	AAA	AAA
7 =	7		Ferrari		$9,243M	$9,054M	AAA+	AAA+
8 =	8	ROLEX	Rolex		$7,938M	$7,873M	AAA+	AAA+
9 =	9	DIOR	Dior		$7,826M	$6,868M	AA+	AAA-
10 ^	13	GUERLAIN	Guerlain		$5,691M	$5,688M	AAA-	AAA-

Figure 8: Best Global Luxury Brands 2021 Rankings[17]

[17] https://brandirectory.com/rankings/luxury-and-premium/table

Consumers associate the brand with a kind of image that identifies them in a certain social class with characteristics. Depending on their financial means, they will position themselves in the highest social class which is desirable and attainable for them. By buying the products of a certain brand, consumers will feel part of a social group.
The best customers are of course those who are loyal to the company and who like the identity and image that the brand represents.
We can conclude that the brand suggests a certain lifestyle to those who own its products.

1.7 LUXURY LEVELS

Nowadays, the world of luxury is accessible to more people than in the past, due to the real increase in income, the development of new technologies, globalisation, etc. We can identify 3 levels of luxury in this market, each with a different level of accessibility.

- Unaffordable luxury: this group includes all those unique, often custom-made, limited-edition products. These are characterised by extremely high quality materials and specialised workmanship, often created entirely by hand. Because of their uniqueness and quality, these products have an extremely high price that not everyone can afford.
- Intermediate luxury: these are products that try to imitate the products of inaccessible luxury, but still have quite high prices.
- Accessible luxury: products distributed on a larger scale; in these products the image of luxury is given by the communication of the brand rather than by the uniqueness of the product.

1.8 TRENDS IN THE WORLD OF LUXURY TODAY

In an extreme and unpredictable post-pandemic scenario, it is important to identify the macro trends that will characterise the luxury market in 2021[18].

a) Digital first but with a human touch. One of the most predictable effects of the lockdown has been the great success of online shopping. With international borders temporarily closed and people forced to isolate themselves in their homes, the pandemic has forced companies to re-evaluate their economic strategy for the future. Similarly, consumers had to abruptly change their consumption habits, causing the already booming e-commerce market to grow during this period.

[18] https://www.nssmag.com/it/fashion/24740/macro-trend-lusso-2021

Many brands have understood that it is not enough to have an online site to sell. The buying experience will certainly be different from that in the physical shop, and there will be no direct contact with the salesperson who guides the customer through the various stages of the purchase, but it must still be an important moment. The luxury company must in any case maintain a high level of customer satisfaction resulting from the purchase of a product.
One brand at the forefront of this is Gucci, which has experimented with AR technologies and microgaming. Thanks to augmented reality it will be possible to virtually try on the brand's watches to see how the Gucci Watches would look on their wrist. A new section of the Gucci app is "Gucci Sneakers Garage" dedicated to the first virtual trainer designed by Alessandro Michele. Users will be able to let their avatars wear the virtual trainers and will also be able to customise or create their own shoe model from scratch.

b) Crucial role of China. A major impact of the pandemic has been the collapse of global tourism. In contrast to Europe, the Chinese market has returned to growth, while the absence of Chinese tourists, who accounted for around 35% of sales in Europe, has highlighted China's different business opportunities to those of Europe.
In this context luxury brands will therefore have to find a strategy in Europe to contain these losses caused by the pandemic and try to attract a local audience and will also have to develop a series of specific strategies for the Chinese market especially since China started building a domestic market in 2009.
c) Sustainability. In addition to the virus emergency, we are also living in a period with a slower but more threatening emergency, the climate emergency. In this context, more and more people are demanding significant and concrete actions from companies. This is a challenge that companies are facing, especially if we consider that it is mainly young people who are calling for this change for the future of the planet and that it is also young people who are the future customers of companies.
d) Cross-sectoral luxury. In the world of fashion, the phenomenon of collaborations is well-established and the collections resulting from these collaborations are unquestionably successful.
e) Mergers & Acquisitions. All economic crises increase the economic gap between companies. Three acquisitions totalling almost $20 billion were made in 2020. The biggest deal ever in the luxury sector was made in late 2020 when LVMH bought the company Tiffany for $15.8 billion. Also, in 2020 the VF Corporation bought Suprime for $2.1 billion and finally there was the merger between Moncler and Stone Island for $1.4 billion.

1.9 PERSPECTIVES OF THE LUXURY WORLD

According to Bain & Company's estimates, market fundamentals are expected to remain favorable for the personal luxury goods segment, with annual growth of 3%/5% until 2025, with a total value of between €320 billion and €365 billion.
The luxury customer base is also expected to grow from the current 390 million to 450 million.

Based on Bain & Company's analysis[19], there are trends that will shape the luxury world of tomorrow.

1. Chinese buyers are increasing their purchases, it is projected that these buyers will increase from 33% in 2018 to 46% by 2025. While in 2017 only 24% of their purchases were made in China, by 2025 they are expected to make half of their purchases at home.
2. The digital world is becoming increasingly important in the sales market, especially after the Covid-19 pandemic. Around half of all luxury purchases will be made online and choices will be influenced by online interactions. Brands must always have attractive, up-to-date and easy-to-use e-commerce sites. Companies are increasingly moving towards an omnichannel strategy and, especially luxury companies, must be careful to sell a unique customer experience even while shopping online.
3. Network consolidation redefines the shop of the future. With the omnichannel strategy the role of the shop will evolve from a simple point of sale to a true touchpoint for consumer engagement.
4. Younger and younger future buyers. It will be the new generations that will grow the luxury market, generations Y and Z will represent about 55% of the market in 2025 to 80% in 2035 and will contribute to 130% of the market growth. The Millennial generation is very tech-savvy and heavily influenced by media while Generation Z is moving towards conscious consumption. These new generations are also looking for changes and concrete actions towards a more sustainable future, this will be another challenge for luxury companies in the future.
5. Consumer trends are also influenced by culture. Companies will need to be able to recognise different cultures, understand their tastes and target them with products specifically designed to remain relevant in that particular country.

[19] https://www.bain.com/contentassets/8df501b9f8d6442eba00040246c6b4f9/bain_digest__luxury_goods_worldwide_market_study_fall_winter_2018.pdf

6. One market will serve 'markets of one'. It is envisaged that the standard model where brands specialise in a single category or diversify into a broader set of products and services will be taken to the extreme as companies focus on catering to individual consumers in specific ways.

By 2030, we will no longer speak of the luxury market but of the market for "insurgent cultural and creative excellence". In order to survive, brands will have to reinvent themselves creatively and boldly, they will have to meet the needs of new customers, particularly the younger generations who place an unprecedented emphasis on diversity and belonging, as well as on sustainability and the environment.

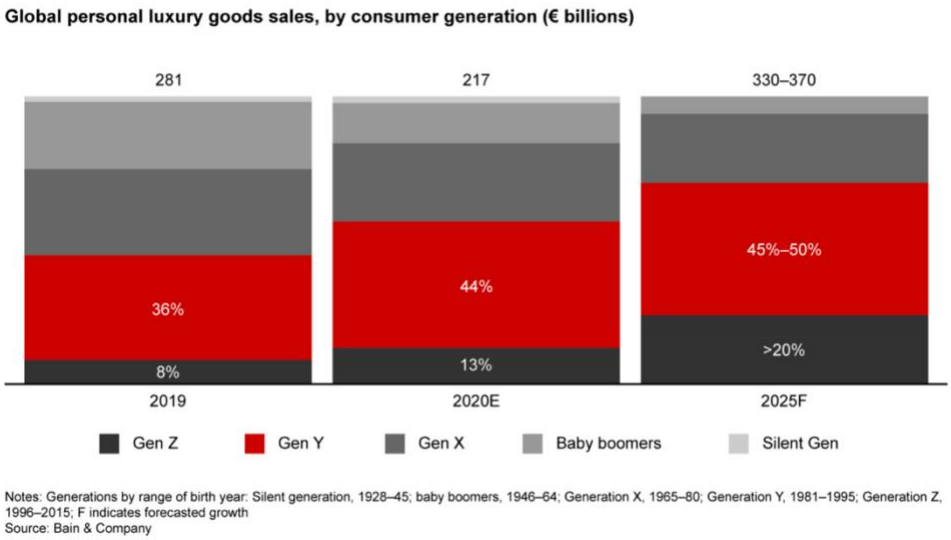


Figure 9: Global personal luxury goods sales, by consumer generation[20]

1.10 LUXURY SALES CHANNELS

The sales channels used to make products and services available to customers are diverse and each has characteristics that make it ideal for one type of market but not for another.

For example, retail channels are most effective when they give the consumer an advantage in terms of location and product assortment. As far as the luxury market is concerned, it is important to preserve the company's brand and to do this you have to minimise the use of intermediaries and licences to third parties, you have to maintain a strictly controlled distribution channel. Naturally, it is not enough to have a controlled distribution channel to be successful, there are many other factors that have to be considered.

[20] https://www.bain.com/insights/the-future-of-luxury-bouncing-back-from-covid-19/

The most popular sales channel for luxury companies are directly owned shops either offline, meaning in the form of independent physical shops or as retail spaces in high-end warehouses, or online.
This type of distribution channel allows controlled distribution and succeeds in preserving the brand by displaying its image.
However, licensing third parties to sell their products is not convenient for luxury brands in terms of quality and control. People are loyal to some companies because of the notoriety of their brand, so when this brand is not 100% visible, this causes dissatisfaction in the customer who begins to doubt the quality of a certain product because it is not sold directly by the company. This is the reason why companies like Gucci and Bulgari are buying back or have already totally bought back their licenses from third party companies.

Luxury brand companies are always looking for new ways to connect with their customers. One of the main themes that luxury companies will be relying on to start the recovery after the downtime caused by the pandemic will be sustainability, many companies have already started to invest in green technologies, to reduce their environmental impact significantly in the coming years.

In addition to sustainability, the internet and online sales will be relied upon. It is expected that this sales channel will continue to grow very quickly in the years to come due to the attitude of buying luxury online and the fact that many brands are now adapting by creating online sites that are able to fully satisfy the customer and guarantee excellent service from home.
Another sales channel that has always been important for companies is that of airport outlets. Airports, stations and duty-free shops are becoming increasingly important for shopping, with a continuously growing performance. Airports capture 55 % of the market, long-distance airlines, in other words what is sold during the flight, absorb 3.7% of the market and railway stations 2.9%. The remainder relates to duty free formulas applied for example in border shops or on cruise ships in international waters etc.

Going into detail, let's see through Bain and Company's annual study how the distribution of luxury brands will evolve in 2020.
The sales channels most affected in 2020 were travel retail due to the travel freeze, department stores and specialty stores due to closures, but still managed to maintain their share.

The most important channel for luxury goods was wholesale, which accounted for 54% of all sales. The retail channel managed to withstand the closures and even increased its share to 46 % from 40 % in the previous year.
Online was the fastest growing channel, by 50%. Globally, the online channel influenced 85% of luxury transactions, up from 75% in 2019 and 40% to 50% of purchases were digitally enabled, up from 20% / 25% in 2019.

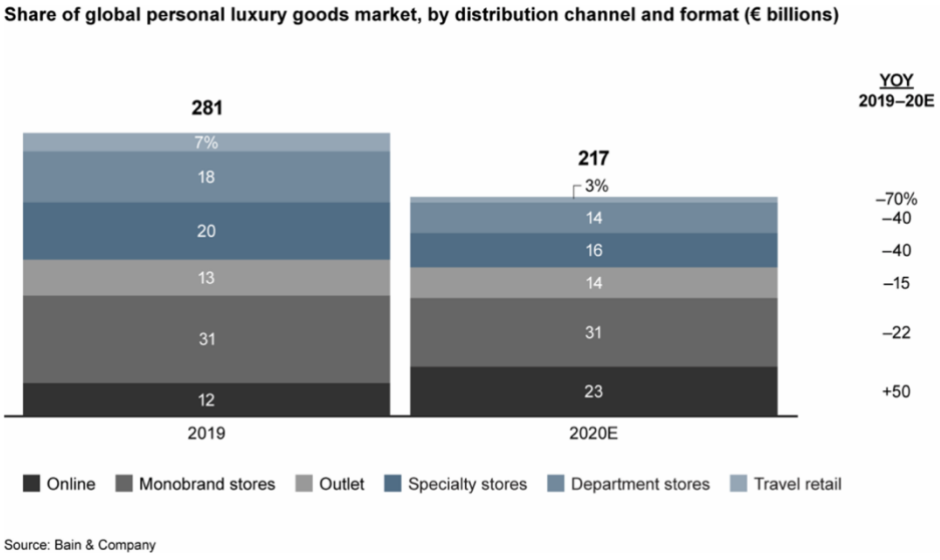


Figure 10: Share of global personal luxury goods market, by distribution channel and format[21]

2. LOGISTICS IN THE LUXURY SECTOR

The main components that need to be considered in order to start understanding how logistics works in the luxury sector are the various types of products and the inherent requirements of these products. When exporting high value goods from one country to another, the transport will be high risk, which is why the logistics chain dealing with these luxury goods must always be prepared from a legal and insurance point of view. The transport and logistics of luxury goods must also be able to track products and control transport conditions in real time.
The company's logistics system must enable dynamic coordination between sales and production, ensuring a high level of customer service at low logistics costs.
This can be achieved by managing the physical flow of materials in synchrony with market demand.[22]

[21] https://www.bain.com/insights/the-future-of-luxury-bouncing-back-from-covid-19/
[22] 'Le basi della logistica', Balestri Gianfranco, Chapter 1: 'il sistema logistico nell'impresa'

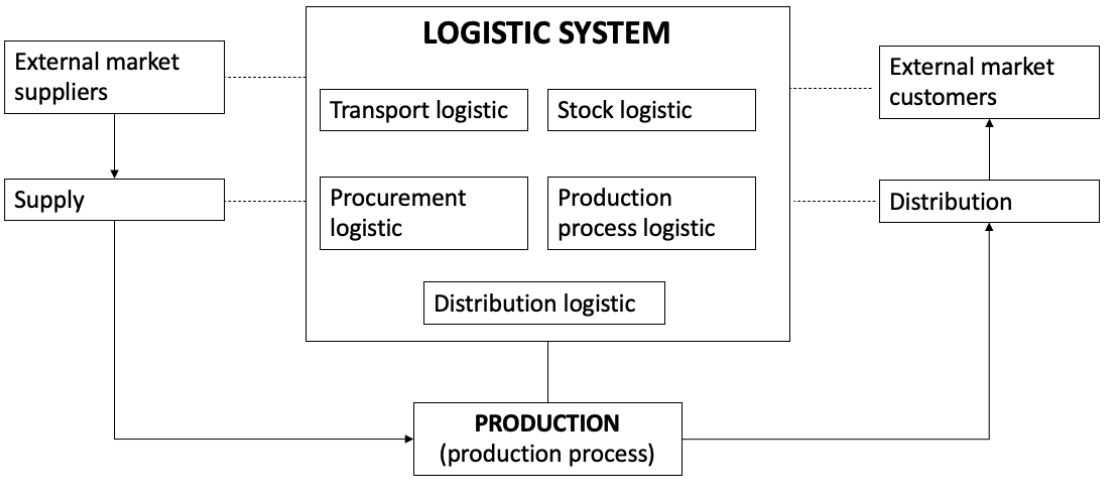


Figure 11: The logistics system: physical and information flows

The company that imposes itself on the market must develop a preferential relationship with the customer, offering him a quality product and a continuous service, making him aware of the advantages of having chosen that particular good and that particular company, this is referred to as total quality.
The determining factors for achieving success in the total quality perspective are:

- the efficiency of the supply of raw materials and goods necessary for the transformation process
- the possibility of having a logistical and commercial organisation that allows the finished product or goods to be placed on the market at the required time and place.[23]

2.1 HOW THE LOGISTICS PART WORKS

Company logistics can be defined as the link that connects the different parts and actors of the value chain, as well as being the system that governs the physical flows within each company, hence the fact that in order to optimise a company's supply chain, it is essential to also optimise the company's logistics system.

Company logistics consists of 3 different parts:

1. Inbound logistics: this concerns the upstream part of a production flow, meaning the acquisition of raw materials, the choice of supplier and the transport of these materials to the production plants. It is responsible for guaranteeing that the

[23] 'Le basi della logistica', Balestri Gianfranco, Chapter 1: 'il sistema logistico nell'impresa'

materials reach the production plants on time, as well as ensuring safe transport by optimising loads and routes in terms of time and cost.

2. Internal logistics and warehouse logistics: this concerns the transformation of raw materials into finished products in the production department. In this part, the logistics sector has the task of ensuring flows in an orderly manner within the production department and must manage stock efficiently.
3. Outbound logistics: this concerns the distribution part of a company, i.e. the transport of finished products from the factories to a system of warehouses and storage points to the end user. As in the case of inbound logistics, the outbound logistics department has the task of ensuring timely deliveries and maximum transport efficiency.

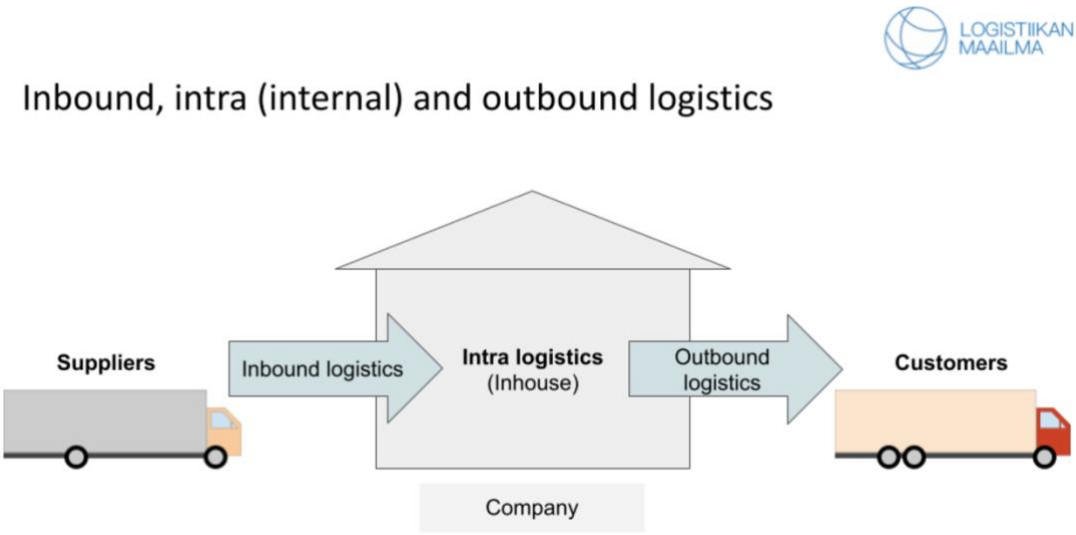


Figure 12: Inbound, internal and outbound logistics[24]

The success of a company depends very much on the effectiveness of the methods of interaction between the various parts of the company, and in particular on outbound logistics, in other words the part of logistics that has the role of connecting production with distribution.

In cooperation with the transport companies operating in the various territories, the logistics system develops efficient models in terms of time, cost and reliability of service to customers. Whereas in the past products were manufactured, distributed and sold in the same place, today this is no longer the case, all these steps are done in different places around the world and distributed globally, which is why, regardless of the size of the company, efficient logistics is important.

[24] https://www.logistiikanmaailma.fi/en/logistics/logistics-and-supply-chain/inbound-inhouse-and-outbound-logistics/

2.2 DISTRIBUTION LOGISTICS

The sale of manufactured products is the final stage of the company's operations on the market and the first stage in which direct contact with the customer is realised.
The logistics service is defined as the set of logistical 'benefits' associated with the sale of goods and products.
The customer satisfaction orientation leads the company to optimise the following elements

- *timeliness and punctuality*, which can be achieved by shortening the lead time
- *reliability*, understood as a continuous guarantee of compliance with the agreed delivery times in addition to compliance with the quantity and quality required by the customer
- *flexibility*, i.e. the ability to model deliveries on the basis of the needs expressed by the customer.

Logistics extends to all levels of the business organisation, having to ensure a high quality of the various stages of the production process. For example, attention to delivery times is an element that guarantees a competitive advantage over competitors.
The amount of costs related to the provision of the logistics service is called total logistics cost and its main components are:

- **the maintenance of stocks in the warehouse;**
- **order fulfilment**, understood as production planning costs, transaction and administrative costs;
- **transport costs.**

The cost components listed above are directly related to the provision of the logistical service, but there are also stock out costs, which are the invisible component of the logistical service cost but are often important.

2.3 LOGISTICS AND LUXURY BRANDS

Logistics and supply chain management in the luxury market are crucial for the success of the company.
Product characteristics and many other factors such as ease of transport, trust with the supplier and quality of raw materials have to be taken into account to build an efficient supply chain.

An interesting study is the one carried out by Fisher[25] where a distinction is made between functional and innovative products, and of course depending on the type of product the most efficient procurement strategy also changes.
Functional products refer to products that meet people's basic needs, such as groceries. Being basic products, the demand for these products is stable and predictable over time. Innovative products, on the other hand, concern sectors such as fashion and technology, in which case the demand for such goods is not predictable over time and they have a very short life cycle in the market.
In the case of functional products, the sourcing strategy that companies use is efficient supply chains that allow them to minimise physical costs, for example, companies usually create schedules for the assembly of finished products for at least the next month and commit to it.
Therefore, this type of company is able to plan production resources, production and supply deliveries in advance, in this way minimising inventories and maximising production efficiency.
This kind of strategy can certainly not be considered for innovative products, in this case a market corresponding strategy is used, thus market mediation cost predominates rather than physical costs as in the case of functional products.
For innovative products, the uncertain reaction of the market increases the risk of shortages or oversupply, moreover, the short product life cycles make the risk of obsolescence and the cost of over-supply high.
In the luxury market, cost issues are not as relevant as in the case of functional products, but not all products of luxury brands have a short life cycle, some do, such as limited-edition products, but some products can be repurposed, so products in the luxury sector cannot be defined as entirely innovative.
Before understanding how the supply chain works specifically, it is worth analysing how the various parts of the company are divided up in the world.
It is now well known that outsourcing is a key component of globalisation, but especially for luxury companies, it compromises the quality and reputation of the brand itself, as well as contributing to greenhouse gas emissions due to continuous transport. This does not mean that all outsourcing has a negative impact on the brand, consider for example Louis Vuitton, its watches are made in Switzerland, the best country for watchmaking craftsmanship; or if we consider Hermes many of its cashmere products are produced in the Asian region of Kashmir, a country known for its quality and expertise in processing cashmere wool.

[25] http://mba.teipir.gr/files/Fisher_What_is_the_right_SC_for_your_product.pdf

"We respect and foster the traditions that are the essence of our products by employing thousands of artisans and craftsmen to work in our ateliers around the world."
(Arnault, 2011)
Naturally, luxury brands cannot adopt outsourcing strategies just to minimise production costs as this would discredit the brand name itself as luxury fashion has to represent exclusivity, quality and authenticity. Outsourcing is used to maximise these 3 adjectives and give customers something more valuable.

If we take the LVMH group as an example, the headquarters of the brands that are part of the group as well as the production sites are located 90% in Europe, 70% of this production is then exported outside of Europe.
The main country in which the logistical and production centres of many of the maisons managed by the group are located is France, followed by Italy.
Luxury represents around 10% of all European exports and contributes significantly to French and Italian foreign trade as well as European trade.
Luxury goods also increase the attractiveness, in terms of tourism, of the countries where they are produced.
As for the second largest group in the luxury sector after LVMH, Kering, it has completely redesigned its logistics structures to meet the changes related to e-commerce and consumers' expectations in terms of increasingly demanding services and experiences.
While the previous warehousing centres were fragmented, the group has now decided to organise everything in one place, which will reduce costs and delivery times.
In March 2020, the first part of Kering's factory in Italy in Trecate (in the province of Novara, Piemonte) became operational, the second part will be operational by the end of the second quarter of 2021[26].
The Kering group in Europe had been running its logistics in Switzerland for 20 years, from where most of the stock and deliveries of the group's brands passed. In 2019, Kering is spreading the news that it is moving all of its European logistics to Italy, which already has twice the storage and shipping capacity of the facility in Switzerland. The storage centre in Italy is strategically located as it is in the middle of the main routes in northern Italy.
The objective of this site is to respond to all international requests from the various brands of the group, all requests being understood to mean requests from physical shops, the wholesale network, e-commerce sites and regional warehouses. The aim is to improve the capacity to deliver products from this location to 80 countries and of course also to improve storage capacity.

[26] https://it.fashionnetwork.com/news/Kering-riorganizza-in-profondita-la-propria-logistica,1293407.html

Thanks to intelligent automation systems, the new hub will also cut delivery times by 50%, which will benefit both e-store customers and the group's brand boutiques.
The Trecate hub has almost entirely replaced the 20 warehouses previously located in Switzerland. To date, only a few sites in Switzerland will remain operational, namely those dedicated to watch production.
The US central warehouse was recently relocated to New Jersey and a new centre was opened in Dubai to serve the Middle East.
There are plans to make the same changes for the Asian market, with the logistics centre likely to be installed in Singapore[27].

"We are transforming our worldwide logistics network in Europe, America and Asia to become fully omnichannel, decisively increasing the speed of deliveries for the benefit of our Maisons and their customers. This brand-new facility is further evidence of Kering's commitment in Italy: the Group continues to invest in the country, not only in terms of craftsmanship and management skills, but also in logistics expertise and know-how."

Jean-François Palus, Managing Director di Kering[28]

2.4 DISTRIBUTION IN THE LUXURY SECTOR

Distribution in the luxury sector has changed due to the need for efficiency in operations and processes.
Nowadays, with the advent of e-commerce, the time factor plays an increasingly important role, so companies must aim for an increasingly reliable and fast production chain.
It is therefore essential to adapt the supply chain of these shops to the new market requirements.

2.5 SPECIFICITIES OF LUXURY LOGISTICS

Transport logistics in the luxury sector, unlike in other sectors, must be well controlled and well managed as it is one of the aspects that affects the reputation of the brand, there can be no delays in delivery or damage to products, as these are products with a very high value.

[27] https://www.ilsole24ore.com/art/kering-novara-il-polo-gigante-che-consegnera-lusso-mondo-ADKZ6EWB#U3012457688808HH
[28] https://www.kering.com/it/news/kering-rafforza-le-proprie-attivita-logistiche-con-un-nuovo-sito-nel-nord-italia

It is precisely because of the value of these products that the need for security increases, both for customers and retailers, especially when considering a third-party transport company. So, it is important to have a continuous tracking system and transport that reaches the recipient in the shortest possible time.
In addition, attention to detail is also important, as goods have a certain price, the price paid by the customer will also affect the customer's buying experience.
Customer experience plays a key role for luxury brands and therefore outbound logistics must also be transparent to the customer in some way in order to update them on the progress of deliveries, for example.
Logistics as well as supply chain management are fundamental aspects of business success.
In this globalised scenario, luxury companies are facing unprecedented challenges due to volatile consumer tastes and expenditures, shortened product life cycles as well as customer demands for sustainability and transparency.
These are all always important aspects of any brand's outbound logistics, but as luxury brands are concerned, the customer also expects a higher quality of service and therefore these aspects must be guaranteed to the customer.

For luxury companies, cutting production costs is not a priority, very valuable raw materials are used and the risk of obsolescence is also very high.
To avoid overstocking some companies prefer to use the make-to-order strategy, which means to produce only when the customer orders the product.
This strategy can be used for companies offering a type of product with a high customisation rate. It cannot be used when the lead time of the operations is longer than the delivery lead time foreseen by the market, for this reason some collections or rather some pieces considered by the company as 'best sellers' are produced in advance in higher quantities and immediately put on the market. For these product lines the strategy used will therefore be a make-to-stock strategy.
With regard to the retail chain according to the study done by (Brun, 2008) companies seek to integrate downstream as an important aspect of success in this segment.
Companies tend to create a direct relationship between consumer and company by trying to create a controlled single-brand boutique network (owned or franchised) in addition to improving service in terms of delivery times, product availability, direct communication with the main company, supporting sales staff and important for information sharing.
The factory outlet channel plays a key role as it allows the company to absorb errors made during the design and production processes. Sometimes the outlet channel is used to keep the utilisation of the production system high and the outlet collection (if it

exists) keeps the production lines running during the "pause" between regular collections.
Many of the companies considered in this research also have small companies or artisans as suppliers and outsourcers and this is important because one of the characteristics of the luxury market is the quality and uniqueness of the product and many of these products require handcrafting for quality details and only specialised artisan companies can guarantee this excellence in production.
As indicated by Brun et al. in 2018 research[29], the critical success factors in the luxury segment of the fashion industry are product quality, style and design, country of origin, shopping experience for the customer and brand reputation.
These critical success factors have a different impact on supply chain management for luxury companies.
Product quality requirements mean that the company is careful in selecting material suppliers and outsourcers, and the company is committed to long-term partnerships to ensure reliable quality over time.
Excellence in style and design is achieved by keeping the design activities in-house and, at the same time, collaborating with experienced external designers and stylists.
Suppliers are also key to finding new materials, technologies and solutions that bring innovation and are appreciated by end customers.
When the country of origin is a key competitive factor, the supply chain configuration is strongly influenced by the location constraints of the country-sensitive stages.
Providing a complete shopping experience contributes to achieving customer satisfaction as well as the feeling of direct contact with the manufacturing company.
For example, providing specially designed packaging is one way to enhance the shopping experience.
The need to maintain a brand reputation influences most choices in the design and retail stages: design activities are often carried out in collaboration with designers and brand owners in order to enhance and maintain the established brand style.

The global outbreak caused by Covid-19[30] has had a dramatic impact on luxury supply chains. Luxury companies have faced supply chain delays, factory and shop closures, cancellations of trade shows and fashion weeks, as well as increased online sales, declining travel-related purchases, and problems with long-term trade agreements.

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[29] https://www-sciencedirect-com.docelec.insa-lyon.fr/science/article/pii/S0925527308000455?via%3Dihub#sec5, paragraphs: 'Supply chain management choices in the luxury segment of the fashion industry' and 'Impact of critical success on supply chain configuration and management'

[30] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7525258/

These uncertainties lead to a domino effect in which decreases in retail sales lead to discouraged payments to suppliers, factory closures lead to cancelled orders and, eventually, the whole supply chain would be disrupted.
This situation represented a huge challenge for supply chain managers and planners, the solution to which required the acceptance of compromises such as:

1. extending the presence of the Spring-Summer collections in shop even in the months traditionally dedicated to the advance sales of the Fall-Winter collections, to exhaust some of the huge unsold stock;
2. skip the launch of some collections
3. creating new collections largely based on colour variations of models from previous collections or avoiding new materials to reduce time to market and allow the creative team to work remotely.

In the post-pandemic era, luxury supply chains may have to take several years to regain lost balance and recover sales.

2.6 SUPPLY CHAIN IN THE LUXURY SECTOR

The supply chain is all the activities involved in planning, coordinating and controlling each stage of the product life cycle, from idea generation through to sale and collection of any unsold items. Operations and logistics are therefore part of the supply chain.[31]
The efficiency and speed of a company's supply chain influences the quality and volume of deliveries.
It is clear that the Supply Chain plays a fundamental role in the success of a product as it directly influences the company's service and distribution; furthermore, as the Supply Chain influences every stage of production, it also affects the costs incurred and therefore the definition of the product sales price.
For companies in the luxury sector it is important to identify and recognise changes in consumer preferences, to be able to produce products in line with new fashions quickly and to be able to distribute products accurately and widely in the marketplace worldwide.
These requirements play a major role in the supply chain and can only be implemented with an appropriate logistical organisation, which is able to adapt to the requirements of the target environment.

[31] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

Effective control of the overall supply chain process must verify that flows occur according to the initially established deadlines; verify product quantity and quality; provide for alternative options in the event of disruptions or unscheduling; avoid unused stocks of goods or information; and finally, avoid bottlenecks.
Preparing for possible problems or schedule changes is not very common in the apparel industry, but this can be considered a mistake given the tight timescales in the industry and any problem could cause a delay in delivery and therefore a lower quality of service with consequent damage to the brand image.
Fashion is difficult to predict and the more forecasts are made in advance of the time of sale the greater the possibility of error.
Speed is the soul of fashion and the static nature of goods and information is the main obstacle to speed of execution.

2.7 GENERAL ORGANISATION OF THE WAREHOUSE

A clothing warehouse is divided into the following areas:[32]

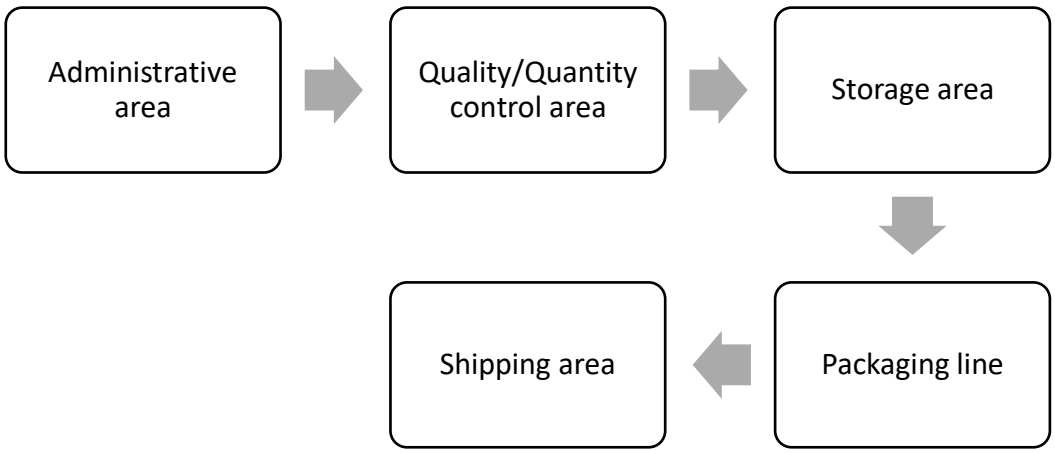


Figure 13: General organization of a clothing warehouse

The organization of the warehouse can be by article or by customer. The first is much more common and implies that it is divided by model. The second means that each space contains the quantities ordered.

[32] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

The shorter the movements in the warehouse in terms of time and space, the faster and more accurate the process. This means that the items with the highest turnover, which are most frequently received and dispatched, should be stored as close as possible to the entries, exits and packing line.

2.8 PROCUREMENT PHASE

This phase requires special attention for fashion companies, as the procurement costs will impact the price of the final goods.
Determining the material supply needs depends on the type of clothing to be made.
If it is a question of standard raw materials or components that are used for different types of products, it is convenient to keep a stock in the warehouse and it is not wasteful, on the contrary, it facilitates production as it allows having the raw materials always available in case of need without waiting time.
The same technique is adopted for those finished products that are re-proposed by the company in each collection.
A different analysis must be made for those items of clothing which respond to specific market trends, which are limited editions or unique pieces.
In these cases, it is important for the company to establish reorder and supply policies based on sales trends and seasonality.
Sales trends are the trends of a market, upwards or downwards.[33] On the basis of these trends, the company can decide its reordering and supply policies.
n logistics, the demand (or sales) of a certain product is said to be subject to seasonality when the corresponding time series presents a predictable cyclical variation, which depends on the time of year. Seasonality is one of the statistical patterns most commonly used to refine the accuracy of demand forecasts.[34]

2.9 STOCK MANAGEMENT

Inventory management techniques involve careful analysis and forecasting of market demand.[35] Inventory management for fashion companies involves managing 'requirements', meaning all the components needed to produce a product, expressed in quality and quantity.
For each product, a 'bill of materials' is drawn up, which is a document that contains a list of all the materials needed to produce that particular product.

[33] https://www.ig.com/it/glossario-trading/definizione-di-trend
[34] https://www.lokad.com/it/definizione-stagionalità
[35] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

Finally, with the aim of determining the right quantity to guarantee the continuity of production, luxury goods companies develop an overall production programme, the Master Production Schedule (MPS), and draw up a Material Requirement Planning (MRP).

The MRP process is divided into 3 stages:

1. Forecasting demand, which is given by customer orders and any quantities that the company wants to keep in stock.
2. MPS, meaning the planning of the items to be produced on the basis of the company's production capacity and delivery date.
3. Calculation of production requirements, in the specific case of companies in the fashion sector this is derived from multiplying the bills of materials for each article by the quantity of articles to be produced.

The characteristics of this sector make it difficult to forecast the quantity to be produced, which increases the risk of situations of excess or shortage of available inventory.

In the clothing sector there is a wide use of minimum supply, that is, buying only the minimum quantity below which the supplier does not accept the order or applies significant surcharges.

2.10 THE TIMING OF WORK PHASES

The phases of work in the fashion industry include the:[36]

- ***Creation of the collection***: the period in which the designers set up the new collection in terms of quantity and type of models to be included.
- ***Presentation***: presentation and sale are roughly coincidental, the presentation initiating sales. Presentations have rather strict dates according to industry custom, coinciding with the major trade fairs.
  Normally companies organise events where the collection is shown to buyers, client shops and sales agents. The presentation is very short and quick.
- ***Sales to shops***: sales of programmed have a longer lead time. Programmed is a sub-category of fashion and refers to the seasonal collections offered by fashion houses. The time-to-market of programmed, or the time between creation and delivery, is about one year. The production of an entire collection requires much more time and creative studies than the production of standard models.
  Sales of this type of collection are made from a minimum of one month to three, depending on the importance of the collection, from the moment of presentation.

[36] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

- ***Purchasing of raw materials and production***: the long production times are also due to the large number of articles and materials that each collection comprises.
- ***Deliveries from companies to shops***
- ***Shop sales to the end customer***: the periods in which the shop sells to the end consumer are obviously seasonal. February/March until July/August for S/S and from the end of June/July until January for F/W. Companies such as Zara have revolutionised the offer, offering batches of new articles all the time.

2.11 CHOISE OF SUPPLIER

Suppliers can be of different types, it is important to distinguish between internal and external suppliers.[37]
Companies that manage to integrate vertically, in other words, those that manage to buy their suppliers, have undoubted advantages in terms of production coordination and control over the quality of raw materials, as they are able to carry out more precise and systematic checks than in the case of external, independent suppliers.
In addition, having suppliers close by is useful for continuous collaboration and for increasing the speed and accuracy of information and exchanges, as well as having greater certainty of the arrival of the expected quantities than an independent producer offering his services to several companies.
In order to calculate the performance of one's suppliers, certain aspects must be taken into account which identify a level of excellence and efficiency for each production entity:

1. Speed in delivering the product;
2. Reliability of service and products, the supplier must always meet the characteristics required by the customer;
3. Quality of the products;
4. Flexibility, which is the ability to vary volumes, delivery time or types of supply;
5. Cost, the ability to provide the above aspects at an appropriate cost;
6. Creativity, the ability to study and create new and different products.

While the first five points are aspects that all types of companies must take into account when evaluating the performance of a supplier, the sixth point, creativity, is specific to the fashion industry.

[37] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

2.12 PRODUCTION

In the clothing sector and especially in the luxury clothing sector, production is handled by sewing machine lines and more artisan production.[38]
The factors hindering technological development in the clothing sector are the fact of working with materials that are deformable and flexible, and therefore not easily machinable; the variety of materials and finally, and very importantly, the uniqueness of the products. Customers in the luxury sector are always on the lookout for unique products and this can only be guaranteed by careful craftsmanship.
The choices regarding the production organization of companies in the fashion sector depend on the complexity of the product and the volumes to be manufactured.
On the basis of these characteristics, it is possible to identify four production organisations:

1. Job shop: production management in this case involves dividing the production centers into islands dedicated to the various garment manufacturing processes. Each island produces its own component, these are then brought together and assembled into the finished garment.
   Large companies are often organized in job shops.
   The advantages of this method are due to the possibility of specializing each island in one process and the possibility of controlling the quality of each part made without stopping the whole production line.
   The main disadvantages of the system are the need to coordinate and move many semi-finished products to different islands, which on high volumes takes considerable time and personnel, thus creating costs.
2. Mass production: This is used when only a few types of products have to be produced in high volumes. In this case, building dedicated lines is economical, because the time and efficiency savings on very high volumes exceed the cost of the line itself.
   This organization is also used in the clothing industry, when an article is produced in a standard way for long periods.
3. Batch production: In clothing, production is done in batches of the same model, in several variants and sizes. Batch production is halfway between a job shop and mass production. In this case the complexity is high, but the volumes to be produced of the same type are large.
4. Continuous production: This production mode is applied when a company is a single-product company and therefore the entire production plant is dedicated to

[38] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

the production of it. In the fashion field it is not used for the production of clothing collections but for the production of standard fabrics for which there is a constant demand.

If we want to summarize these four modes of production according to the volumes to be manufactured and the complexity of the product, we can summarize them in the following graph:

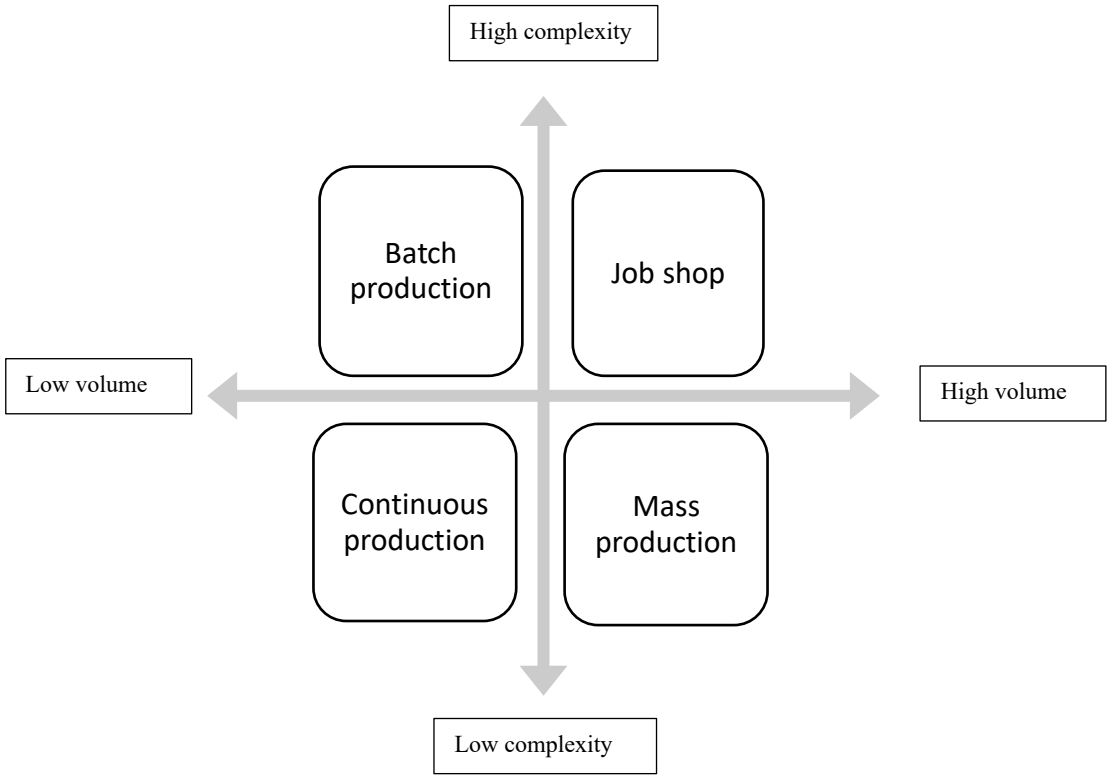


Figure 14: Types of production systems in the fashion sector

2.13 SUSTAINABLE ASPECT

With the outsourcing phenomenon also comes the issue of sustainability, of always respecting the environment and adopting a production and transport approach that minimises pollution.

The large LVMH group, Moët Hennessy - Louis Vuitton, is focusing heavily on these challenges and has been trying to improve itself from an environmental point of view since the 2000s.

Louis Vuitton and Veuve Clicquot (one of the largest champagne producers in the world) have made innovations in the shipping and packaging of products to save around 150 tonnes of cardboard. Celine has increased deliveries by electric trucks within major urban environments.

The LVMH group focused on progress in transport and shipping and therefore on managing environmental impacts and company objectives. The group has purchased small solar electric vehicles to transport employees and visitors to its wineries, in addition its factories are located all over the world (USA, Spain, France, Germany and Italy) this reduces CO2 emissions from transport and also minimises shipping costs for the company[39].
The Kering Group's biggest investment in Italy is the large logistics hub in Trecate, Novara. This hub has been designed with sustainability in mind.
The Italian site will be able to produce more energy than it consumes. The electricity not consumed will be reused in Kering's shops and corporate offices.

2.14 PHENOMENON OF SERVITISATION

The logistics market is changing very fast, e-commerce has revolutionised traditional structures and increasingly demanding consumers have forced many of the major players to radically review their business structure and strategy.
The consumer has a strong interest in having access to same-day delivery when placing an order. However, this choice is constrained by the logistics network in each city.
The first logistical changes take place in large cities, as it is there that the 'early adopters' are to be found, meaning those curious consumers who decide to test innovative services by sending signals to the market.
It is no coincidence that Amazon has launched a new delivery system, in Italy only in the cities of Milan, Rome and Turin.
Amazon Prime Now[40], a service reserved for customers registered with Amazon Prime that allows orders placed through a dedicated application to be received within 1 hour or within 2-hour windows.
This is how, the strategy of companies shifts from the mere sale of products to the sale of a service.

This is the phenomenon of servitisation, where the consumer is at the centre of any business decision or transformation.
According to the needs of the consumer, distribution logistics change. We can say that it is the consumer himself who defines the basis of corporate logistics.
Servitisation indicates a business model that focuses on the transformation of companies from the sale of a product to a service.

[39] https://fashionbi.com/newspaper/outsourcing-s-repercussions-on-the-luxury-industry
[40] https://www.digitaltrends.com/home/what-is-prime-now/

During the Coronavirus pandemic, buying a car was a very difficult affair, a difficulty related to closed dealerships or paperwork agencies that only carried out urgent services.
The US company Tesla[41], has implemented a new way of buying a car, the Direct Drop, which allows for contactless delivery of its models.
Once the payments due and the bureaucratic paperwork have been completed, even through electronic signature, by means of a special fully covered car transporter, the car will be delivered to the customer's home or desired address.
The person, or his delegate, must be present at the time of purchase to check the condition of the car and sign the final documents certifying delivery.
At this point, via the official Tesla app, the car can be opened and inside the car will be the card that replaces the physical key.
The delivery therefore takes place without any physical contact, the car is increasingly experienced as an experience and not as a simple purchase of a durable good, this is the phenomenon of servitisation, i.e. the adaptation of companies to the needs and desires of the customer.

2.15 REVERSE LOGISTICS

With the definition of reverse logistic[42], is the opposite process to the distribution chain. The flows of raw materials, semi-finished and finished products go from the end customer to the producer/distributor or third-party recovery agent. Return logistics therefore starts at the end and allows products that have reached the end of their life cycle to gain new value.
The typical activities of return logistics concern the management of returns, meaning their recovery and collection, transport, reception and sorting of the return.
Returns are often placed on secondary markets (e.g. outlets), disposed of in dedicated landfills, but also remanufactured. Regenerating 'returned' goods or components has an environmental benefit as it avoids the exploitation of new resources, but it also allows to give new value to the product, with the additional possibility to put it on the market.
As a result of the growing importance of the topic of environmental sustainability, reverse logistics has over time assumed an important role for companies, on the same level as direct logistics.
The valorization of activities concerning the recovery, resale or disposal of products has become a priority for companies that want to gain a competitive position on the market.

[41] https://insideevs.it/news/407290/coronavirus-tesla-consegna-casa-contactless-model3-modely/
[42] https://economiacircolare.com/glossario/reverse-logistic/

2.16 SALES CHANNEL

Sales channels, in other words the way of bringing products or services to the market and making them purchasable by consumers, are:[43]

- Department store: large multi-brand shops, are one of the most effective and powerful distributions. They are private multi-brand organisations, very attentive to the level of service. Orders are placed through professional buyers usually divided by product category.
- Corners or shop-in-shops: these are small shops within a larger shop, which is usually the department stores.
- Multi-brand boutiques: in Italy, France and many other countries, boutiques have long dominated the market, but today they suffer from several problems. The main ones are:
    - General decline in sales and increasing presence of outlets;
    - Policies of manufacturers increasingly aimed at opening single-brand shops;
    - Cost of locations that in many cases is such that it can only be recouped by those who manage large sizes and sales volumes;
    - Progressive decrease in the importance of clothing;
    - Restrictive policies of the big brands against multi-branding.
- Single-brand shops or company shops: the most popular brands now have hundreds of owned or franchised shops around the world:
    - wanting to establish their own brand, many companies have decided to sell directly to the consumer with their own shops.
    - search for higher sales volumes, it is easier to enter the market with one's own distribution rather than relying on increased purchases from independent traders.
    - Willingness to offer the public its complete range.
    - General willingness to break free from the will of the retailer.
- Outlets: The development of outlets is linked to that of the single brand. It is normal for outlets to have stock at the end of the season, and when there are hundreds of outlets the unsold stock is so large that an effective system for disposing of it is necessary. Hence the birth of outlets, which, however, in order to function cannot be limited to offering the unsold stock of the first line shops. Many companies therefore supplement their unsold stock with missing colours and sizes and with other articles that are perhaps simpler and cheaper.

[43] V. Bini, La supply chain della moda. Strumenti per la gestione globale dell'impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

- Websites: operations are fundamental, the basis of the system is the logistical ability to control stock, to process many small shipments quickly, to receive, check and finally to put back in stock customer returns. Web orders on the other hand can have tens or hundreds of thousands of distinctions, customers want to receive their purchase in a very short time; in many countries. Warehouses need to be extremely fast in shipping.

2.17 ATTRACTIVE MARKET FOR THE LUXURY SECTOR

One of the particularly attractive markets for the luxury sector is China.
Some of Europe's top fashion brands are outsourcing their internal processes to China and other countries to meet the demands of these countries while trying not to give up their initial brand identity and recognition.

Chinese consumers are very important for large luxury groups such as Kering and LVMH because they represent about 8% of the global total. These buyers are willing to spend on luxury brands but want fast turnaround times.
According to the report by Bain & Company[44], 2020, the luxury goods market in China could absorb almost 50% of the total global demand for luxury goods by 2025, expectations also confirmed by McKinsey & Company's experiments.
Traditionally, Chinese consumers have tended to buy luxury goods while travelling abroad until the pandemic stopped them from doing so. Chinese people are now starting to buy these products directly at home, allowing the luxury sector to grow exponentially in China.

According to this report, the four drivers that powered the Chinese luxury goods market in 2020 were:

- **Repatriation**: with reduced tariffs, tighter controls to combat the grey market, harmonisation of brand prices and a freeze on international travel, have meant that purchases in China have increased steadily. The various brands interested in being part of this growth should start by improving the effectiveness of their supply chain and their skills to serve Chinese consumers.
    - **Millennial and Gen Z shoppers**, as already mentioned millennials are the future top consumers in the luxury market. The various brands should therefore focus on meeting the needs of these consumers and provide them with personalised products, perhaps in collaboration with other brands.

[44] https://www.bain.com/insights/chinas-unstoppable-2020-luxury-market/

- **Digitalization**, given the growing influence of the younger segment of the population in the luxury market, Chinese luxury brands are also starting to make greater use of online e-commerce.
- **Hainan duty-free shopping,** due to policy changes and international travel restrictions, duty-free sales in Hainan Province grew at a rate of 98% in 2020. Hainan duty-free shopping is the first step to begin the development of a national duty-free channel.

The China Duty Free Group on Hainan Island deserves special attention.
Duty-free sales in China have been extremely strong over the past year because with the pandemic the Chinese could hardly leave China.
Since President Xi Jinping designated Hanan as China's largest free trade zone two years ago, the island has been able to gain some great advantages.
Corporate tax and personal income tax are limited to 15%.
Raw materials are exempt from import duties as long as they are used for local production and Beijing has also exempted visitors from certain foreign countries from visa requirements.
Chinese citizens also benefit from this tax exemption, as long as they do not reside on the island.
This is a way to encourage its citizens to spend at home rather than wait to travel to foreign countries to avoid heavy import duties, up to 50% on luxury goods.
All this was done before the Covid-19 pandemic.
Since the Coronavirus hit the world, however, Chinese visitors can receive their purchases at their home address and can continue to buy duty-free products online from Hainan shops for six months after leaving the island.
Thus, despite the Covid-related drop in visitor numbers, spending has increased; according to government figures, duty-free sales in Hainan averaged CNY 180 million per day, in January this year.
Moreover, while until the end of 2020, duty-free trade on Hainan was entirely controlled by the state-owned China Duty Free Group (CDFG), from 2021 the CDFG will face competition.
Since the beginning of 2021, four new Chinese public operators have been granted licences, with five new shops operated by Shenzhen Duty Free, Hainan Development, Hainan Tourism Investment and Sinopharm.
As not all of these newcomers have sufficient experience in the sector, partnerships are being forged, for example between Hainan Development and Swiss duty-free giant Dufry.
Among the various partnerships being forged is the one between Alibaba and Dufry who have announced the creation of a joint venture that will develop the duty-free

business in China; in addition, Richemont and Alibaba already have an e-commerce joint venture, Feng Mao, launched in China in 2020.
Hainan is expected to become the country where China's consumption will boom. China also plans to open duty-free shopping complexes in the mainland's major cities, so the prospects for development are growing[45].

According to Deloitte's report, the geographic parts most affected by the pandemic were Europe and North America.
Apac, on the other hand, was less impacted and is expected to have a faster recovery in the 2020-2025 horizon, along with America.
In the coming years, Apac will be the main geographic basin for the luxury sector's recovery. As early as 2020, China recovered from the pandemic crisis and consumers started to spend more than before in the luxury market.
The strategies companies are adopting to cope with the crisis include enhancing digital sales channels, using artificial intelligence, improving stock management through an omnichannel strategy and adapting products in an ethical and sustainable way.

According to the consulting firm McKinsey[46], the goal of global brands today must be to become the main form of social capital for young Chinese consumers and to succeed in staying in this market.
Young Chinese consumers are not very attached to wealth, they are more interested in aspiration, as some interviews with young consumers show, they are not interested in saving a part of their salary by creating reserves for the future, but they are more interested in aspiration, so they are interested in spending on luxury brands while they have the chance.
That is why, the strengths that luxury companies should focus on to survive in this market are novelty and exclusivity. This can be achieved by launching limited edition products in the market, for example, doing collaborations with influencers and creating an annual calendar of special events.
In addition, brands should design a marketing strategy that caters for the new consumer purchasing behaviour. This means integrating a strategy that encompasses all customer touch points, from online to offline channels.
As the majority of luxury purchases are still made online, luxury brands should re-imagine the in-store experience and offer the customer a higher level of satisfaction, so the customer will return to that shop.

[45] https://journal.hautehorlogerie.org/en/hainan-is-paradise-island-for-chinese-duty-free-shoppers/
[46] https://www.mckinsey.com/~/media/mckinsey/featured%20insights/china/how%20young%20chinese%20consumers%20are%20reshaping%20global%20luxury/mckinsey-china-luxury-report-2019-how-young-chinese-consumers-are-reshaping-global-luxury.ashx

To improve the customer experience, luxury brands should also invest in highly qualified staff who can maintain a one-to-one relationship with customers at every stage of the purchase, from decision to post-sale.
Chinese cities are subdivided, although unofficially, in a hierarchical classification used in various media publications for purposes including trade, transport, tourism, education etc.
According to research by the McKinsey firm, a great opportunity for companies could be to source affluent customers who are part of China's lower-tier cities and therefore not well served by physical shops.
Luxury brands could design a travel retail strategy that captures these consumers and drives them home.
At this point, staff could maintain contact with these consumers through the use of the WeChat platform which is a text and voice messaging communication service for mobile devices, developed by the Chinese company Tencent[47].

[47]https://www.mckinsey.com/~/media/mckinsey/featured%20insights/china/how%20young%20chinese%20consumers%20are%20reshaping%20global%20luxury/mckinsey-china-luxury-report-2019-how-young-chinese-consumers-are-reshaping-global-luxury.ashx

3. OMNICHANNEL

3.1 WHAT IS THE OMNICHANNEL STRATEGY

We can define omnichannel strategy as the simultaneous management of various contact points and channels of interaction between company and customer with the aim of optimising the customer experience.
Contact points are all the assets that the company has at its disposal to establish contact with the end customer throughout the buying process, including advertising, pre-sales, payment and post-sales. These contact points can be both physical such as call centres and online such as social media or the company's e-commerce sites.
Omnichannel retailing is a development of multichannel retailing.
In a multi-channel approach, the company develops different touch points for the customer such as social channels, chatbots etc. In this type of strategy, you do not optimise the connection between all these contact points by sharing all the information about users and strategies, you do not use an integrated management of all the information but you optimise the management and performance of the single channel.
With the omnichannel strategy companies put the consumer at the centre and create an interconnected system between all the company's contact points. This means that they transfer all the data between the different channels and the strategy must be coherent, so that the buyer can, by interacting with the company, experience the same shopping experience in all the company's channels.

3.2 OMNICHANNEL CONSUMER BEHAVIOUR

In all companies' strategies the consumer is at the centre, all sales and brand relationship strategies are designed to provide the best possible user experience for the customer. Navigation, purchase and brand relationship paths are also built to collect data and feedback from customers to provide a high level of personalisation.
The consumer is used to using all the platforms provided by the company, for example the consumer sees a product he is interested in in a shop and then searches for it on the internet to compare the price, read the features and look for reviews. The opposite could also be the case, where a consumer finds a product, they like on the internet and then looks for it in physical shops. Where the purchase will take place depends very much on the type of consumer, some do not trust technology, to enter sensitive data in the various online sites, others for convenience and time saving prefer to buy products online directly from home.

3.3 OMNICHANNEL IN LUXURY COMPANIES

The pandemic has accelerated this process of digitalization of companies and also of customers themselves, before the pandemic not everyone used to go on the internet and buy products from home, especially if these are luxury products and therefore with a certain price level.
In order to monitor consumer purchasing behaviour, the big luxury brands are starting to study big data to increasingly tailor the sales channel to that type of consumer using artificial intelligence and are starting to apply augmented reality to improve the shopping experience.
To do this, they are using an omnichannel strategy to continue to maintain a constant relationship with their customers, who are now increasingly digital.
Large luxury companies have immediately started working on online platforms, Giorgio Armani for example, has partnered with Ynap to ensure a more effective and efficient shopping experience for its shoppers.[48]
Ynap (Yoox Net-A-Porter Group S.p.A.) is an Italian company active in the online sale of fashion, luxury and design products.
Another major company specialising in online sales, Amazon, has announced the launch of a new app dedicated to luxury designers together during New York Fashion Week 2020.
The American giant's new app, already officially launched in September 2020, offers luxury brands to American customers with an Amazon Prime subscription. Amazon Luxury Stores is an exclusive invitation-only experience, so only selected Prime customers in the US will be able to participate and it can only be accessed through the Amazon app.
Within this app, each designer will have their own store, the brands themselves will decide on products, inventory and prices, Amazon will only take care of the merchandising aspect.
The first designer to open a store in the app was Oscar de la Renta with his pre-autumn and autumn/winter 2020 collections.[49]
The innovative feature lies in the technology of this app: thanks to a special 360° viewer, customers can rotate the image of a dress worn by a virtual model. Shoppers can also choose the virtual model that best represents them, so they will choose the size, body shape, skin colour, etc.

[48] https://www.ynap.com/news/the-armani-group-and-yoox-net-a-porter-group-come-together-to-design-distribution-model-for-the-future/
[49] https://press.aboutamazon.com/news-releases/news-release-details/amazon-announces-new-shopping-experience-luxury-stores/

3.4 ADVANTAGES OF AN OMNICHANNEL STRATEGY

Consumers are increasingly demanding companies for their shopping experience. Turning shopping into a unique experience by offering online channels for purchases but maintaining a high level of customer relations has become a necessity for companies that want to survive in such a competitive market and in an era of continuous evolution especially after the pandemic period.
With the omnichannel strategy we want to improve the services offered by the company; the sales numbers as the number of platforms for sales will increase, both online and offline and they will all be connected; the customer loyalty process, by making the customer more satisfied with the shopping experience he will become more loyal to the company and finally we will improve the brand image.
As far as luxury brands are concerned, out of all the companies they have had the most difficulty in opening up to this new type of market because most remain convinced that the luxury consumer wants to have an exclusive shopping experience in person. This is not what the sales figures show, at least 60% of all luxury sales are made online or are influenced by an online presence, so even luxury companies have had to change their strategy and invest in e-commerce to try to survive and remain competitive in the current market.

Nowadays, consumers have become increasingly accustomed to online shopping. Buying online means looking at the product from the picture, assuming certain intrinsic characteristics, such as the softness of the fabric, and finally buying the product.
Not being able to touch or examine the item as in a physical shop, the consumer is not fully able to understand if that product will meet all their requirements and this leads to customers returning the item. According to the website Eurostep.it[50] today's return rate is around 15% of purchases made online, rising to 25% in the fashion sector.
Whereas before traditional returns could only be made online, the mechanism has now evolved. With online-only returns, consumers had to take time to return the item, sometimes at their own expense, and they did not receive a refund from the company immediately, which made the customer dissatisfied and therefore the company tended to lose customers who bought online from its site.
With the rapid development of the omnichannel strategy, retailers have been able to provide customers with the ability to return items to physical shops. In this way, customers can receive an immediate refund or exchange the product. This return policy is very important for retailers because they can receive more feedback on consumer dissatisfaction and improve their products and services.

[50] https://www.eurostep.it/resi-ecommerce-come-ridurli-piano-di-miglioramento-shop-online/

This new return policy also has crucial aspects to consider, in addition to the above-mentioned benefits, namely inventory strategy.
As many consumers have moved to buying on the online platform rather than in physical shops, retailers need to replenish online stock with offline stock.

4. HOW THE STOCK WORKS

4.1 ONESTOCK

The OneStock strategy[51] is an agile OMS (Order Management System) designed for omnichannel retailers.
The aim of this OneStock strategy is to unite all the stocks of a company, the stock of e-commerce, warehouses, physical shops, suppliers and so on.
In this way, this strategy allows all sales channels to be managed in the same way.
One of the problems that causes customer dissatisfaction is that of looking online for a product and not finding it, with the OneStock system all stocks are managed together, so this means that if that product is not available online but is available in shops or in a wholesale channel for example, the customer can still buy it online, the available shop responds to the order and prepares it.
The shop assistant who has prepared the package, also prints out the transport label in a few simple steps and from the OneStock app, by entering that the package is ready to leave, the courier is automatically notified to pick up the product from the shop.
From the OneStock app it is also possible to follow the tracking of the parcel. An interface is available for the company to check the turnover in real time and the number of items per origin.

This strategy allows companies using it to offer both a physical and electronic experience to their customers, therefore a totally omnichannel experience, this will increase customer satisfaction, help build customer loyalty and also make it quick and easy to ship products anywhere.

4.2 INVENTORY WITH ONESTOCK

When new products are received in the shops, in order to ensure that all units are received in the ERP and confirm that they have arrived in the expected condition, the sales teams scan all products. In this way, the shop's stock is stabilised and updated.
With the Onestock strategy, inventory and order processing for dispatch are managed in a single interface.
In addition, to avoid having unsold products at the end of the season, because for example these products have been very popular with customers in one country but not in another, it is possible to transfer stock, via an application interface, between

[51] https://www.onestock-retail.com/it/

boutiques nationally or internationally or, in the case of products from past seasons, to transfer them to outlet boutiques for sale.

Another advantage for the inventory will be to have a real stock that is always up-to-date, since if an item has been sold or reserved or if it is damaged it can be entered in the computerised stock in real time and consequently you will always have a complete and up-to-date view of the condition of the stock without having to wait for the end-of-season inventory[52].

4.3 LVMH GROUP

The world's leading luxury group, LVMH, has adopted this Onestock strategy to unify the stock of one of its maisons, it has not yet been said which brand is benefiting from it.
This new project, which uses the order processing technology of the start-up OneStock, has been adopted by the group to meet customer expectations.
It will also offer customers "ship from store" shipping services.
These options are increasingly used by fashion brands and companies in all price ranges have reported an increase in their online sales after the introduction of these services.

"Nous voulons atteindre des niveaux exceptionnels de personnalisation de l'expérience client et de l'expérience en boutique. Nous voulons aussi améliorer les services de e-commerce que nous proposons"

Laetitia Roche-Grenet, director of business synergies at LVMH[53]

4.4 FARFETCH'S INNOVATIVE STRATEGY

When products are not sold after a few months they go out of fashion, in which case the company can send them to outlets to sell them at a reduced price.
Farfetch is used as an online outlet that sells last season's luxury products and ships the products worldwide.

Farfetch is the world's largest global marketplace for luxury fashion. It was founded in 2007 by Portuguese José Neves.

[52] https://www.onestock-retail.com/it/
[53] https://fr.fashionnetwork.com/news/Lvmh-lance-un-service-d-engagement-de-livraison-avec-onestock,1179016.html

Its main country of operation is the UK but it operates in a total of around 190 countries including Germany, Spain and Italy.
It sells the remaining stock of around 880 brands and boutique partners in over 40 countries. Farfetch has offices in 14 cities and employs over 4,500 people.

The logistics part of Farfetch is organised to provide not only the luxury good but also a consistent experience for the most demanding buyers.
The platform's algorithm calculates the fastest and most efficient delivery route.
Boutiques and partner brands prepare the goods and often add a personal note, this will increase customer satisfaction.
The logistics process is the main part that distinguishes this platform, every time Farfetch enters a new market it organises the sales and transport procedures together with the retail partners that will supply that particular market.
Farfetch's platform allows retailers and brands to integrate in an omnichannel way, i.e. to synchronise their websites with their in-store and warehouse inventory, which facilitates in-store pick-ups and consumer returns.
Their platform is enabled for API (Application Programming Interface).

5. ANALYSIS OF THE MARKET

As we can see from the various strategies designed to help luxury brands expand around the world, they all agree that having an omnichannel strategy is essential for today's businesses. Companies need to synchronise their warehouses, which will minimise inventory and maximise customer satisfaction.
For our model we need to make initial assumptions and understand how companies react when faced with these assumptions.
For example, the British company Burberry has its traditional factory in Yorkshire, in Castleford. The Prorsum line is produced in factories in England, a large part of the textile production is carried out in China while shoes, bags and belts are also produced in Italy and cashmere scarves come from Scotland. The company also has its own production sites or concessions in many other countries, from Turkey to Vietnam.
Outsourcing production allows these luxury brands to benefit from low production costs, rapid response to consumer demand in the countries to which they have moved production and better contract negotiations with upstream or downstream parts of the supply chain.
However, it must be remembered that today the outsourcing phenomenon is being replaced by the reshoring phenomenon, that is, the return of mainly medium-high range production from Asia to the countries of origin such as Italy.
It is very interesting to observe how much the theme of perceived quality is central in orienting the production choices of the various brands, given that the luxury market abroad is looking for the real Made in Italy for which the super-rich Chinese buyers are willing to spend up to 50% more.
The challenge today is to maintain Italian-made products, meaning that they are produced in Italy, but to be able to satisfy the demand of consumers in other parts of the world in the short term.
We need to understand how to reach these buyers in a short time and minimise transport and storage costs.

5.1IDEA OF THE PROPOSED STUDY

In this research a multi-store and multi-product inventory model of a company located in different parts of the world is considered. In this model the fashion & luxury market will be considered to be precise.
This thesis aims to study the warehouse and outbound logistics of luxury companies. the objective is to study the management of the warehouse which can vary from a more manual management to a fully automated one according to the needs of the companies.

The study will continue with the analysis of some important indicators for luxury companies. KPIs that companies need to monitor in order to optimise warehouse management, transportation time and customer satisfaction.
We will consider a main warehouse serving the whole continent, from this warehouse the company will send the products to the various smaller warehouses on the continent which in turn will serve the various shops in the area (Figure 15).

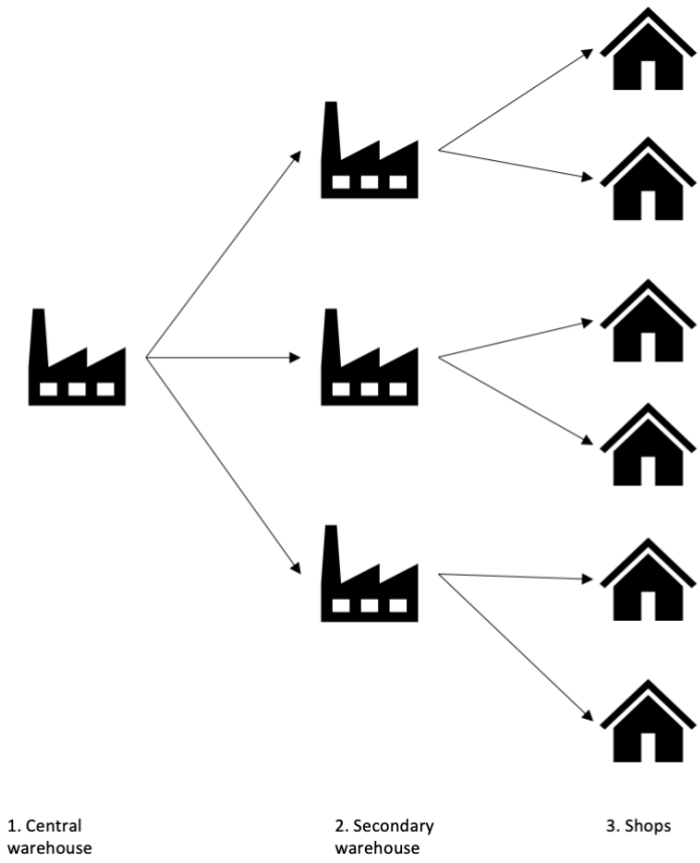


Figure 15: Level of network considered

5.2 SCOPE OF THE STUDY

The idea of the study is that the company's products are distributed from the central warehouse to the secondary warehouses according to the demand expectation of the various markets. Secondary warehouses are thought of as warehouses in different countries, with different demand, and then these secondary warehouses will serve the various shops in the country.
The central warehouse will distribute the products according to the demand forecast to secondary warehouses located in each country. In this case the risk that may arise is a risk due to a forecasting error, which means that the warehouse in the country that

received that particular product will pay extra management costs that do not add any value to the company, while countries where demand for the product was higher will have few items to offer customers and therefore will have to order the product from the central market.
Re-ordering the product will result in transport costs and delayed deliveries.
The same problem could occur if a certain product is put on the market in limited quantities and another is put on the market in large quantities. The same problem would occur if the product put on the market in large quantities did not receive the expected interest.
It is therefore important to carry out a preliminary study of market demand and warehouse space management, as well as optimising transport time in the event that a particular product has to be reordered.
Companies will have to analyse a number of KPIs in order to better manage this part of warehouse and outbound logistics.

In the following chapters, a theoretical analysis is made of what may be the warehouse solutions that a company can adopt and in general the warehouse and transportation KPIs before analyzing a real case in Chapter 8. the next section lists the characteristics that a company must take into consideration in order to serve the market with its products.

5.3 CHARACTERISTICS TO BE CONSIDERED

a) MEANS OF TRANSPORTATION

Freight transport activities represent a key moment in the planning of logistics systems. Transport logistics represent a significant percentage of costs and have a significant impact on customer service and thus ultimately on customer satisfaction.
Transport operations are classified according to the means of transport chosen, the route to be covered (distance from the place of departure to the place of arrival).
When the connection from the point of departure to the point of arrival is made by a single means of transport, it is referred to as direct or door-to-door transport.
In some cases, when the connection is made by air, other means of transport must be used in addition to the plane, in this case we speak of intermodal transport. In this type of transport, there may be a case where the goods are stored in intermediate warehouses on a temporary basis before reaching their final destination.

The most expensive means of transport is air transport, followed by road transport which is seven times more expensive than rail transport. Finally, rail transport is four times more expensive than ship transport.
The cost per unit of product decreases as the quantity transported increases and the cost per km decreases as the distance between the point of departure and the point of arrival increases.[54]

- RAIL TRASPORT

Rail transport is the cheapest but also the slowest and least reliable form of transport. It is considered to be the least reliable because there is usually no direct connection between the terminals of origin and destination, so goods have to be unloaded and loaded several times, which increases the risk of losing them.
Rail transport is generally suitable for rather large quantities and is often used for the transport of raw materials and products with a low specific value.
Because of the characteristics of this type of transport, I think we can come to the conclusion to exclude it from the analysis, as luxury brands will opt for the use of other, more reliable transport systems due to the high value of the products to be transported.

Advantages	***Disadvantages***
Low operating costs	Low journey times
High load capacity	Low safety

- ROAD TRANSPORT

This type of transport is the most suitable when considering flexibility and speed.
Road transport can be used for direct or indirect connections. Direct connections are economically viable in the case of full-load journeys, in other words when the capacity of the vehicle is fully utilised.
The capacity of a means of transport is the maximum amount of goods it can carry.
Full-load Road transport is the fastest and most economical system in Europe, ensuring a faster and more extensive distribution of goods.
Within a given country, this type of transport is also used by luxury brands as it is the most efficient.

Advantages	***Disadvantages***

[54] *Source: https://core.ac.uk/download/pdf/79617932.pdf, chapter 2.2.2 'Modi di trasporto'*

Direct connection between sender and receiver	High operating costs
High delivery speed	Low loading capacity
High flexibility in connections	

- AIR TRANSPORT

Air transport is used when the point of departure and the point of arrival are very far apart. It is used for luxury goods because of their high value.
This method of transport is expensive, but at the same time the quickest and safest. It is used because it offers a very fast service, which is essential for companies that want to keep one central stock, avoiding the costs of managing several decentralised stocks.
This type of transport is very interesting to consider as it is the best solution for luxury companies that want to transport their products from one market to another in the short term, depending on customer demand.

Advantages	***Disadvantages***
Short connection times	High operating costs per load unit
Coverage of large distances	

- MARITIME AND RIVER TRASPORT

Maritime transport is convenient for companies that want to transport large quantities of raw materials, capital and consumer goods and not alterable goods for intercontinental connections.
This transport is managed on a forecast basis.
This type of transport can be considered in the first part of the model.
In the second part, when we go into the details, i.e. transferring products already on the market from one country to another, this type of transport will be ignored because although it is less expensive than air transport, it is also the slowest and in this part time plays a key role.

Advantages	***Disadvantages***
Low operating costs	Low journey times
High load capacity	Low flexibility

b) DISTRIBUTION CHANNEL

A distribution channel is defined as the route a product must take to reach the final consumer.
There can be different types and structures of distribution channels and these can be:[55]
- Direct, if no intermediaries are involved
- Indirect, if one or more intermediaries are involved.
Two direct channels are, for example, mail order where the final consumer sees the products he intends to buy in a catalogue, orders them and receives them mostly by post or courier. Similar to this is the internet sales channel.
The indirect channel may be short or long. In the short indirect channel the producer reaches the final consumer indirectly through the retailer's intervention.
The industrial companies that use this channel consider the intervention of the retailer to be essential, both for promotion and for the sale of the goods themselves.
In the indirect long channel there are several routes. The most widely used route is where manufacturers decide to use wholesalers, who resell the goods to retailers, and the latter in turn to final consumers, or they may use agents or other sales intermediaries.

c) RISK COMPONENT

A random risk component must also be considered in the transport optimisation model. Such as the risk of the product being lost or damaged during transport.

a) DETERIORATING ARTICLES

The problem we want to solve with this model is to understand how companies can transfer products from one shop to another, even internationally, in a short time and minimising transport costs, in order to send certain products to countries where their demand is higher, thus avoiding that the product goes out of fashion and is either sold in outlets at the end of the season or is then destroyed.
Consideration must be given to deteriorating items.
Today's fashion has a very short life expectancy, the latest trends are always changing patterns and colours so that people buy new items every time and neglect old ones because they are out of fashion.
Although, nowadays, fashion is moving towards an increasingly sustainable vision.

[55] 'Le basi della logistica', Balestri Gianfranco, Chapter 4 'la logistica distributiva'

Fashion is the second most polluting industry after the oil industry, and being a growing industry, the environmental damage it causes can only increase in direct proportion to its development.
Another aspect that contributes to the short lifetime of a certain model of clothing is social media: many people perceive a garment as old and therefore need to be changed and no longer used, just because they have posted more than one photo of themselves wearing it.
If you look at Instagram as feedback, luxury fashion as well as fast fashion has a very short life span.
Of course, the deteriorating items par excellence for companies are limited edition items.
Limited edition items are used by companies as a key form of persuasion, all companies use this strategy of putting products on sale only for a few weeks at higher prices than usual, many buyers will go and buy them just to feel a higher status due to the uniqueness of that item.
In extremis we have for luxury companies the unique pieces from fashion shows.
But what happens to these items if they are not sold? Or if they are sold in a country where they do not arouse much interest while consumers in other countries would be more interested in buying them?
This is an important aspect, of a product category that is very popular among brands, that we want to solve with this model.

b) COST RETURN MANAGEMENT

One must also ask what luxury brands do with unsold products.
Some luxury brands destroy their products that have not been sold over time, Burberry, for example, destroyed products worth around €32 million in 2018.
This has caused a lot of controversy, both from an environmental point of view and from an investor point of view, in the sense that many investors have complained that they were not consulted and thus missed the opportunity to buy the remainders.
Burberry, as well as Richemont, prefer to eliminate unsold products so as not to devalue the prestige of their brand. In this way they also avoid that their prestigious products can be sold at a very low price in the grey market.
The elimination of these products will cause a cost to the company which we will call cost return and which will have to be considered in the analysis[56].

[56] https://www.rivistastudio.com/borse-gucci-louis-vuitton-burberry-usate-invenduto/

Another way of eliminating unsold goods, the most painless and also the most profitable, is to send the goods to large outlets.
It becomes paradoxical that the biggest sales are made in these outlets, as if the mono-brand boutique were simply the shop window, the place where people can observe and try on the products and then buy them the following season when they are sent to the outlets[57].
This method adopted by luxury companies does not detract from the value of the brand as the outlet stores will never carry the current collections, so the uniqueness of the company is not affected.
The largest outlet in Europe is the McArthurGlen Designer Outlet in Serravalle Scrivia, Italy. This outlet offers year-round savings of around 70% off the list prices of brands such as Burberry, Gucci, Valentino and Versace.

Figure 16: The entrance to the Serravalle Designer Outlet[58]

Also in France, there are various outlets such as 'La Vallée Village' near Paris, which offers 120 fashion and luxury brands at reduced prices.
Even in this case, however, the products that are not sold will become waste to be disposed of, so even with this solution there will still be an extra cost that the brands will have to pay, the cost return.

c) SECOND-HAND COMPETITION

The second-hand luxury market is growing at 12% per year and accounts for around €25 billion of the market's turnover.

[57] https://www.radiocolonna.it/economia/con-loutlet-il-brand-fa-il-vero-fatturato/
[58] https://forbes.it/2019/01/02/dove-trovare-lusso-firme-saldi-outlet-griffati/

This type of market is fuelled by new customers who want to own luxury products but who, for example, do not have the financial means to do so and are therefore able to buy at lower prices in second-hand markets.
On the other hand, there are these second-hand sellers who are, for example, loyal customers of brands who resell old products to buy new ones.
Luxury brands have identified this 'second-hand competition' as a real growth opportunity.
Seeing their products sold in this kind of market represents an opportunity to find new customers, we can define it as a kind of introduction of these new customers in the luxury market.
On the other hand, the customers who sell the products are in a sense retained, in the sense that they resell the old-fashioned pieces to buy new ones.

a) MANAGING PRICE DIFFERENCES

Luxury companies, as they have to sell globally, need to adopt global pricing strategies that achieve objectives such as maximising value extraction.
Exchange rate fluctuations must also be taken into account in the cost strategy.
In addition, they must be able to manage price differences between markets and currency appreciations or depreciations.

b) CUSTOM DUTIES

Customs duties are those indirect taxes levied on the value of all products imported and exported from the country imposing them. In the case of Europe, a customs duty is levied on all products coming from or going to countries that are not part of the EEC (European Economic Community).
Customs duties are calculated on the basis of the value of the product, applying a percentage, which also varies according to the type of product.

- CHINA

China has so far imposed very high customs duties, which has prompted millions of Chinese to travel abroad to buy luxury goods at prices that are discounted for them.
Many buyers from China, rather than buying products at home at very high prices due to taxes, opt to buy them online on foreign sites or at least commissioned from shipping specialists.
For this reason, due to the growing demand for luxury items by Chinese consumers, Beijing has decided to scale down these customs duties in order to discourage the flight abroad, but going so far as to give up a substantial gain from the customs rates.

As reported by the president of Altagamma, Armando Branchini, *« As of 1 July 2018, the duties imposed on imports from Europe of products such as clothing, accessories and furniture will be halved. At the moment, depending on the exact category, duties are between 15.7% and 19%. Reducing them by half will bring them very close to those imposed by Brussels on China. »*

- USA

Italian apparel exports to the United States have always been very frequent, testifying to the loyalty that American customers have for Made in Italy. The US market appreciates the quality and reliability of Italian-made products.
Particularly appreciated in the United States are men's and women's clothes, which reach export values of over 200/300 million dollars.
In addition to a series of documents required to export products to the United States, these documents vary according to the type of product and its composition, duties must also be paid.

- EUROPE

No customs tax is imposed on products traded between members of the customs union. The EU customs union is a customs union comprising all EU Member States, Monaco, Akrotiri and Dhekelia (non-EU dependencies of the UK).
The members of the customs union impose a common external tariff on all goods entering these countries.
As of 1 July 2021, European customs rules have been changed.
Previously, goods imported into the EU with a value of less than €22 were exempt from VAT (value added tax).
As of 1 July, all imports of products of any value from non-EU countries are subject to VAT and must be declared individually.

c) CURRENCY FLUCTUATION

Sales of any type of product, including luxury products, are very much influenced by currency volatility.
The luxury market is extremely widespread geographically and also in terms of product offerings.
Currency volatility has a significantly different impact on companies, depending on their reference currency and their geographical spread of activities.
In order to avoid serious effects on them, companies try to respond to currency movements by attempting to keep their pricing structures constant between countries.

This means that if the value of the currency in a given country decreases, companies operating in that country will tend to increase the prices of their products. If, on the other hand, the value of the currency increases, companies will have to lower their prices in order to remain competitive in that country.
For example, one year after the 2016 referendum in which British citizens voted for the UK to leave the European Union, the pound has depreciated by 16% against the dollar and 13% against the euro. This scenario means that inflation in the country has increased, which means that travellers will also decrease their purchases in that country because they might find the same products, more cheaply, in other countries or even in their own.
This shows how prices, stock levels and replenishment intervals vary from market to market and from city to city, which is always a challenge for the management of luxury companies to optimise their pricing strategies.

5.1 CLASSIFICATION OF MODEL CHARACTERISTICS

In the following paragraph we will rank, in order of importance, the characteristics that a luxury company should consider in order to optimise warehouse management and outbound logistics.

The main characteristics are those of time and quality of products and services.
The characteristic of quality plays an even more important role than cost. As explained in the previous paragraphs, in the choice of the transport system to be used, time and quality of transport are given more importance than cost.

In terms of cost, one has to take into account the cost of customs duties and currency fluctuation. We could consider this as a single cost and call it external cost.
Another type of cost to be taken into account is the cost return, i.e. the cost that the company has to pay in the case of inventories, meaning products that have to be disposed of because they have not been sold even in outlets.
As far as internal costs are concerned, the cost of managing inventories must be considered and finally the transport costs.

In addition to a risk variable, one must also consider a potential variable such as the possibility of taking advantage of new markets. The likely new profitable markets for luxury companies are the second-hand market and, geographically, the Chinese market.

Another important aspect is having to ship products, which have already been placed on the market, to another country. This could be happening because the assumed market is not the most profitable one as expected, so the company has to transfer these products to another geographical area where demand is higher and should do so as quickly as possible. We can consider this aspect as "sales strategy" and put it within the risk variable.

Another phase to consider is that of inventory provisioning. Inventory taking is a periodic activity for the company that also identifies and classifies the products present in the warehouse at that particular time.
It is important to understand how often a luxury company creates new products and thus replenishes its inventory.
Normally during the year there are two main collections that each company presents, the autumn/winter collection and the spring/summer collection. Sometimes between these two main collections, companies may present flash collections to the public, meaning those items that are available for sale for a limited period, while stocks last.
For an autumn/winter collection, a luxury brand will take about 5 months to conceive and create and about 2 months to organise and do the shows. It is during this period that buyers start ordering the brand the different items they would like to buy, at which point the company buys the necessary raw materials and produces the required quantities. It then delivers the products to the shops, which then sell them to the end customers.
The same is done for the spring/summer collection.
As a result, brands supply shops with new collections at least twice a year.
The stock of the individual shops may be supplied with the same products several times during this period because there may be a high demand for a certain product.
For simplicity's sake, we can consider that brands supply the shop twice a year, and therefore every six months.

We consider the **fundamental** characteristics as those characteristics that must be taken into account in the model; **important** but not fundamental are those characteristics that can be taken into account perhaps by using variables that include different properties; finally, we have the **optional** characteristics that we can also ignore in the model.

MODEL CHARACTERISTICS	ORDER OF IMPORTANCE	OTHER RELATED CHARACTERISTICS	HOW IT IS SUBDIVIDED
Time	**Fundamental**		Delivery time Article deterioration time Inventory provisioning time Time to prepare and deliver Time to receipt the order
Cost	**Important**	Delivery time Quantity	Transport cost External costs Cost return Warehouse management costs Item shipping cost
Quality	**Fundamental**	Delivery time	Product quality Service quality
Transport mode	**Fundamental**	Delivery time Transport cost External costs Service quality	
Risk variable	**Fundamental**	Time Cost	Sales strategy Transport risk
Potential variable	**Important**	Time	New markets
Items	**Fundamental**	Cost return Product quality Article deterioration time Transport cost	Deterioration item Volume Product type (Unique, Limited edition, Permanent collection)
Supplier confidence	**Important**	Service quality	
Customer loyalty	**Optional**	Product quality Service quality	
Quality of raw materials	**Optional**	Product quality	
Warehouse supply	**Important**	Time	Stock capacity

		Cost Number of items	

Table 1: Classification by importance of model characteristics

5.2 MANAGING INVENTORY IN SUPPLY CHAIN

The effective management of inventories in the supply chain is one of the key factors for success in any organization.
The goal of a company in managing inventories is balancing the supply of inventory with the demand for inventory. In other words, that means, an organization ideally wants to have enough inventory to satisfy the demands of its customers for its products with no lost revenue because of stockouts. In the other hand, the organizations do not want to have too much inventory due to cost of inventory.

The cost of logistics is made up of the cost of order processing, personnel cost, inventory cost, transport cost and return logistics cost.
Transport and inventory account for 72.1% of all logistics costs. Figure 17 shows how logistics costs for companies are broken down in 2020.[59]

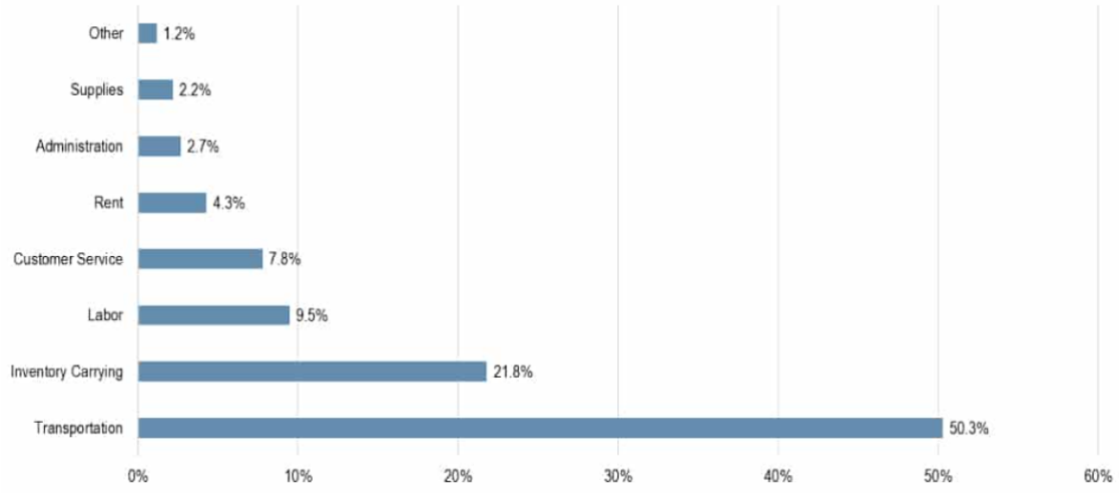


Figure 17: breakdown of logistics costs

This shows how important it is for companies to optimise these two cost components.

[59] https://www.edesk.com/blog/are-you-spending-more-than-you-should-on-logistics/

5.3 UNCERTAINTY AND SAFETY STOCKS

Every type of business faces uncertainty, both on the demand side, i.e. how much and when will customers buy, and on the supply side, i.e. there may be uncertainty about whether raw materials will be obtained or how long it will take to process an order. Tradeoff analysis is important and can be done using the necessary tools to reduce risk and calculate the cost of inventory.
Today, thanks to the development of technology, companies can rely on receiving and transmitting timely and accurate information between trading partners.
Collaboration in sharing important information between partners has produced significant results in reducing safety stock and improving service.
An example of this collaboration is the CPFR (Collaborative, Planning, Forecasting and Replenishment) model. This type of model integrates all stakeholders in the supply chain, including retail and distribution activities, in order to make the logistics sector work more efficiently.
It is an evolving business practice that aims to reduce supply chain costs by promoting greater integration, visibility and co-operation between the supply chains of trading partners who may be a combination of suppliers, manufacturers, distributors or retailers[60].
As with demand forecasting, deciding what the safety stock will be for certain products is very difficult and uncertain. Today, however, companies can use some statistical techniques to decide from time to time how much safety stock they should have in stock.

Today, forecasting demand is becoming more and more difficult due to new customer purchasing patterns.
For example, for clothing companies, mass customisation is the production strategy oriented to satisfy individual customer needs without giving up the efficiency advantages of mass production, in terms of low production costs and thus low selling prices. This type of strategy is not used by luxury goods companies, as customisation of products has a very high cost for customers, so in that case it will not be mass customisation.
Another strategy used by clothing companies is late differentiation manufacturing. Delayed differentiation, also known as late product differentiation, refers to the practice of postponing changes to a basic product until the end of the manufacturing process.

[60] https://www.logisticaefficiente.it/tesisquare/supplychain/scorte/cpfr-l-evoluzione-dei-sistemi-di-riordino.html

This strategy is widely practised by manufacturers of flavours and fragrances, home and personal care products, adhesives, speciality chemicals and others[61].

Organisations faced with seasonal problems are constantly challenged when determining how much stock to build up.
Another reason to maintain a certain level of inventory arises when it is anticipated that an unusual, external event may occur that will have a negative impact on the source of supply. Examples of this type of event are a strike, a sharp increase in the price of raw materials or finished products due to political uncertainties, wars, weather conditions and so on.
These elements mentioned so far summarise some of the concerns that companies may have whenever they have to decide how best to manage their inventory levels.

[61] https://www.specchemonline.com/feature-article-delayed-differentiation-skids-product-variation-efficiency#:~:text=Delayed%20differentiation%2C%20also%20known%20as,end%20of%20the%20manufacturing%20process.

6. MANAGING INVENTORY

In addition to figuring out how much and when to produce, companies today face other types of challenges such as where to place core inventory, which advertising elements to use and in which specific locations, etc.
Today's organisations are faced with product line extensions, global markets, higher service requirements and constant pressure to minimise costs. Inventory decisions have to be made in order to simultaneously optimise costs and customer service.
Several factors make this goal of minimising costs while maximising service levels possible, such as real-time order management systems, improved technologies to manage logistics information, more reliable and efficient transportation, and improvements in the ability to position inventory so that it is readily available where and when it is needed.

6.1 DESIGNING THE FASHION & LUXURY WAREHOUSE

In the fashion sector, compared to other sectors, certain concepts such as excellence of service level, flexibility or innovation are extremely important. Another aspect that differentiates the fashion sector from other sectors is the complexity of the products, a heterogeneity of products that is becoming more and more evident, from the rolled out article to the hanging article, which will therefore have different handling requirements within the warehouse.
The management of small accessories, shoes and bags is also different, not to mention the presence of more and more new product categories, such as companies introducing ceramics, food products, household appliances, etc.
The complexity of warehouse management also derives from the processes and flows, which are influenced by the seasonality, the work increases a lot during the launches of new collections for each season, although nowadays there is an increasing shift to so-called 'capsule collections' which are small collections that respond to high customer demand for new products in a relatively short time.

Luxury companies need to be able to offer a service of excellence in terms of accuracy in warehouse handling to be able to preserve the quality of the product, avoid damage during the preparation of an order to avoid returns from customers. Timeliness in setting up shops or updating e-commerce sites or even short response times is a very important feature as we talk more and more about fast fashion. Also linked to timeliness is the ability to simplify downstream retail activities, through dedicated processing stations

such as the labelling phase, to allow shops to immediately put goods on sale as soon as they are received in the warehouse.

6.2 THE DESIGN PROCESS

The design process for choosing the best solution for managing the company's warehouse involves researching and processing various data.
It is necessary to analyze which load units are involved, using the logistics master data it is possible to study the load types, dimensional analysis, weight analysis, load saturation, etc.
Analysis of the incoming and outgoing flows of the warehouse, studying trends, seasonality, the profile of customer orders, which is fundamental for understanding the characteristics required of the warehouse when preparing orders, ABC curves, etc.
Analysis of inventories that identifies the store levels and therefore the static dimension of the warehouse, also in this case it is done by studying the seasonality, the profile of the stock by product type, in the case of the fashion & luxury warehouse it is necessary to try to differentiate the stock into those that can then become sub-storage areas, so hanging garments, accessories, etc.
Analysis of the flow and of the means for loading and unloading, which is fundamental especially in the case of defining a new warehouse.
Analysis of staff commitment, i.e. breakdown of hours worked, productivity and cost analysis.
Finally, there is the definition of projection factors, which serves to project into the future what has been analyzed of the current situation.

6.3 STORAGE SYSTEMS

Warehousing systems can be of various kinds, from traditional systems where activities are normally carried out entirely by employees, to highly automated solutions where some warehouse activities are carried out by automated systems. There are also solutions that depend on the intensity of storage, for example selective solutions where you can pick the single load unit you need without having to handle other units, which is most efficient from a handling point of view, but not in terms of space occupation. After that, there are denser or more intensive solutions that are more efficient in terms of space because the goods are more concentrated and therefore occupy less space but, at the same time, are less efficient in terms of handling because unit selectivity is lost and therefore, for example, in order to access the load you need, you must first move other loads and therefore make non-added value movements.

There are also solutions that can be further differentiated in terms of picking activity. Here too, different solutions can be implemented depending on whether the act of picking is manual, i.e. done by the operator, or fully automated solutions at this point too.

All these solutions mentioned can be used in any type of sector, there is no model that is absolutely right for a given sector, but each company has its own specificities that must be assessed in each context.

It is clear that there are characteristic aspects of each sector that can push for certain solutions, but there are also examples of automatic or partially automatic solutions in the fashion sector.
With today's technologies it is possible to have automated solutions even for companies working in a sector with unstable demand, whereas in the past, only manual solutions were considered for this type of company because of the flexibility of the people.
At the same time, picking accuracy (i.e. reducing errors) and timely order picking are becoming increasingly important as the focus is more on the service that accompanies the product and not just the product itself.
Among the levers that can push towards automation are easily monetisable elements such as surface area occupied and production efficiency, and more qualitative elements such as improved working conditions, ergonomics, safety, accuracy when picking and - for luxury companies not least - improved corporate image, in addition to the cost of the solution itself due to investment costs plus operational costs.
By studying on the one hand the surface yields (pieces/sqm) of the various possible solutions and on the other hand the staff commitment required according to the flows involved, it is possible to construct a cost comparison model that will see manual solutions typically with greater surface occupation and greater staff commitment but lower investment costs, and automated solutions that allow savings in surface area and staff commitment but which certainly require greater capital expenditures.

6.4 HIGH-DENSITY STORAGE SOLUTIONS

When **designing a warehouse** and evaluating the most suitable storage structure, it is necessary to consider two very important parameters **for proper material handling**: **selectivity and density**. Often a company's objective is to find the right compromise between the two.

Density refers to **the storage capacity per cubic meter**.

Selectivity, on the other hand, represents **the accessibility of products**; a company will choose a selective storage solution when it is necessary to have accessibility to a single load unit.

These two parameters are not directly proportional; usually, the denser a warehouse is, the less selective it is. Furthermore, the less selective a warehouse is, the longer the access time to the material will be.[62]
Growing stock levels coupled with a shortage of space or expensive expansion areas lead companies to consider solutions to increase capacity by focusing on storage density.
A company might also focus on storage density from a forward-looking perspective, because for example the company is anticipating a certain growth in business that will also bring with it a growth in stock and that will require a certain amount of storage space that may not be there or may be there but at a cost.
Trying to think in terms of high-density solutions makes it possible to minimise the occupied surface area, i.e. an increase in the surface utilisation coefficient, i.e. the amount of goods that can be placed per unit area.
If, on the other hand, production batches are expected to change over time, for example, then it may not be acceptable to densify the warehouse over time because a certain amount of flexibility will be needed in the structures.
When storage density is more difficult to achieve, one has to think about storage intensity.

In stocking intensity, one goes to work on a reduction of working lanes, on an exploitation of height and the characteristic of selectivity is maintained.
In stocking density, one goes to exploit a multi-depth that also minimises the number of working aisles and therefore increases the surface yield given by the stock, which however clashes with selectivity and accessibility.
High-density storage solutions hide pitfalls because what is on the one hand the theoretical capacity of the solution given by the number of places that the solution allows to represent, clashes with the real capacity of the solution, given by the possibility to go and fill those channels in full and reach as much as possible the theoretical capacity.
This is because those channels that are multi-depth, in order to be used efficiently, must be filled with the same item. So if the quantities per item are not such that the channels

[62] https://www.youtradeweb.com/2021/03/progettare-un-magazzino-come-massimizzare-selettivita-e-densita/

are filled, there will be a lot of occupied channels but not all of them and therefore a real capacity that drops compared to the theoretical capacity.

6.5 DIFFERENT TYPES OF SOLUTIONS

Warehouses can be classified by type:

- **warehouse per loading unit**, the goods are stored by individual loading units
- **warehouse by packages**, packages are containers or objects of up to half a metre in length. They are mainly cartons or plastic boxes, but a single object can also be considered as such.
  It can be inferred that packages can be single objects (e.g. a lipstick) or small secondary packaging units (boxes). This type of warehouse organisation is mainly used in the pharmaceutical sector, where the individual units are very small and it is therefore convenient to group them into packages to facilitate storage and subsequent dispatch.
- **special warehouses,** this type is not very common. This is the case for particular materials, such as textiles, which need to be stored in certain shapes or hygienic compliance that cannot be achieved with boxes, cages or pallets.

or by level of automation in:

- manual warehouse, goods handling and maintenance are carried out by specialised operators;
- semi-automatic warehouse, warehouse managed half by specialised operators and half automatically;
- automatic warehouse, the warehouse is completely managed mechanically, with the exception of maintenance, which is carried out by specialised operators.

The advantages of a complete automated warehouse system are manifold. Modern warehouse automation technologies are more flexible and scalable than previous automation solutions such as conveyor belts, which are cumbersome and fixed in place. Other benefits of warehouse automation include:

- Increased productivity
- Less effort and worker fatigue
- Increased worker satisfaction
- Fewer accidents
- Lower operating costs
- Greater accuracy
- Fewer shipping errors

Space optimisation is another benefit of warehouse automation, allowing warehouses to maximise the use of vertical space by storing items in higher locations that are usually difficult for humans or forklifts to reach.
On the one hand, investing in the right warehouse automation solutions is a smart financial decision that saves money in the warehouse by reducing errors, accidents, and productivity; on the other hand, it involves a large initial investment that cannot always be justified by companies.

6.6 TECHNOLOGIES THAT CAN BE IMPLEMENTED

A distinction must be made between the types of loading units, whether heavy or light. In both cases, both purely traditional and more automated solutions can be used, as well as selective, intensive or dense solutions.

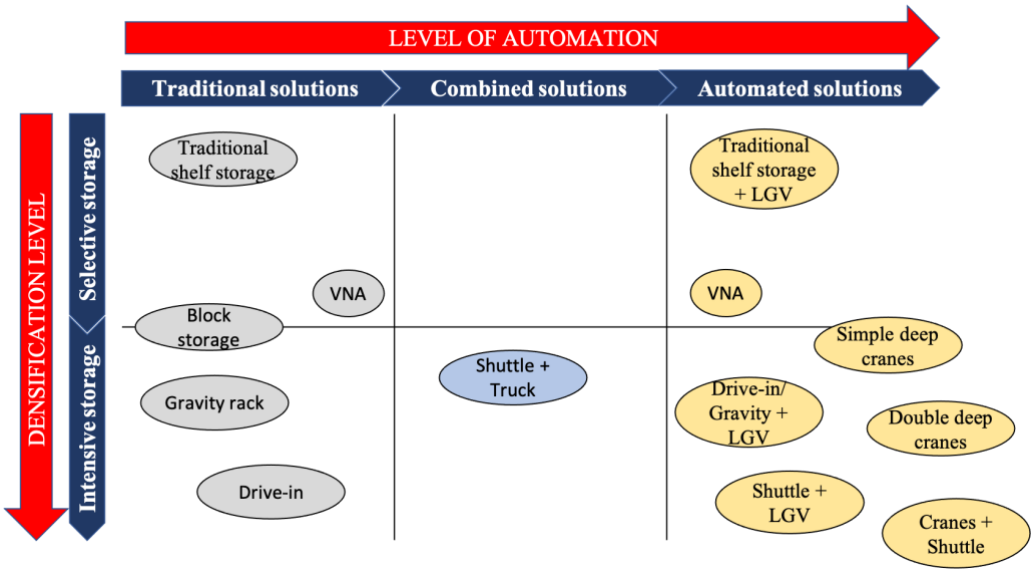


Figure 18: technologies available for 'heavy' loading units[63]

[63] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

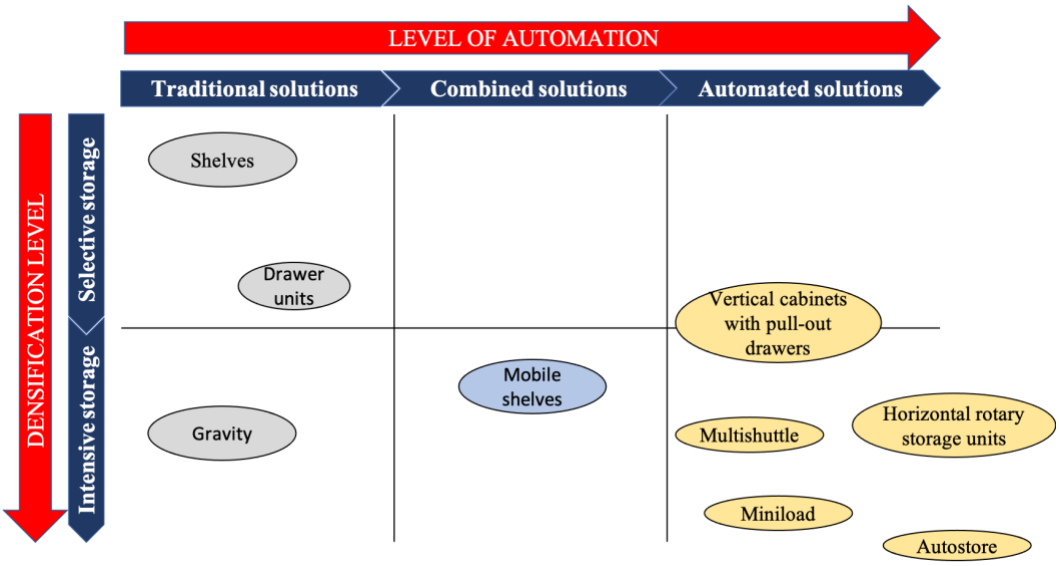


Figure 19: technologies available for 'light' loading units[64]

6.6.1 HEAVY LOAD STORAGE – Multi-depth solutions

TECNOLOGY	DESCRIPTION	VANTAGES	LIMITS
Drive in + LGV	Drive-in shelf served by automatic trolleys	- Flexibility on pallet sizes - Lower costs - Possibility to operate in FIFO or LIFO	- Less selectivity - Shelf access time
Gravity + LGV	Gravity rack served with automatic guide trolleys	- Flexibility on pallet size - Greater selectivity	- Possibility to operate in FIFO - Double lane required (unless adopt push-back solutions) - Shelf access time - Shelf costs
Drive in + shuttle + LGV	Drive-in shelf served by automatic trolleys	- Flexibility on pallet sizes - Greater selectivity - Possibility to operate in FIFO or LIFO	- Shelf access time - Shelf costs - Increased system complexity

Table 2: Storage of heavy loads - multi-depth solution[65]

[64] Webinar 'What automation to densify storage and gain area', Simco Consulting slides
[65] Webinar 'What automation to densify storage and gain area', Simco Consulting

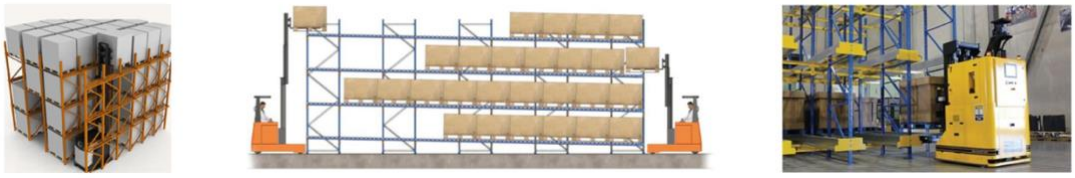


Figure 20: Example of storage solution[66]

- ***Drive-in + LGV***: In the drive-in, the trolley enters the channel and starts filling it from the bottom outwards. Automation occurs because you have the possibility of interfacing these racks with automatic machines, i.e. LGV (Laser Guided Vehicle) trolleys that move automatically. In this first solution, the LGV trolleys will enter the drive and go to fill the channel.

- ***Gravity + LGV***: in the gravity channel, it is filled by interfacing on one side and then, by gravity, with a slight inclination of the rollers that are connected to the shelf, the pallets gradually fill the channel, positioning themselves towards the other side of the shelf. Also in this second solution, automation is provided by LGV trolleys that move automatically.

These trolleys interface with gravity either in pass-through mode, loading from one side and then unloading from the other, or in push-back mode where the operator always interfaces from the same side and then in the deposit phase pushes the pallets, creating a space in front where to place them. Finally, in the picking phase the first pallet is picked up.

- ***Drive-in + shuttle+ LGV***: In this variant, during the drive-in phase, the trolleys do not go inside the channels to fill them but remain outside. The movement inside the channel is given by a small shuttle that takes over the pallet placed in the trolley and places it in the depth by moving inside the racking.

This solution makes it possible to limit certain safety issues because moving inside the racking is never too safe and therefore to do it safely you have to do it at a slower speed, hence a longer operation time, which translates into less efficiency. Another great advantage is being able to consider the channel differently. In the classic drive-in, we must consider not only the depth of the rack but also the levels of a single channel. For example, if we have 5 levels with a depth of 5, we have to consider as a single channel 5X5, i.e. a channel with a capacity of 25 pallets to be filled, because in order to take the pallets that are in the highest or lowest channels, we must first empty what is in front. In the case of satellites, each individual floor is settled because the satellite can be placed on each individual floor, which is

[66] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

equipped with guides, and therefore the goods on the top floor can be moved regardless of how saturated the first floor or second floor etc. is, so in this case the channel capacity remains 5.
By decreasing the capacity of the channel, it makes it easier to fill it, the filling coefficient increases and the net capacity is better, so with the same depth, a better net capacity is achieved than with the classic drive-in.
Obviously, there are limits, mainly due to the cost of the structure and also to the efficiency that can be achieved in the handling of the satellites because while in traditional racking the operator move the single pallet, in a rack with a satellite, the satellite must first be placed in the channel needed and then the pallet placed on top of it, so there is double handling.

6.6.2 HEAVY LOADS STORAGE - Intensive storage

TECNOLOGY	DESCRIPTION	VANTAGES	LIMITS
VNA + AGV	Traditional shelving served by three-sided trolleys without a man on board	- Unit selectivity - Investment cost	- Time of access to the shelf - Sizing of the duct - Height limits
Single or double depth stacker crane	Integrated system (self-supporting shelf served by stacker cranes and header)	- Unit selectivity (or almost) - Performance - Few height limits	- System costs and complexity - Not cost-effective on low heights
Multi-depth stacker crane	Integrated system (self-supporting shelf served by stacker cranes + shuttle and header)	- Maximum surface yield - Performances - Few heights limit - Flexibility on pallet size	- Costs and system complexity - Less convenient on low heights

Table 3: Storage of heavy loads - Intensive storage[67]

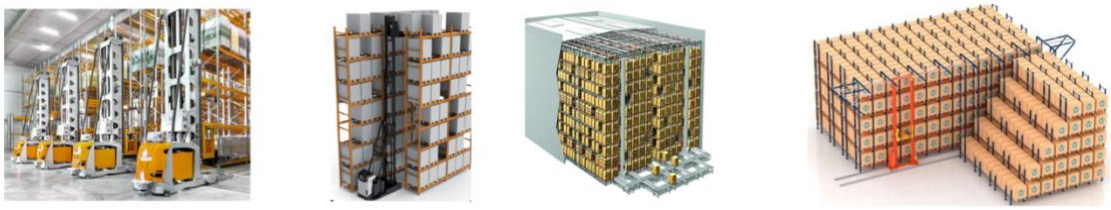


Figure 21: Example of storage solutions[68]

[67] Webinar 'What automation to densify storage and gain area', Simco Consulting
[68] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

- ***VNA (Very Narrow Vehicle) + AGV (Automatic Guided Vehicle):*** solutions involving three-sided trucks, i.e. channels that move in very narrow aisles, in this case the trucks can also be automatically guided and be interfaced with trucks that do service movements that are also automatic.

In this solution, an increase in surface yield will be dictated by the intensity of storage, not the density, it is a solution that allows less square metres to be occupied.

- ***Single or double depth stacker crane***: stacker cranes are machines that move within the aisle and can be equipped with telescopic forks that allow pallets to be placed to their right or left in single or double depth.
- ***Multi-depth stacker crane***: in this case the stacker cranes are equipped with satellites, similar to those of the drive-in, and allow the filling of multi-deep channels.

These stacker cranes reduce working lanes and intensify storage.
Finally, there can be other solutions, for example, instead of having a machine for each aisle, one can have a shuttle for each floor within an aisle, clearly the various shuttles will have to interface with a lift that guarantees the vertical movement of the goods (Figure 22).
It is also possible to have small stacker cranes which, however, move on tracks and not on a rail, thus allowing vertical movement for some floors and not all for levels as a stacker crane would, these too will then interface with lifts to guarantee vertical movement (Figure 23).

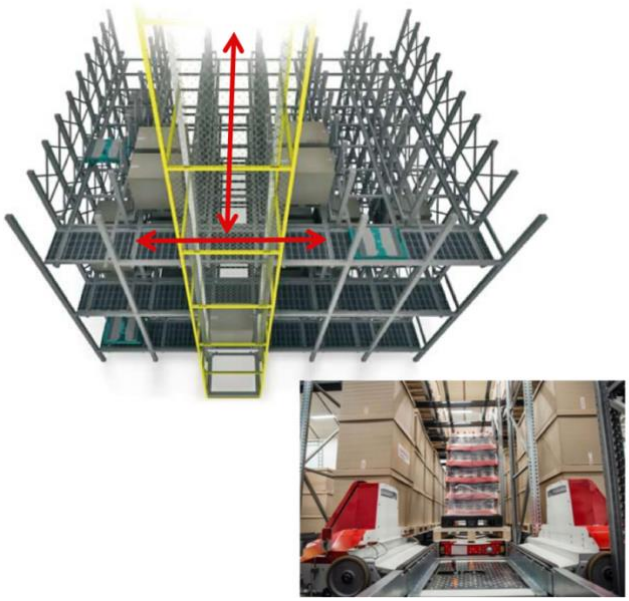


Figure 22: Example of a solution with shuttles for each floor[69]

[69] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

Figure 23: Example of a solution with small stacker cranes[70]

6.6.3 LIGHT LOADS STORAGE - Intensive storage

TECHNOLOGY	DESCRIPTION	LIMITS	ATTENTION POINTS
Vertical cabinets with pull-out drawers	Modular system with GTM (Go to market) philosophy	• Unsuitable for high rotation codes	• Building height • Drawer sizing, type and picking stations • Compartment configuration • Maximum capacity and load distribution
Horizontal rotary warehouse	Modular system with GTM (Go to market) philosophy	• Usable height • Unsuitable for heavy codes	• Machine balancing • Compartment configuration • Header configuration
Mobile Shelving System	Lightweight shelving transported with	• Usable height	• Dimensioning the number of robots

[70] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

	AMR (Autonomous Mobile Robot)		• Configuration of preparation stations
Miniload	Single/multi-tool stacker crane in single/double depths	• Cost and system complexity • Less convenient on low heights	• Single / Double / Multiple depth • Mono / Bi-column • Type and number of forks
Multishuttle	Modular system with lift and shuttle	• System costs and complexity	• Single/double depth • Number of lifts • Number of shuttles • Modularity
Autostore	Modular system with robots moving on the roof	• Usable height	• Building height • Modularity • Dimensioning the number of robots • Maintenance

Table 4: Storage of lights load - Intensive storage[71]

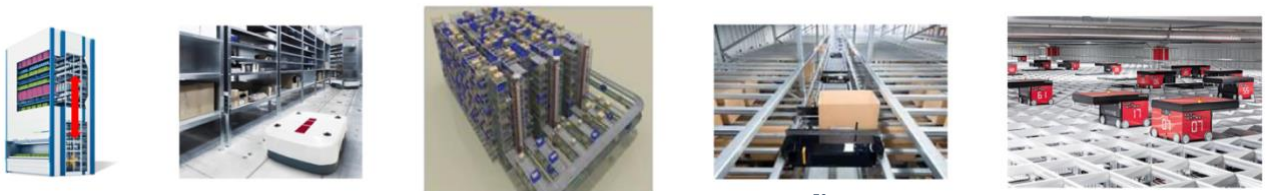


Figure 24: Example of storage solutions[72]

Light loads are small objects that can be placed in boxes, parcels or drawers. Let us look at the solutions in more detail below.

- **Vertical cabinets with pull-out drawers and Horizontal rotary warehouse** the storage density is given by the possibility of having the goods placed on drawers stacked one on top of the other, which insist on a few square metres rather than a series of trolleys next to each other. In these cases the space used is only a few square metres, and there is no need for work aisles because the trolleys then reach an operator in horizontal rotation. These solutions, however,

[71] Webinar 'What automation to densify storage and gain area', Simco Consulting
[72] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

require greater attention because the drawers or trolleys must be correctly sized and balanced to prevent operators from waiting too long between one drawer and the next because, in this case, they have to do all the horizontal movement to reach the operator.

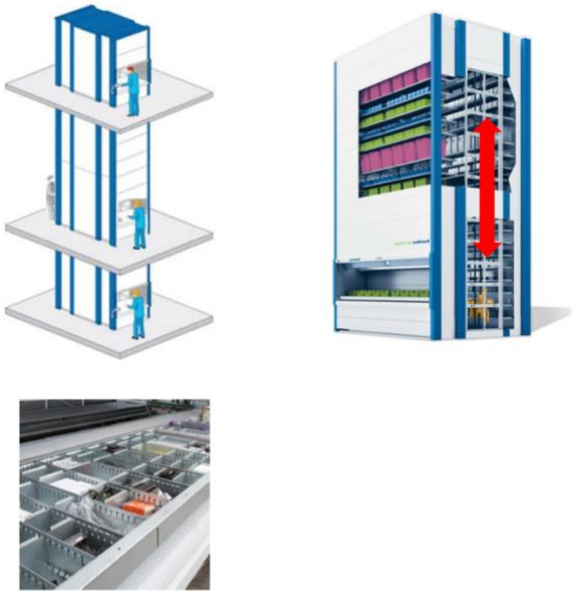


Figure 25: Example of vertical cabinets with pull-out drawers[73]

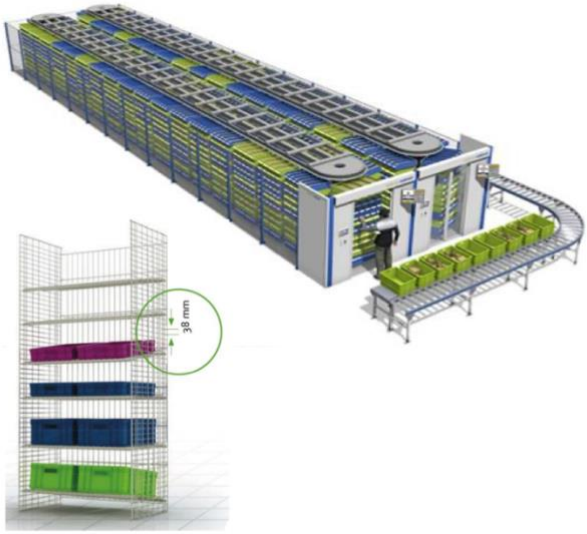


Figure 26: Example of horizontal rotary warehouse[74]

[73] Webinar 'What automation to densify storage and gain area', Simco Consulting slides
[74] Webinar 'What automation to densify storage and gain area', Simco Consulting slides

- ***Mobile shelving system***: this solution is suitable when you have a building with a limited height. In this case, the shelves are light and can be reached by a person on foot.

The shelves are transported by small robots to bays where the operator works.
Here the focus must be on the creation of the picking display and therefore one must on the one hand try to maximise the picking per shelf and one must size the number of robots so as to avoid bottlenecks.

Figure 27: Example of mobile shelving system[75]

- ***Miniload***: is a system in which we have a machine moving horizontally in a narrow aisle and vertically moving the gripper pull along a column to pick and deposit packages or drawers. The storage system can be single or double-deep and each system must integrate a gripping element, such as a telescopic fork, suitable for 'picking'. The Fork is the perfect handling system for a single/double-depth storage/ retrieval Miniload system.

While providing high performance, they do have their limits.
Meanwhile from a cost point of view, the investment to implement this solution is quite high, so the company must be sure that there will be a return in the medium term.
In addition, it is not advisable for all types of goods; this aspect should also be studied before implementing this solution.

[75] https://tech.fanpage.it/i-robot-di-amazon-arrivano-in-italia/

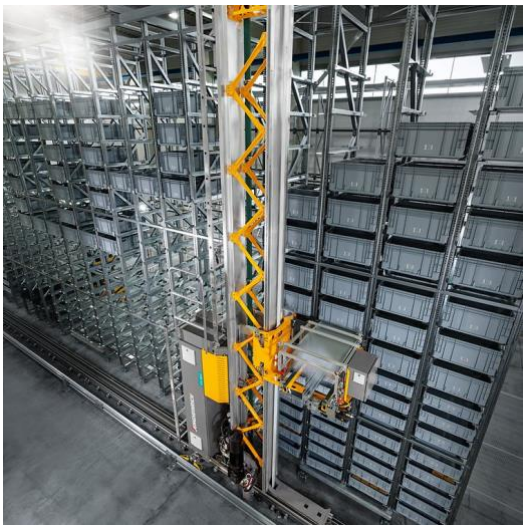


Figure 28: Example of miniload[76]

- ***Multishuttle***, is a solution that improves warehouse efficiency compared to the miniload. One no longer has a single machine within an aisle but as many machines as there are floor levels.

In this case, the performance is greater because each level is able to handle goods. Of course, this merchandise must then be moved vertically by lifts that must be well designed to avoid bottlenecks, but here the dynamic capacity can be increased with a static capacity, a similar surface performance.

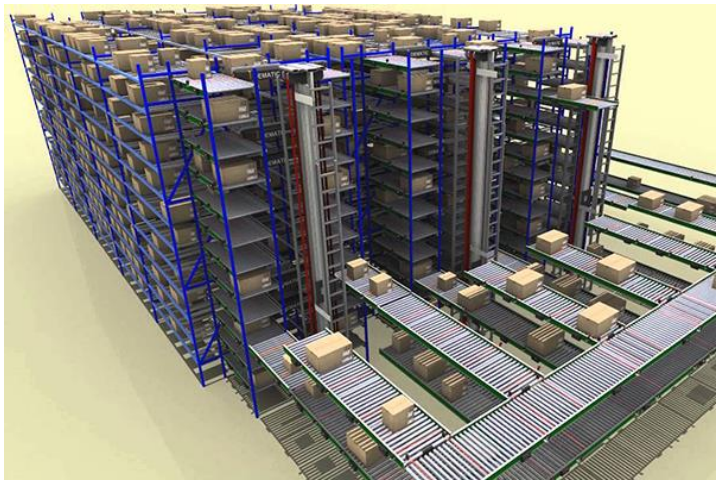


Figure 29: Example of multishuttle[77]

[76] https://www.jungheinrich.it/sistemi/trasloelevatori/magazzini-automatici-minuterie/trasloelevatori-minuterie

[77] https://www.materialhandling247.com/product/multishuttle_flex_automated_inventory_staging_buffer_system/storage

Also in this case, as in the case of the pallets, we have the multilevel variant, i.e. a middle way between the miniload which works alone in one aisle and the multishuttle which works with machines for each floor, in this case we have shuttles covering a certain number of floors which, placed one on top of the other, cover the entire height.
Compared to the miniload, there is a greater dynamic capacity, which, on the other hand, remains somewhat lower than with the multishuttle.

- ***Autostore:*** is a technology where we have the highest representation of storage density because we have stacks of cassettes on top of each other and attached to each other. On top of these boxes move small robots that pick up the required boxes.

Compared to multi-shuttles they work on a more limited height. At certain height levels, although not fully utilised, these solutions are optimal from a surface yield point of view because they have no clutter from the working aisles, they have no clutter between one box and the next, so the storage density that can be achieved is considerable.

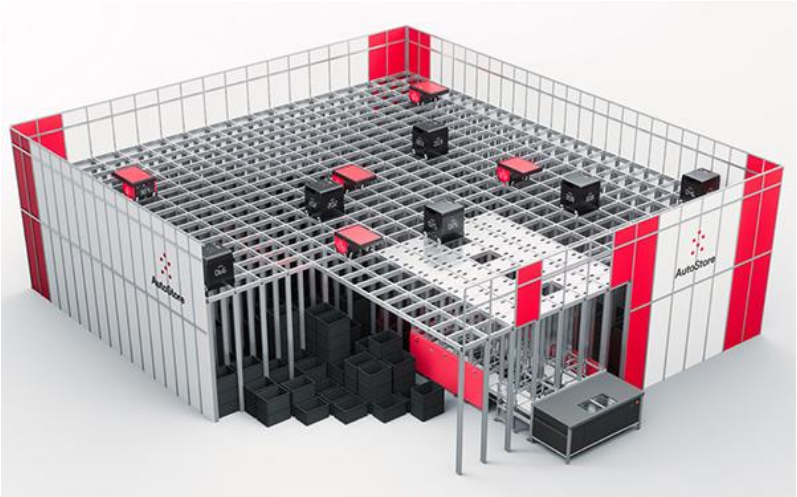


Figure 30: Example of autostore[78]

[78] https://www.fivesgroup.com/smart-automation-solutions/technologies/as-rs/autostore

7. KEY PERFORMANCE INDICATOR[79]

7.1 DEFINITION OF KPI

In order to choose the most suitable solutions for the type of storage and the characteristics of the warehouse used by the company, it is important to analyse certain KPIs. In this way, it becomes easier for the planner to understand which solution to adopt, whether to use the same storage solution for all the products managed by the company, etc.
KPIs, Key Performance Indicators, are indicators that reflect the critical success factors for an organisation.
KPIs can be used not only as a performance monitoring tool, but also as a planning tool to help plan future activities with a view to improvement; where there are deviations between expected objectives and achieved results, management can take the necessary actions to correct the gap.
Measuring performance is fundamental in every business area in order to implement improvement processes. In a manufacturing company, it is therefore very important to be able to identify strategic KPIs to assess production performance from the point of view of efficiency, service level and process quality.

There are four groups of KPIs, some of which are particularly useful when the aim is to reduce costs and operation times, while others serve to improve productivity (producing more with fewer resources) without losing operational quality.

- Financial indicators: these are used to monitor operational costs related to warehousing.
- Productivity-related indicators: assess the efficiency of processes by comparing production and the resources used to achieve it.
- Speed (time) indicators: acting quickly is a prerogative of any warehouse.
- KPIs related to quality: they measure the level of service offered to customers. This group of KPIs are not completely independent, depending on the actions taken, quality improvement can also increase, for example, product costs.

[79] Webinar 'KPI for logistics excellence', Simco consulting

7.1.1 KPI CHARACTERISTICS

The fact that a performance indicator is defined as 'key' does not mean that the performance is to be considered strategic. KPIs can also be associated with operational objectives, the fact that it is defined as 'key' means that it must be associated with objectives that create value for the company.
That the indicators are linked to company-specific objectives means that KPIs are company-specific. It cannot be said that there is one set of KPIs to be used for all companies. Each company must understand its own characteristics, define its own objectives and consequently its own KPIs.
KPIs are strongly linked to the concept of 'process' and the concept of breaking down the process into hierarchical levels.
In general, KPIs must respond to two macro-objectives, that of **effectiveness** and **efficiency**.
Effectiveness, or quality understood as conformity to customer expectations. Efficiency, meaning performance of resources according to the achievement of objectives.
There are also two other components that should never be missing but depending on the process under consideration may also be of lesser importance, they are **saturation** and **volume/flow.**
Saturation is the level of resource utilization understood as space occupation and use of machinery with fixed capacity, i.e. resources that are difficult to increase. Since it is not possible to increase the available space or the number of machines in the short term, these must be monitored with a view to anticipating possible problems and considering potential evolutions of the activity in the future.
Volume/flow is understood as a trend of operational activity in quantitative terms, they are measures that are also important for better interpreting the other indicators.

A performance measurement system, for the measured performance to be true key performance indicators, must be S.M.A.R.T. meaning Specific, Measurable, Achievable, Relevant and Time-bound. An S.M.A.R.T. KPI should have the following characteristics:
- **Timeliness**, related to the ultimate purpose of performance indicators, i.e., to the fact that it must return information in time for decisions to be made at the right time.
- **Completeness**, it must measure all those levers that create value for the company.
- **Long-term orientation**, must be useful to help anticipate future issues
- **Focus on specific responsibilities**, to allow the identification of people, groups of resources responsible for deviations, in order to match an incentive and reward system.
- **Accuracy**, it must be properly sensitive to variations, it cannot be assumed that when faced with a large variation in the context, there is no large variation in the indicator.

- **Measurability**, it must be able to be based on objective and quantifiable data;
- **Maintainability**, it must have that capacity to evolve over time;
- **Affordability**, there must also be feedback from a cost point of view.

7.1.2 KPIs FOR LOGISTCS

The purpose of KPIs is to support decision-making.
Measurement is the key element of any improvement process, it allows to check the health of the company, therefore what results have been achieved and what are the views, perceptions of customers. It makes it possible to plan resources and activities, it allows monitoring whether the resources have been deployed as planned, whether the quality of the service offered has met the schedule, and then to define a reward and incentive system for the people who have enabled this improvement.
Measuring is fundamental because any activity is improvable, what is optimal today, may not be optimal tomorrow, this is because the system in which we live is always developing rapidly.
To improve a process, one must know it thoroughly and to learn how to know it one must measure it.
For measurement, 2 types of actions can be distinguished:
- **Ordinary actions**, i.e. actions that can be easily repeated over time. This type of analysis is done through the extraction and study of data from company information systems, supplier evaluations and customer surveys.
- **Extraordinary actions**, these are actions that are more onerous in terms of both time and resources, so they are not carried out with any repetitiveness. They are analyses of work, times and methods applied to logistics, a fundamental tool because it allows one to analyse with great precision and attention the way in which an activity is carried out and the time taken to carry out that activity.
This analysis makes it possible to study productivity, but at the same time to identify all those activities that do not give any added value and which can therefore be eliminated or can be performed in a different manner, and consequently to study how the system can be improved.
Finally, benchmarking can also be considered as a measurement system, in which case we are talking about the comparison of, for example, all the warehouses of the same company or other business units or reference players, thus competitor companies or other companies that have nothing to do with the own sector but whose comparison could be important.

7.1.3 IMPLEMENTATION OF A KPI SYSTEM

The first thing to do is to understand in which processes of the company to invest time and money.
It is necessary to select the most important processes, those that create value, to break them down into phases and activities so as to identify the performance associated with all the phases and activities identified.
For each performance considered useful to be monitored, it is necessary to define the actual KPI, i.e. to establish the metrics, the method of calculation, to establish the frequency of determination, and then every time to reprocess the data to determine the result and to verify the deviation from the previous measurement.
One would set targets, ranges of values for each KPI, and also set thresholds of values that would trigger an alert if reached or exceeded.
Establish the level of aggregation because there is a hierarchical level that links activities, phases and processes and there will also be a hierarchical level in the KPIs linked to them, and finally we need to establish the source of the data, i.e. the data used to calculate these indicators come from which systems.
The next step is to formalize a documentation, describe the processes, list the KPIs, describe the properties, requirements, etc. This step is important because it allows everyone to know how to carry out that particular activity and to have a basis for thinking about an improvement process.
Finally, it is necessary to verify that what has been constructed makes sense, to verify for example by means of known data whether the results obtained are equally known, to verify whether when faced with extreme situations the result is equally extreme, otherwise it means that there is an error in the metrics, then test and finalize what has been done.

7.2 INVENTORY KPI

7.2.1 MULTI-DEPTH ANALYSIS FOR STORAGE

In addition to the study of the type of load unit, i.e. whether we are talking about heavy load units such as pallets, large containers or light load units, i.e. those products that can be stored in parcels, packages and crates, we must also study the structure of the load units in terms of the possibility of automatic handling. A fundamental aspect is that of the specific stock, i.e. the quantity of goods per item, which allows us to study how we are going to fill the multi-depth channels, even though this may clash with the constraints of the building, i.e. shape, height of the building, etc.

SPECIFIC STOCK

A productivity-related performance indicator that the planner must monitor is the specific stock.
In order to understand what type of solution to adopt, whether to use the same storage solution for all products handled by the company for example, the planner performs an analysis of the stock profile, an example of which can be found in figure 31.

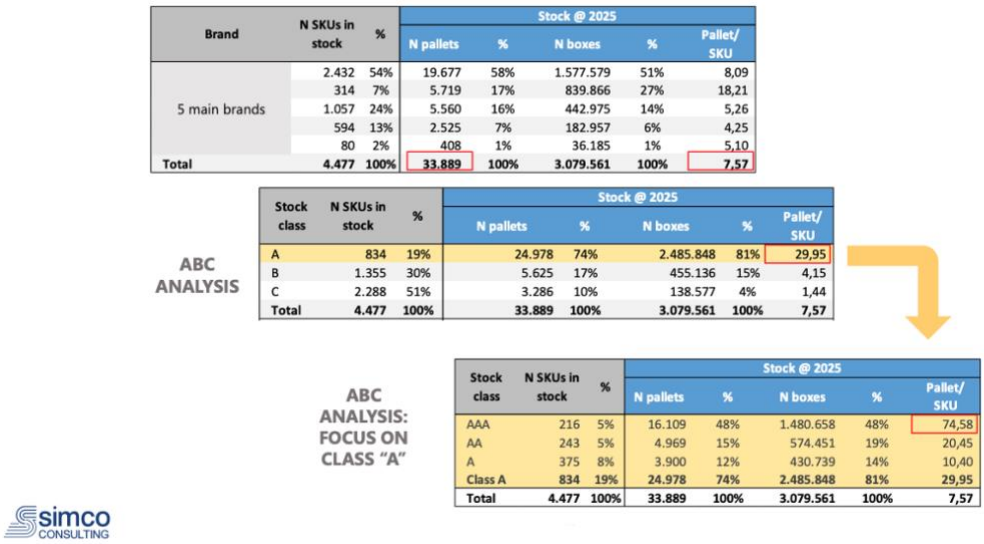


Figure 31: ABC Analysis for the choice of storage solution

In the first table, the quantity of pallets in stock compared to the number of articles handled in the warehouse, so this gives us an idea of how many pallets per article there may be.
Reasoning in overall terms, it can be seen that there is an average of around 7.5 pallets per article and this is neither high nor low, so when faced with situations of this kind, one has to think about whether multi-depth solutions can be efficient or not.

When there comes a point where the choice on which solution to adopt is not immediately apparent, one can use an ABC analysis, which is a statistical analysis used to categorise a company's inventory by assigning a class to each item (or SKU, stock keeping unit). Typically, class A is the class associated with the most sold or consumed items and class C with the least sold or consumed items.
In this case, we see that 19% of the items use 74% of the pallets in stock. So if the total average was 7.5 pallets per article, in reality for these first 800 articles, the average stock pallet is almost 30 pallets per article.
Even at this point, one might think of moving towards solutions that increase stock density for these class A articles and use more conventional solutions for the remainder

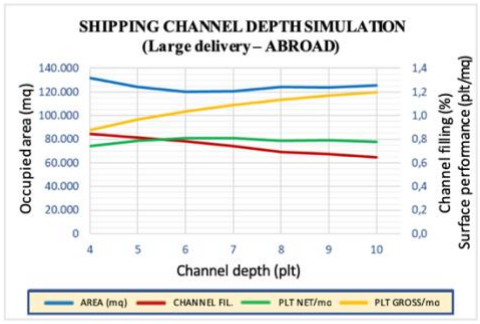
of the articles (class B and C) which are a majority in terms of articles but represent a minority in terms of stock.

In order to have an even higher level of detail, one could redo the analysis by focusing on the products that represent a majority in terms of stock, i.e. in this case category A products.
In the third table, the same ABC analysis is made, but only the category A products. It can be seen that of those 800 articles, 200 are responsible for almost half of the total pallets in stock, with a number of pallets per SKU of almost 75. Faced with these numbers, different pictures begin to emerge, on the one hand, with the first ABC analysis we see that there are articles that are worth densifying and others that are not, with the second analysis we see that, even among those that are worth densifying, further differentiations can be made and say that there are articles for which it is possible to go deeper and articles with which it is easier to go shallower.
A key parameter in the analysis of multi-deepness is filling, i.e. the factor that determines how depth is used. In the example above, since you have more pallets/SKUs for class AAA articles, it is easier to fill the channel, so channels with a greater depth could be implemented.
For class AA and A articles, one must stop at a shallower depth in order to be able to fill the channel with the pallets one has available and thus try to reach the theoretical capacity as far as possible.

7.2.2 MULTI-DEPTH ANALYSIS FOR SHIPPING CHANNELS

NUMBER OF PALLETS

If multi-deepness is designed for shipping channels, one way to choose the optimal depth is to study every single shipment in a year.
It is analysed how the pallets of each shipment fill the channels according to the channel itself, which varies. In this case, it is important to know the number of channels required by all shipments throughout the year and their area in square metres.
In this way, it is studied, for all the shipments handled, what filling is to be achieved.



EXAMPLE

CHANNEL DEPTH	N. OF CHANNEL	TOT CAPACITY	AREA (mq)
4	16.497	115.479	131.770
5	13.344	120.096	124.099
6	11.339	124.729	120.335
7	10.113	131.469	120.598
8	9.395	140.925	124.366
9	8.493	144.381	123.573
10	7.918	150.442	125.599

CHANNEL DEPTH	CHANNEL FILLING	PLT NET/mq	PLT GROSS/mq
4	85%	0,74	0,88
5	81%	0,79	0,97
6	78%	0,81	1,04
7	74%	0,81	1,09
8	69%	0,78	1,13
9	68%	0,79	1,17
10	65%	0,78	1,20

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Figure 32: Example of an analysis by number of pallets

In the example in figure 32, it can be seen that by increasing the depth of the channel, at the beginning, the net capacity in terms of pallets per net square meter improves because it is possible to have such a high profile of pallets per shipment that even by increasing the depth, the number of pallets saturates the channels well.
Above a threshold value, however, this net capacity decreases. This is because, at this point, the profile is such that the channels cannot be filled well and this leads to choosing a certain depth.
In the example, 6 is the depth that minimises the required surface area because it takes an optimal target fill that allows for potentially the best net capacity.

7.2.3 INVENTORY TURNOVER

Number of times, within a considered period, during which the stock is completely renewed.
This index is crucial because it gives an idea of the way in which the financial resources committed to inventories are recovered. This is because with stock the company anticipates the purchase of products and these costs will only be covered after the consumption and sale of these products.
The longer goods are in stock, the more capital is tied up, so a measurement of this type is important.
The inverse of the turnover ratio expresses the average stay of goods in stock, the coverage, which can be defined in days, weeks or months depending on the results.

7.2.4 ITEM FILL RATE & ORDER FILL RATE

This is an indicator that measures the fraction of demand that can be met immediately from the available stock of a specific article.

The higher this indicator is, the more it means that the company is able to satisfy its demand immediately. On the other hand, the higher it is, the higher the stock will be and therefore the cost of inventory is high.
The Order fill rate is the fraction of orders that can be filled with stock. It depends on the item fill rate.

7.2.5 WAREHOUSE OCCUPATION INDEX

This index indicates the saturation of the warehouse, i.e. the occupation of space.
This indicator can be calculated as the *number of occupied rooms/total rooms* or *occupied surface area/total surface area* or *occupied volume/total volume*.
Depending on how I decide to measure it, this will give me different indications, for example it may be that with the pallets available I occupy all the available surface area, but these pallets are half the height of the available space, so I have not optimized the space in terms of volume. In this case, the solution will not be to look for a larger warehouse due to lack of space, but the company will have to make a different intervention by modifying the structures and recovering spaces by modifying the height of the compartments.
Looking only at the formula with the occupied area compared to the total area would not lead to this type of solution, the information would be incomplete and the solutions suboptimal.

7.2.6 INVENTORY ACCURACY INDEX

Indicator that can be calculated as *number of articles with errors/total number of articles*; or as *misaligned stock quantity/average stock*; or as *misaligned stock value/average stock value.*

7.2.7 HANDLING INDEX

It relates to flows in the warehouse, it is a measure of incoming rows and outgoing rows, a trend over time to identify upward or downward trends.
Indicator that can be calculated as *daily incoming (outgoing) rows/total daily rows*.

7.2.8 PRODUCTIVITY INDEX

It indicates efficiency in the sense of resource utilization capacity.

This indicator can be calculated as *rows of unloading or loading vehicles per day* (or hour), *rows of planting per day* (or hour), *rows of picking per day* (or hour).

7.3 PRODUCT DELIVERY KPI

7.3.1 CYCLE TIME

On the subject of deliveries, we can speak of cycle time (order-delivery), i.e. lead time, which, if we monitor the inbound process of the company, elapses from the moment an order is placed with the supplier, to the moment the goods are received, checked and put down, because that is the moment when they become available for collection.

$$ORDER\ LEAD\ TIME = \Delta T\ (order\ issue) + \Delta T\ (supplier) + \Delta T\ (delivery) + \Delta T\ (verification) + \Delta T\ (storage)$$

Part of this lead time is the lead time from when the goods are unloaded to when they are made available for collection. This is important because the longer this lead time is, the more difficult it is for this company to fulfil orders.

$$LEAD\ TIME\ GOODS\ AVAILABILITY = \Delta T\ (acceptance) + \Delta T\ (quality\ control) + \Delta T\ (storage)$$

7.3.2 DELIVERY FREQUENCE INDEX

The number of deliveries made within a planned time frame could be measured, again to be measured against set targets.
This indicator can be calculated as the *number of deliveries made/ number of deliveries scheduled* within the reference time frame.

7.3.3 DELIVERY PUNCTUALITY INDEX

Ability to meet an agreed delivery window at the time the company has agreed with the supplier or customer. it measures which delivery window is to be met and whether there has been a delay or an advance, because when faced with an agreed window, even an advance means a disruption.
This indicator can be programmed as *orders received on time (late or early)/total orders received.*

7.3.4 DELIVERY ACCURANCE INDEX

Ability to comply with agreed conditions e.g. completeness of orders (complete orders/total orders), whether the end customer has received the number of items he had requested.
It can also relate to loading units, for example if the company has agreed with the supplier on how the goods are to be delivered in a certain type of container or in a certain type of pallet of a certain size, every time it deviates from this type of condition there could be a disservice to the company.

7.3.5 DELIVERY FLEXIBILITY INDEX

Ability to respond to requests for variations from what was agreed.
The more it is a dynamic company that manages to change plans at the last minute, the more important it is to measure whether the supplier is flexible.

7.4 TRANSPORT KPI

All concepts referring to quality and efficiency for warehousing apply to transport. Those involved in transport must also measure the quality of their service, their activities and the efficiency with which they carry out these activities.

INDEX	**FORMULA**	**DESCRIPTION**
Delivery lead time	$\Delta T\ (goods\ delivery)$	Delivery time of goods.
Punctuality	1. *On-time delivery (pick-ups)/total delivery (pick-ups)* 2. *Early delivery (pick-ups)/total delivery (pick-ups)* 3. *Late delivery (pick-ups)/total delivery (pick-ups)*	Indicator that measures how many goods were delivered late, early, or on time. Focus on means, whether there is any delay or advance in this case depends on the mode of transportation.
Accuracy	1. *Incorrect deliveries/ total deliveries* 2. *Damaged packages/ total packages dispatched*	Indicator that measures the quality of products at the time of delivery. Again, if a product was damaged the reason must be found in the mode of transportation as this indicator gives

		a particular measurement on transportation.
Saturation	1. *Volume dispatched per truck/ capacity per truck in volume* 2. *Weight shipped per truck/ capacity truck by weight* 3. *Pallet shipped per truck/ capacity per truck in pallet*	Vehicles have limited volume and weight capacities, so it is important to calculate the weight shipped versus the capacity of the vehicle, or the volume shipped versus the volumetric capacity of the vehicle, to understand how well that resource is utilized.
Indicates characteristic of the route	1. *Volume shipped per trip* 2. *Average number of deliveries per trip* 3. *Average number of km per trip*	They are indicators related to trip performance, i.e. volume per trip, number of deliveries or number of kilometers per trip, etc.

Table 5: Transport KPI

7.5 SERVICE INDICATORS

These indicators put the customer at the center of logistics and measure the level of service related to the product according to the customer.
Some indicators may disregard having to interact with the customer, as a measure of the service provided comes through the concept of loyalty, and so it might go to measure the number of customers over time **'Customer Development Rate**', or go to measure how many of the customers who bought at time t0 continued to buy in subsequent instants of time **'Customer Retention Rate'**.
One can also consider the seniority of the relationship, **'Average Customer Seniority',** is an indicator of customer loyalty that measures the average length in years of the relationship. This indicator complements the 'customer retention rat' since the latter does not provide an indication of the importance of customers who have left/continued the relationship.
'Customer Lifetime Value' is an indicator that measures predictable profits based on the relationship with customers, from their purchasing behavior, over a time frame equal to the 'expected life' of those customers.

Then there are other indicators that somehow require direct interaction with customers, such as surveying customers to measure customer views and feed into performance indicators on the service provided.

‘Customer Satisfaction Score’, which is the degree of customer satisfaction, usually determined by the question *'how would you rate your degree of satisfaction with the service received?*', the customer will give an answer that can range from, for example, 1 to 5, after which the score obtained as the sum of the scores of the various customers compared to the maximum obtainable will give the indicator sought, the higher it is, the higher the perception of service quality.
‘Net Promoter Score’ measures the level of customer loyalty because they are asked *'how likely would you recommend this company to a friend or colleague?'* Again, there will be a scale for responses ranging from 0 to 10 because this scale will allow customers' responses to be ranked.
Who answered 0 to 6 will be considered as negative because they will advertise negatively, those who answered 7 or 8 are the so called 'neutrals' because they are satisfied but still would not take so long to go to the competition, while those who answered 9 or 10 should be considered as promoters because they will definitely speak well of the company.
So, the net promoter score could be the percentage difference between promoters and detractors, and therefore the higher this value is, the more it means that promoters will prevail and therefore there is an important degree of loyalty.
‘Customer Effort Score’, which is the measure of experience, thus typical of after-sales and support services, typically determined by the question 'did the company make it easy for me to handle my problem?' Also in this case, the indicator could be calculated as the percentage difference between those who gave an affirmative answer and those who did not, in this way, the higher it is, the more positive the customer experience was and thus the indicator will show that the service provided by the company is positive.

7.6 PERFORMANCE CONTROL SYSTEMS

7.6.1 REPORTISTICS

The goal of a reporting system is to provide analytical documentation of relevant activities of the organization within which it is developed.
Documentation that is used to represent measures and communicate them. The report exactly because it puts together KPIs, it must have the same characteristics as the KPIs, so it must be complete from a standpoint of the type of measures that are included, but at the same time the information must be concise, meaningful, and reliable.

The reporting system is used to indicate to management (promptly and in a comprehensive and understandable manner) whether the company is in line with the profitability, cost and performance targets set in the budget.
Provide the solid, shared basis for evaluating managerial performance and that of suppliers and outsourcers.

7.6.2 DASHBOARDS

The dashboard is a complementary way but not a substitute for reporting. The dashboard shows performance and measurements but it takes on a different meaning because the dashboard carries with it that ability to process very short-term data and therefore allows in real time and in a very dynamic way to see the performance of the company.
Whereas the report might contain tactical and strategic data, in the dashboard only operational indicators are shown because the dashboard is accessed through information systems that perhaps operational managers turn their attention to.

CASE STUDY

To analyze warehouse solutions and KPIs in a real company, I was given the opportunity to visit and study the warehouse of Golden Lady Company in Casalmoro, Italy.
The peculiarity of this company is that it manages several brands, in addition to the well-known brand Golden Lady also manages Philippe Matignon, which produces goods of much higher quality and consequently higher prices.
This allows, to compare how a company performs in managing different brands of different categories, from the most commercial to the top-quality and then to the luxury brand in the industry.

8.1 GOLDEN LADY COMPANY

Golden Lady Company S.p.A. is an Italian company specializing in the production of hosiery, founded in 1966 by entrepreneur Nerino Grassi.
The company grew through the acquisition of domestic and foreign hosiery and lingerie brands, including Omsa, SiSi, Filodoro, and finally the Philippe Matignon brand was created internally within the company; these are the brands that comprise Golden Lady Europe. Golden Lady United States acquired other American brands such as No-Nonsense and Hue.
Over the years the Golden Lady empire became the most important sock empire in Europe.
While in this early period, the company's main customers were wholesalers, retailers, large foreign distributors etc. About 20 years ago, entrepreneur Nerino Grassi decided to further evolve the company by creating the specialty stores and a chain of stores, Calzedonia, which was initially created to sell the SiSi brand, was created.
Initially there was the Golden Lady brand for large-scale retail and wholesale, the Omsa brand for a level a bit higher, the SiSi brand for retail and finally the Philippe Matignon brand that represented the top quality and therefore also the highest price, and finally the Filodoro brand that was acquired later.

Nerino Grassi grants management of the retail stores to his son-in-law, Sandro Veronesi. After a few years, since the separation of Sandro Veronesi with his wife (Nerino Grassi's daughter), the companies were also separated, Golden Lady remaining under the control of Nerino Grassi while Calzedonia of Sandro Veronesi.
There was no direct competition in the beginning as Calzedonia served only specialized markets while Golden Lady all others, but Golden Lady also needed specialized stores

with its own brands, hence Golden Point stores were born. So the 2 groups became more and more competitors.
In recent years, however, there has been a rapprochement due to the fact that Golden Lady is very good in production, Calzedonia in marketing and sales, now Golden Lady produces almost all socks for Calzedonia, although they still remain 2 completely separate companies.

Golden Lady Company now has 14 factories located in Italy, Serbia and the United States with a production of more than 400 million socks a year, exported to 70 countries around the world and a total turnover of more than 600 million euros. The Group is the market leader in Italy and holds significant shares in major European markets.
Currently the president of Golden Lady Company is Nerino Grassi's daughter, Nadia Grassi with 5 factories in Italy and 2 in Serbia.

8.2 PRODUCTION SITE IN CASALMORO, ITALY

Golden Lady's production site in Casalmoro is the logistics hub for worldwide distribution of all brands; all distribution for all plants is concentrated from this site and from here it leaves for the whole world. The largest volumes are sent to Italy and Spain, but the whole world is then served with different volumes.
Serbia is a warehouse where shipments are sent to Russia (the company's main foreign market, 30 % of sales, there is only one customer who then distributes products throughout Russia) and to England. This is inbound transportation, products that are produced in Serbia are then brought to Italy for distribution to the rest of the world.
Serbia is the largest producer of socks in the group, about 80% of the production is done in Serbia, part of this production is then sent to Italy for distribution.
In Serbia and England there are 2 important customers which are Primark and Marks & Spencer.

The United States, on the other hand, is a world apart, there are other brands, they have their own commercial, their own president, their own production manager, it is an independent republican but under the control of Golden Lady Italia. The only trade there is between the U.S. and Europe is the yarn, which is largely sent from Italy to the U.S.

The production site in Casalmoro consists of about 67000 square meters, of which 37000 square meters are covered. The production site is divided into production and logistics. The production includes the raw warehouse that includes the socks still to be

dyed that arrive from the various factories of the group, the dyeing plant, the packaging where the socks are dried, ironed and packaged, a warehouse where there is all the necessary pack that is used to package the socks to be shipped (this is next to the packaging), and finally there is a part for setting up the displays that are sold in supermarkets.
On the opposite side, which is connected to the production warehouse, is the whole logistics part where there are loading doors, shelving structure for picking and shipping.
Golden Lady is a vertically structured company, that is, they buy the chip which is a ball of polyamide of the various types, melt it down, create the yarn to make it usable in the weaving part, weave it, then create the sock tubular.
The sock tubular is sewn, they iron it, fold and pack it, check it, and ship it. They have the whole process from start to finish. At the Casalmoro site, the goods arrive already woven and assembled; they just need to be dyed and packed.

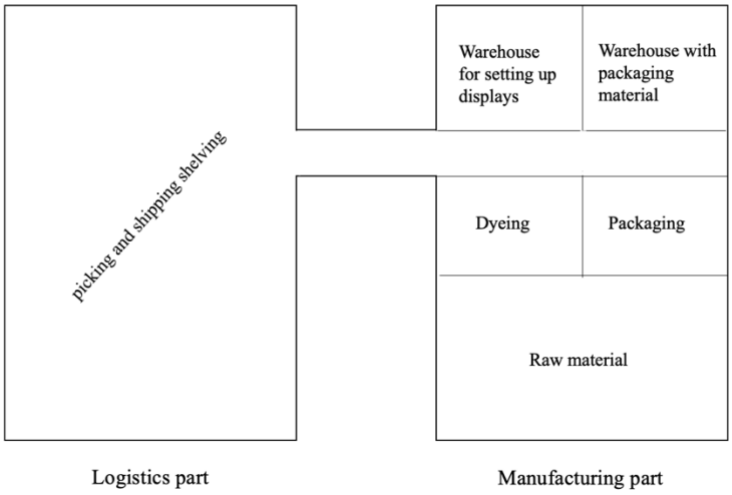


Figure 33: Subdivision of production site

8.2.1 THE YARN

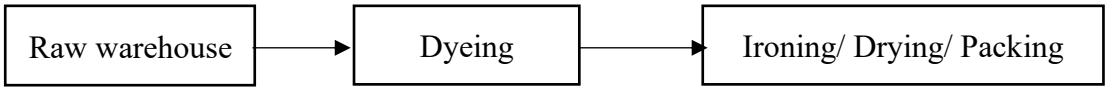
All the yarns used by Golden Lady Company are yarns that the company produces itself.
Golden Lady buys the chip which is a ball of polyamide that is bought from the refineries and from there the various types of yarns are created. Golden Lady has 2 spinning mills in Italy, one in the province of Teramo and one near Casalmoro, where through this spinning mill the various types of yarns are created according to the needs of the products.
The spinning mill is located only in Italy. Golden Lady is the only company that creates the yarns itself. All other competitors buy the industrial yarns from a company that produces the standard yarns for all other hosiery mills.

One of the most widely used yarns is called 22/7, this is the yarn title.
A yarn title is expressed like this, 22/7, 22 is the weight in grams of 10 thousand meters of yarn and it consists of 7 burls, that is 7 filaments. Then there are other types of yarn like 33/10, 44/40 which is microfiber etc.
The yarn starts smooth with the various filaments joined together according to the type of yarn, then processing is done. It starts with texturization that is the operation that is done on the continuous filament yarns of chemical fibers to improve their elastic characteristics and increase their volume, at which point the yarn from smooth becomes spongy. This characteristic is essential because it allows the absorption of sweat because it becomes breathable.
The socks that cost less are made only with this type of yarn that has some elasticity through the texturing process, they are also somewhat breathable.

The highest quality yarn, used for **Philippe Matignon socks**, on the other hand, has an elastomer core, which gives incredible elasticity but is quite uncomfortable in contact with the skin.
To maintain both elasticity and comfort, there is a process, spiraling, where one of the yarns is taken and spiraled around the elastomer until it is covered.

8.3 MANUFACTURING PART

Production starts from the raw warehouse where the products yet to be dyed that arrive from the group's various factories are stored, after which it goes to the dyehouse where the socks are precisely dyed, and finally in the packaging part the socks are stretched, dried and packaged.



In the following paragraphs we see in more detail how the production of Golden Lady Company socks takes place.

8.3.1 RAW WAREHOUSE

Figure 34: Raw warehouse logistics hub in Casalmoro, Mantova, Italy

At the Casalmoro site, the goods arrive already woven and assembled; they just need to be dyed and packed.
The goods are then prepared in carts according to production type, they are divided according to size and final color, dyeing arrangements are then prepared, the recipe to be used is indicated in the label, and they are sent to the dyehouse.

8.3.2 DYEING

There are 3 types of dyeing:

1. **Rotating dye**, socks to be dyed are placed in a large rotating washing machine. In this mode, the water remains still while the goods rotate. To the water are added dye, softeners, detergents that are able to penetrate the yarn due to this rotary movement of the sock. This type of dyeing is used for very heavy items (cotton, wool, acrylic...).
2. **Static dyeing**, in this case the socks are placed in baskets with holes that are then placed in machines. In this mode the goods are stationary, while water rotates and passes through pumps and into and out of the basket through holes in the basket. This mode is used for lightweight items (lycra, etc.) because in this case the water passes more easily, there is no need to move the socks.

3. **Cassette cabinets** in which pre-ironed socks are put before dyeing to avoid creases. They are a type of heavy socks (microfiber) that if they are dyed in static dyeing take creases that can no longer be removed to then, to get around this problem, they are dyed in cabinets but first they are ironed.

When the socks are dyed, they are placed on carts. Each cart has its own dyeing note indicating the type of product, color, quantity, machine number, and dyeing day.
There is at this time a small quality control where they see if the color is uniform, the company also has an electronic photometer spectrum that verifies that the color obtained is exactly the color of the folder presented to the customers; there is also a soundness check, they have an **OEKO-TEX certification**.
Standard 100 OEKO-TEX certification is an independent and internationally uniform control and certification system for raw materials, semi-finished and finished textile products at every level of processing, as well as for the accessory materials used.
This certification certifies that the product has been tested and that no harmful substances are present, so the item is harmless to human health.[80]

8.3.3 PACKAGING

The dyed products are then taken to the packaging department.
There are various types of packaging.
For any type of packaging, the steps followed are always quality control, ironing and drying, packaging, and creation of sales units.

The sock after dyeing is wet and wrinkled, an operator takes the socks individually, places them in backlit forms, in this way he can perform quality control by going to check for holes, pulled threads etc. In some types of machines, quality control is done electronically.
If the sock has no defects the machine takes it to the next stage, which is a steam ironing chamber. Once the sock is ironed it passes into the drying chamber where is used the hot air-drying method. The dried and ironed sock is picked up and taken to the packing machine. In this part, the machine picks up the insert, which is the label with all the product characteristics and brand name, the sock is folded on the insert and is placed in the plastic bag, is labeled and is ready for the final consumer.
Finally, the operator creates the sales unit, there can be the 10-pair carton where 10 pairs of packed and labeled socks are placed in the carton and this is the carton normally sold to large retailers and distributors. There are the cartons of 50 or 100 pairs

[80] https://www.oeko-tex.com/en/our-standards/standard-100-by-oeko-tex

depending on the item, and these are the sales units for wholesalers and large foreign distributors. Finally, there is the single pair which is the one used in e-commerce.

Figure 35: Different types of packaging for different brands

Lastly, these packaged products are taken to the warehouse for picking and shipping

8.4 LOGISTICS PART

8.4.1 WAREHOUSE FOR PICKING AND SHIPPING

a) LARGE RETAIL, RETAIL, E-COMMERCE

In the warehouse there are all available SKUs from the collection of all brands, from this warehouse they ship to all channels that have either the single pair or the 5-10 pair container as the minimum sales unit, sales units for large retail, retail or e-commerce.

Figure 36: Casalmoro (Italy) picking warehouse

Warehouse solutions for the fashion & luxury sector are chosen from the light load unit solutions analysed in Chapter 6.
In the case of Golden Lady Company, the shelves are divided into 2 parts, in the lower part there are **gravity racks** that allow the picking of the container by the employees, the upper part is **stock** which means pallets with the various cartons.
The largest shipment volume is Golden Lady brand about 50 % of shipments (the remaining 50% are the other 4 brands). During the off season, so the summer months about 500 thousand pairs per week are shipped, during the other periods it comes to about 700 thousand pairs per week.
Because of these large shipping volumes for the Golden Lady brand, one of the warehouses is used only for the stock of this brand, from this warehouse is done both the distribution for the carton suppliers and the refilling meaning the replacement of the area used for Golden Lady in the retail warehouses when they get empty.

Le soluzioni di magazzino per il settore del fashion & luxury vengono scelte tra le soluzioni di unità di carico leggere analizzate nel capitolo 6.

There is also a space set aside for past collections, these are products that are still of very good quality but belong to a past collection of about a couple of years. These products are sent to markets such as the Polish market or outlets. The company has only one outlet where it sends products from the past collection.

Obsolete items, that is, those that are about 3 years old, are 6%. This is a quantity kept under control that is being sold to other markets where they are in demand such as eastern European markets.

The picked products are put into cartons created for customers as there may be a case where a merchant's order includes different items and also the company's different brands.

The carton is taken to a sorting line where a barcode is read that identifies the products inside the container. The person doing the picking does so through a radio frequency terminal that indicates the products in the order, quantities, customer, etc.
Each time he picks a product, the picker has to scan the bar code to confirm that he is picking the right pair; everything the terminal reads is associated with a shipping unit, which is a bar code that tells what is inside the carton.
When the carton comes through the line the barcode is read, it recognizes the products inside the carton, it is weighed, a label is created and printed that makes explicit the various products, and finally the carton is destined according to the type of shipping courier.

b) PICKING ACTIVITIES

The carts in the figure (37) are the carts that operators use for picking activities.
Each operator takes a terminal which can be either a finger barcode scanner or classic barcode scanner.
The operator takes the cart, connects with the scanner and terminal, they enter the user's name and password, and then according to the operations they need to do, the sequence of the items they need to pick appears in the scanner. When the item to be picked comes out, it is specified which aisle to go to, which column to go to, which location to pick, they pick the product, read the barcode of the item, and confirm. Once they have finished picking all the items are placed in the carton which is placed in the sorting line.

Figure 37: Cart used for picking activity

The systems are not automated, there are automated parts that help the operator understand where to go, what to pick, automatic confirmation, the line that packs automatically weigh the products but the picking part is still classic with the cart. This is because automating a warehouse with 11 thousand SKUs would be very expensive and the company's volumes during the year do not justify this investment, the seasonality of the product does not justify such an investment.

c) E-COMMERCE

The company has 2 owned e-commerce sites: Golden Lady and Philippe Matignon, plus they have a presence in Amazon, PostalMarket, other sites such as Privalia etc.
The logistical impact of e-commerce is still very low at the level of shipping volumes, ad-hoc trolleys have been created in anticipation of the future where e-commerce may occupy a large part of daily shipping volumes.
A kind of shelf with 12 compartments was placed in the prototype e-commerce cart. While retail shipping order involves cartons with about 100/200 pairs of products inside, e-commerce involves an average of 5 to 7 pairs at a time, so carts were designed that allow the operator to pick 12 orders at a time and each order is placed on a compartment.
To improve the efficiency of the operator and minimize the risk of errors, lights were included to help the operator understand that pair of socks in which of the 12 orders it should be placed, then this LED model was designed so that when the operator reads the

barcode of the picked pair, the compartment that corresponds to the customer who ordered that product is illuminated.
Once the products are picked, the operators return to the dedicated e-commerce order station, create the package with the products ordered by the customer with an envelope, close the envelope, and create the shipping label. To date, the impact of e-commerce in the company's supply chain is not significant because it is about 100/200 orders per week, although it is growing month by month, in recent years it has tripled but is not yet at a stage that requires special attention.
The company with the expectation of future growth has already created prototypes of picking carts that will be created in larger numbers when needed.

d) FOREIGN AND ITALIAN WHOLESALERS AND LARGE DISTRIBUTORS

The minimum sales quantity for Golden Lady distributors is about 50/100 pairs. These products are stored in pallets ready for pickup. In the stock warehouse used for delivery to wholesalers or large Italian or foreign distributors, there are about 3000 SKUs of Golden Lady products.

Figure 38: Stock warehouse used for delivery to Italian or foreign wholesalers or large distributors

The picking activity is the same as that used for smaller retail orders, only in this case 100-piece cartons are picked, but the logic is still the same.
Everything that is picked in cartons is taken to an area designated for shipping in cartons.

8.4.2 EXHIBITOR SET-UP AREA

This is also an important part because about 30 thousand displays a year are shipped in large retail. There is just an area of the warehouse dedicated to the daily setup of these displays.
The display is a structure into which stockings can be placed and is ready for stores to use.
These displays are ordered by various supermarkets who also order the type of socks that are to be inserted. The displays are prepared already filled with socks.
Once they are filled, they are locked for the carrying part, they are then closed and so when they arrive at the store all they have to do is remove the cap and they are ready for sale.

Figure 39: Exhibitor prepared with the socks ordered by the customer

Figure 40: Exhibitor covered and ready for transport

8.5 FUTURE INNOVATIVE PROJECTS

8.5.1 LINE AUTOMATION

There are some parts of the logistics warehouse that can be automated.
For example, in the area where large distribution cartons are stored, the sorting of finished products that arrive from Serbia also takes place. Different SKUs arrive with different characteristics between them (size, color, etc.), then the operators sort the different pallets and they are then taken to the warehouse.
In the future they want to create a line where instead of having unloading of the goods coming in from Serbia and several people sorting the different pallets by hand, they want to create a line where they directly unload these cartons and when they get to the bottom there will be bays that will sort the cartons according to SKUs, so people just have to pick up the carton and take them to the warehouse. This automates a part of the business, makes it faster, and there will be less use of people to do this unloading of goods coming from Serbia.

8.5.2 CIRCULAR ECONOMY AND SUSTAINABILITY PROJECTS[81]

[81] https://www.ilgiornaledellalogistica.it/case-history/i-progetti-realizzati-in-golden-lady-company-economia-circolare-e-sostenibilita/

In recent years, Golden Lady Company has placed environmental sustainability and circular economy at the center of its business strategy by investing much of its human and financial resources.
Golden Lady Company has developed three types of projects aimed at environmental sustainability:
- Production of innovative environmentally sustainable yarns
- Reduction of packaging use
- Use of environmentally friendly fuels for transportation

8.5.3 ENVIRONMENTALLY SUSTAINABLE YARNS

Most of Golden Lady Company's stockings and tights are made from two types of yarns: Polyamide and Polyester, synthetic fibers of fossil (petroleum) origin with textile characteristics superior to natural fibers but with a much lower cost.
The fibers are obtained through a process of polymerization, which is a chemical reaction that leads to the formation of the polymer chain, that is, a molecule consisting of a sequence of repeating equal parts, from simpler molecules called monomers.
At this production stage, the circular economy project was carried out by reusing waste yarns, used socks or yarns obtained from the processing of plastic materials, usually primary packaging that is no longer usable, for the production of new yarns to produce new socks and tights without resorting to the use of the fossil-derived polymer.
The use of these environmentally sustainable yarns also has a major impact on logistics inside and outside the company. The suppliers of raw materials change, which are no longer traditional chemical companies but companies that recycle and process waste plastics.
Internal logistics within plants aimed at recovering and accounting for all waste material and reconditioning it for easy collection, storage and transportation to recycling companies change.
Thus, in the future, there will be an increase in logistics related to the collection of used plastics at the expense of purchasing and transporting virgin fossil and natural materials, such approaches require managing more uncertainties, as the supply and the quality of used materials cannot be forecasted like classical raw materials.

In partnership with Calzedonia, a project is already underway to create a yarn reuse line; a machine will arrive in Casalmoro in December that will take used socks, split the elastomer from the polyamide, and with the recovered polyamide will be reused for other socks.

8.5.4 PACKAGING: REDUCTION AND REUSE OF PACKAGING

The finished product is packaged in many different types of packaging (primary packaging) depending on the customer, channel, country, location, etc.; each pack, produced by third-party suppliers, arrives at the plant contained in cardboard trays (fourth-tier packaging) stacked in wooden crates that allow for storage and internal handling in warehouses and departments.
Initially, the packs were stacked and delivered on wooden pallets, contained in cardboard boxes, wrapped in a layer of stretch film. The fourth-tier packaging reduction project resulted in the replacement of the fourth-tier, protective, self-supporting disposable cardboard packaging that wraps the packs in multiples of 500 packs and the stretch film used to stabilize the pallet, resealable and reusable wooden crates were introduced for storage and round trips with suppliers that contain the same number of packs but with a significant reduction in the paper flaps that separated the layers of stacked cartons.

This solution made it possible to go from a fourth-tier packaging waste of 24 kg of cardboard per 20,000 packs to a waste of 9 kg. Considering the plant in Casalmoro (Mantua, Italy), for example, produces and packages about 50 million pairs of socks per year, with the new solution the reduction of cardboard waste is around 40 tons/year and 1 ton/year of plastic film, as told by the Plant Director of this site.

Also, as the goods are taken from the gravity shelves, the cartons are emptied and at this point the workers throw these cartons on the ground, there is then an employee who picks up all these empty cartons. At one time, a few months ago, the empty cartons were thrown directly into the garbage, a separate collection was still done so it was still recycled but not reused.
Nowadays, on the other hand, the company recovers these cartons, opens them up, sorts them according to various sizes and brings them back to the packaging department so they can be reused. So there is no longer the use of the containers that used to come and pick up these cartons to recycle them because now the company continuously reuses them. Whereas before the company owned two containers to throw away the paper that were emptied every week, now they only have one container that is emptied every two weeks.
Another step they would like to take soon is to minimize the type of cartons, from 20 sizes to 5, so it will become easier to recycle and reuse them and therefore also easier management.
So, in addition to no longer throwing cartons away but recovering and reusing them, there are also plans to rationalize the number of carton types.

In a few months in this way there has been an obvious cost saving, about 20 to 30 thousand €.

8.5.5 USE OF ENVIRONMENTALLY FRIENDLY FUELS

In recent years, Golden Lady has revolutionized its transportation logistics. Until a few years ago, Golden Lady owned a fleet of 23 vehicles, which it used to transport goods to its main customers in Italy and Europe.

With the progressively increasing parcelization of sales volumes, increased frequency of deliveries and greater complexity of customer needs, Golden Lady necessarily had to turn to the specialized transportation market to remain competitive.

Transportation is handled by outside companies, the choice was made to completely outsource transportation using the couriers who best serve the routes they are interested in, this was done for pure savings and service improvement, so we could focus on the company's core business which is sock production.
But, also for ecological impact because when the company owned its own fleet, they would deliver the products to the customer and return empty and this was a waste of fuel and personnel. Since they have been using couriers, the saturation of the trucks is dedicated to those who do it for a living, so there is also a CO2 savings related to the fact that they have left this part to those who do it for a living.

The green turn that Golden Lady wanted to introduce in inbound transportation took the form of the purchase of its own vehicle powered by Liquefied Natural Gas. The advantages of LNG over a Euro 6 diesel are significant, starting with a 15% reduction in fuel consumption, 70% reduction in nitrogen oxides, 96% reduction in particulate matter, and finally a halving of noise emissions.

8.6 KEY PERFORMANCE INDICATORS

As already mentioned in Chapter 7 on KPIs, performance indicators cannot be considered as standard for companies. Every company, even those in the same sector, has its own KPIs that depend on the objectives set, the type of product and the importance that one decides to give to certain product and/or service characteristics. Once the company's needs and objectives have been identified, KPIs can be set to monitor these objectives periodically and understand how to improve the product and/or service. Golden Lady Company for example analyses various types of KPIs, those on dyeing, electricity, inventory, production, and quality. The same KPIs are used for each

brand. However, in each brand there will be different interest, for example for Golden Lady which impacts about 50% of total shipments it is important to monitor KPIs related to shipping, picking and delivery.
For the luxury brand Philippe Matignon on the other hand, the market demand is lower but the quality expected by customers is much higher so in this case it is important to monitor product and service quality.

8.6.1 INVENTORY KPI

Every Monday, Golden Lady's plant director, receives stock data from the sales department that is extrapolated through their systems such as SAP.
the engineer keeps track of this data weekly to see trends and see if the previously set goals are being met.

8.6.2 LARGE ORGANIZED DISTRIBUTION

One of the most important channels from which they ship from Casalmoro is large organized distribution, that is Golden Lady brand, very high volumes, about more than 100 thousand pairs per day that are shipped, delivery time today for tomorrow. If the order arrives today for tomorrow, there is no time to produce the products ordered, so they have to have a warehouse that can have this speed of response, so it is one of the most critical channels because they have to be fast and send high quantities but also maintain acceptable costs. The parameters that are monitored are:

- **Pairs ordered every week**, the engineer has been monitoring this information since 2015, he has a 7-year history available. Over these 7 years the average has gone from 500 thousand to 400 thousand pairs ordered per week, but during the years there have been several peaks. This KPI is used to still have a baseline quantity, despite the spikes, so the not insignificant variation in quantity ordered from week to week, the average quantity ordered is about 400/500 thousand pairs per week.

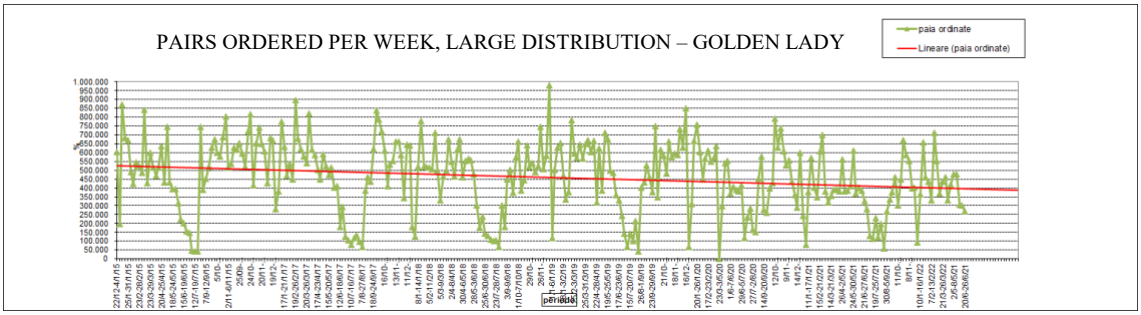


Figure 41:Pairs ordered per week from large distribution (brand: Golden Lady)

- **Level of service offered to this channel**, KPI related to the number of pairs ordered during the week, i.e., out of the several pairs received to be shipped each week, what is the percentage that I actually ship? The average is 99.5%.
  This parameter is very important because the company has to be perfect in-service quality, so it has to strive for 100%.

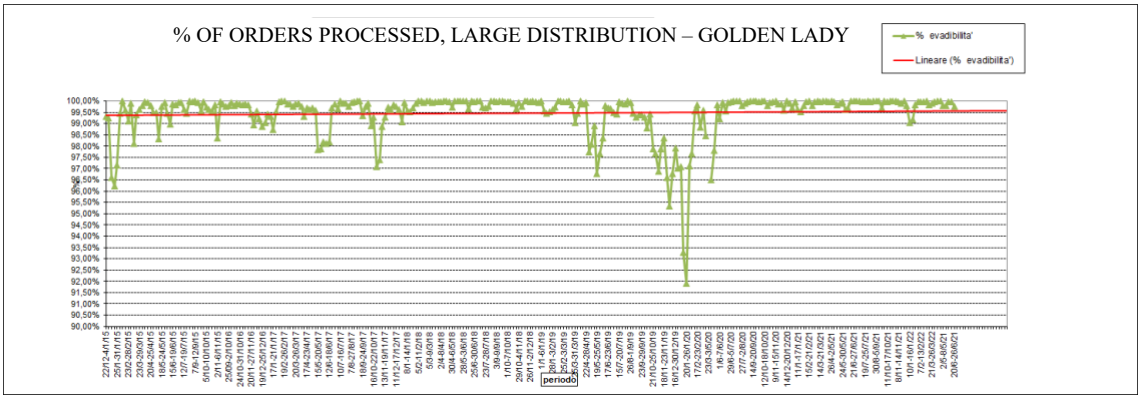


Figure 42: Percentage of orders processed for large-scale distribution (brand: Golden Lady)

- **Number of orders received**, in addition to pairs, orders received within the week are also monitored. On average 900 orders per week, so about 200 orders per day received which is equivalent to 100 thousand pairs per day, an average of about 500 pairs per order.
  This KPI has been monitored since 2010, at first the Organized retailing and distribution industry was very low in terms of orders, then over the years it grew and now they are increasing in importance, in fact the Golden Lady Company is the undisputed leader in sock sales.
- Another KPI keeps track of **how well picking employees perform**. In 2019 there was an average of each picker of about 85 missions now, there are about 20 pickers working, to date, thanks to various improvements, placement of goods through ABC laws that have allowed staff to take shorter and shorter routes, also equipping people with ring scanners (with the gun there is more time lost because they only have one hand free, with the ring scanner both hands are free), they got to an average of 110 missions now, now the goal is to get to 120 missions now, because there was a time when they got to that figure, now the goal is to get there consistently.
- Another KPI always related to gravity picking, there is a lot of focus on gravity picking because it is quite a critical activity due to the large volumes, high response speed and a lot of staff employed, about 50 percent of the warehouse staff is employed in this activity. An average is kept of h**ow many missions are done at picking, per container**. This indicates the sum of all operator picks. On average about 40 thousand missions per week.

8.6.3 RETAIL STORES

This includes merceries, small stores, boutiques, about 4 thousand small stores that purchase Golden Lady's products throughout Italy.
This channel has a very high management difficulty because, unlike the wholesaler, for retail stores all 5 brands are shipped, small quantities and delivery is not today for tomorrow but there is a week to complete the order and delivery.

- **Pairs ordered per week**, averaging about 40 thousand pairs per week.

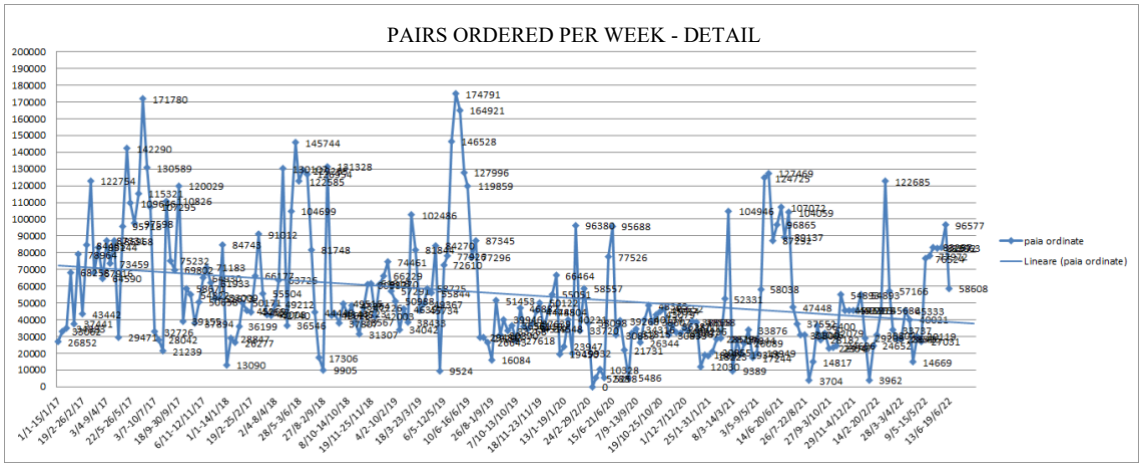


Figure 43: Pairs ordered per week for retail (all brands)

- **Fulfillment rate**, i.e., products not shipped, on average 1.95%. These products are not shipped normally because the variable asked for by the customer is missing, there are 11 thousand variants to satisfy for the 5 brands so it might happen that in some order the variable asked for by the customer is not in stock.

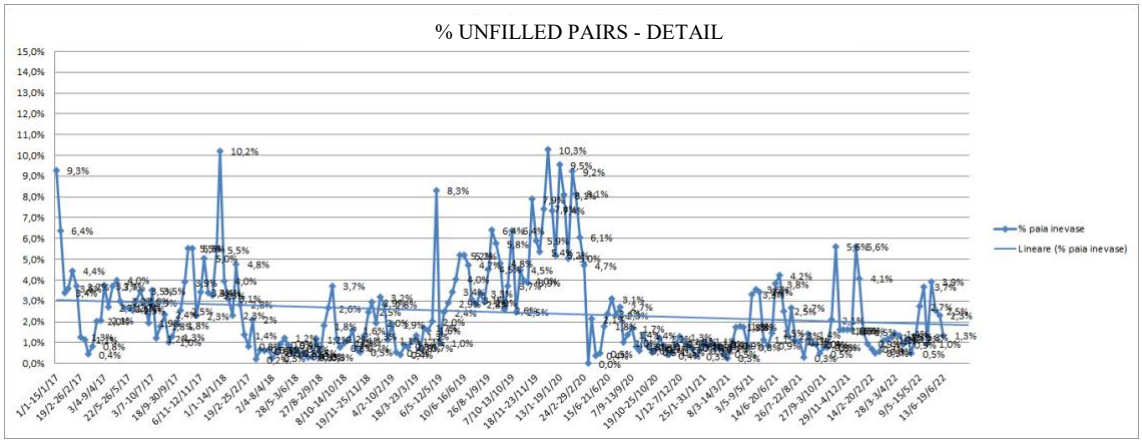


Figure 44: Percentage of unfilled pairs for retail (all brands)

- **Number of employees used in warehouse**, on average finished goods warehouse includes about 35 employees.
- **Stock in warehouse**, in 2013 they had 30million pairs, as of today, June 2022 they are 14million pairs. Inventory is a very variable figure throughout the year due to the seasonality of the product. In the months of July and August they

work to fill the warehouse, with those products with a constant demand so those products that are repeated in every collection, so in these months the stock in the warehouse will increase to handle the most critical and important months which are those from September to January especially. However, the tendency is to keep stock a little lower to meet the market without having too much capital use.

8.6.4 E-COMMERCE KPIs

The number of orders is monitored, the channel started in 2019 with 50 orders per week, to date there are an average of 150 orders per week. The number has tripled, but compared to large-scale distribution or retail store orders, it is still a very low number.

These KPIs on the number of orders in the different services (distribution, retail, e-commerce) are used to understand how orders evolve over the years, by keeping and studying the order histories of the different channels we can understand at what time of the year customer demand increases and at what time demand decreases, in this way we come prepared at times when there will be peaks and we are able to meet market demand.

8.6.5 QUALITY KPIs

Quality in the packaging department is monitored. During quality control, if the operator finds any defect, he/she puts the pair of socks aside, at this point there are people walking around the department with an ipad where they mark all the defective pairs compared to the total number of pairs and so the defects that happen most often are monitored.
Out of all the defect types most are pulled threads, then there can be a few torn pairs, dirty pairs, double thread so when the weaving is not done well so this defect is noted, other defect can be the unstitched toe, etc.
Based on this it can be seen which items showed these problems so for example if one finds 20 pulled threads, one goes and studies these pairs in detail and notices that 5 were part of a certain item, 3 of another and so on.
This way one sees which type of item has this defect for the most part and tries to study why in order to find a solution.
KPIs on quality are linked to production because all first-rate socks must arrive in the warehouse so the study and sorting is done during production.

8.7 MARKET CHOICE

One of the initial objectives of this study was to understand how companies that serve a worldwide market and have a certain variety of products choose the country in which to offer their goods.

When choosing a country to ship their products, it may happen that the forecasts are not 100 percent reliable, and so they find themselves shipping high volumes of a product to a country where the customer's final demand will be low, while in countries where demand will be very high following the forecasts lower volumes of goods have been sent. At this point changing the market is very difficult both in terms of time and cost. To avoid this kind of problem Golden Lady Company asks customers to order little and often. Whereas a few years ago the company's salesmen aimed to sell as much as possible to distributors, and in this case the problem could occur that the chosen market had not absorbed all the goods shipped to the warehouses, while in other markets, to which fewer products of that specific type were sent, demand was higher. When the market is started directing the goods to another country is a problem, there may be customs problems, assortment problems as they have 11 thousand SKUs available, label problems, if the product is sent to France the label will all be in French, redirecting this product to the German market would mean reciprocating all the labels with the language of the destination country. To overcome this problem, the solution is to ask the customer to order less and often, as the company boasts delivery times of up to one week for certain channels.

This solution was also born out of the realization that forecasts are becoming more and more unreliable, in an era like today's where fashion changes rapidly, where customers prefer customization, forecasts no longer work, they are no longer as reliable as they once were.

The company is moving more and more toward policies for speed. Demand forecasting can no longer be reliable at a time when customization is a widespread phenomenon.

8.8 FINAL CONSIDERATION

8.8.1 CHEAP VS. HIGH-QUALITY BRAND

Golden Lady Company's luxury brand is Philippe Matignon, differing from other brands in terms of quality, cost, and production time.

All of Philippe Matignon's yarns are made up of this *core of lycra, this elastomer, covered with so many spirals, about 1,800 spirals. To make 1kg of this yarn used for*

Philippe Matignon takes a week of work, to make 1kg of the yarn for the cheapest sock takes a day.
In addition, *Philippe Matignon offers a number of variables of unique sizes and colors that other brands do not have, which is also an extra service for the customer.*
The packaging is also different, while Golden Lady's envelope is a paper envelope with Golden Lady, the size and color written on it, *Philippe Matignon's envelope has a perfectly white paper with the brand's gold lettering on it, with the cardboard inside where the stocking is wrapped, this is to let people know that the product is different, that it is a higher quality product.*

In terms of warehouse management of this type of product, the picking and shipping part is done in the same way as other brands. This product is stored in gravity shelves that allow manual picking by operators who place these products in cartons for shipping. The checking of products to be shipped is always done in the same line using RFID technology.
Extra attention will be paid instead to the measurement of KPIs, especially in KPIs that relate to product quality and are analyzed at the production stage.
For Philippe Matignon products, the company cannot afford to have defective products because this would cause both economic damage, in terms of material cost and production time, and brand image. This means that if, during quality control, which takes place before the ironing and drying stage, Philippe Matignon pieces are found to have some defects, the cause must be thoroughly investigated to avoid other defects in the future.

8.8.2 PRODUCTION AND SHIPPING

As mentioned earlier, nowadays, market demand forecasts are no longer reliable and cannot be taken into account as it was done a few years ago to decide the quantities to be produced and the type of product to have in stock.
As of today, customers want products that are always new and many times customized with fairly short lead times. To meet these needs, companies must be fast in production and shipping.
The company must always be ready with all the components, raw materials that are needed to produce the goods they offer to the market and improve the production part to increase the speed of response.
For example, even item changes on the production machines have become routine, whereas before they used to work on efficiency and therefore each change caused a decrease in efficiency, today it is the norm, it is a strategic factor. The company must

make sure to speed up this part of production by creating e.g. ready-made kits for changeover, specialized personnel etc.
The speed of production and shipping is the factor that allows companies to remain competitive in the market.
Golden Lady has already worked on this over the years making production very fast and is able to ship their products today for tomorrow.
This advantage also depends on the type of product they offer to the market, since it is a seasonal product, the summer months when sales are greatly reduced are taken advantage of to fill the warehouse with classic products that are repurposed every year, in this way even if they sell less in a given year, the same items can be sold the following year. The same reasoning cannot be made for those products with particular designs or colors that change every year for each collection. This way they engage the production machines during the summer to fill the warehouse with these 'classic' products and during the winter months they can use the machines to produce the other products according to market demand. This is also what makes Golden Lady the unquestioned sales leader in their industry.

This reasoning can be made and works for a company like Golden Lady in that, despite the various brands they have to manage, they have managed to make the production that goes from dyeing to storage and distribution more or less standardized, as well as for the type of product they have that allows them during the summer break months to fill the warehouse and be ready when the market will demand that product.
But, for clothing or shoe companies, production is continuous, there is continual resets so the same solutions cannot be put in place.
Whatever type of company, speed is critical to staying alive in today's fast-paced market.
This is true for almost all except unique products.
Some customers, who may be considered elite customers because of their economic possibilities, may require one-of-a-kind pieces, thus the creation of a product such as a handbag or dress that no one else in the world has.
In this case, the cost or time of production and shipping take a back seat because it is no longer enough to have the designer item but true luxury becomes a one-of-a-kind item in the world.
This is done for all luxury products, from accessories such as handbags to custom-made clothes to wedding dresses, cars, and home accessories.

Another solution adopted by companies to remain competitive in the market during the customisation phenomenon is late differentiation is a method of organising the manufacturing or assembly process in which final finishing operations or product

customisation are pushed as far downstream as possible and, if possible, completely disconnected from production or assembly.
This method of organisation makes it possible to obtain a low manufacturing cost and to allow a certain degree of customisation, differentiation, and to take into account specific customer requirements or expectations.

In the luxury ‘normal’ apparel or handbag market, on the other hand, you have continuous restores, as these are products that are sold year-round, so there are always new collections to be produced.
For these kinds of fashion & luxury companies, a more connected and agile supply chain is needed; we have come to the era of 'agile supply chain commerce.' To reshape the supply chain and make it more 'agile' and 'adaptable' to the new variables we face on a daily basis (such as adverse economic, political, health, and environmental situations), the enabling factor is technology and omnichannelity.
The logistics of the fashion world have always been challenged by the peaks resulting from the seasonality of this industry and the release of new collections. With the ever-increasing prevalence of e-Commerce in the fashion industry as well, the supply chain has to deal with a greater amount of goods to control, a high number of orders, and very often reduced timelines
People who buy clothing, footwear and accessories online expect not only to have a wide selection available, but also to be able to receive their purchases within a few days. In order to be flexible and respond to new requirements, companies have therefore adapted over time by increasing control of their stock in the warehouse, streamlining processes throughout the supply chain, from production to delivery to the end customer, and above all, synchronizing processes with each other. To do this, they decided to turn increasingly to automation. An efficient answer has been found in automated warehouses, which have the property of being able to be fully integrated throughout the supply chain. These automated warehousing systems, in addition to making the best use of available space, make it possible to reduce the timing of flows while keeping their quality intact or even improved.
In addition to this, companies need to monitor new trends and be ready to expand on them as well. These trends include, for example, using esports to test new products or the metaverse as a possible world in which to expand their stores.

9 FUTURE OF LOGISTICS

The era of great transformations we are experiencing involves every aspect of the industrial world, technological innovation is also profoundly changing logistics.

9.1 THE INDUSTRIAL SECTOR

The main trends that are radically transforming the industrial sector are:

1. **Automation and artificial intelligence**; automation has already started to influence the logistics department for the efficient and functional coordination of all activities related to order management.
   AI will influence both the transport sector, which will be changed by the introduction of robots and automated systems for moving goods. (e.g. Amazon Air).

2. **Internet of things,** objects will be able to communicate with each other through sensors that allow them to exchange and process data. Sensors will collect, store and exchange information in order to optimize performance. This will allow for greater control of the logistical flow and increase accuracy, as potential problems can be discovered immediately and resolved quickly.
   Industrial Internet of things, for example, represents the application of IoT in the industrial world. The application areas of IoT are:
   - *Smart Factory*, production progress control, work safety, maintenance, material handling, quality control and waste management.
   - *Smart Logistics*, traceability and supply chain monitoring via RFID (radio-frequency identification) tags, security management in complex logistics hubs and fleet management.
   - *Smart Lifecycle*, improvement of the new product development process, end of life management, supplier management in the new product development phase.

3. **Eco-sustainability**, electromobility and the search for eco-friendly energy sources is currently a strong trend. The development of electric vehicles will continue to grow by providing more and more cutting-edge solutions that will enable companies to choose new environmentally friendly tools for the logistics department. Amazon Prime Air, is an example of an eco-friendly solution as it will reduce carbon emissions.

The incubator Supernova Hub and the company Italmondo, together with the universities of Copenhagen and Zurich, are creating a mathematical model for truck load management. The goal is to optimise the loading of trucks by reducing the number of vehicles on the road and thus reducing carbon emissions.

4. **Blockchain technology**, this technology will revolutionise logistics by increasing transparency in the management of orders, minimising the risk of errors in the transmission of information, eliminating intermediaries so as to achieve a simplified and reliable supply chain.
   If one considers blockchain as a shared data structure where all transactions taking place within a network are recorded and stored, one can understand the great opportunities offered by this technology to connected logistics, especially in the areas of transport document management, goods tracking and fleet monitoring.

a) AMAZON AIR

In America, Amazon is already starting experiments to be able to deliver products from the sky, i.e. by drone, in the towns of Lockeford, California, and College Station, Texas. The e-commerce giant aims to reach, via 'Amazon Air', 12,000 total flights by the end of 2022, initially with products weighing no more than 2.3 kg (mainly pharmaceuticals, cosmetics or pet products). The expected delivery time will be around 30 minutes or less.
As Jeff Wilke, former CEO of Amazon Worldwide Consumer, explains in an article[82], the new Amazon Prime drones have an original design and include advances in efficiency, stability and safety. It is a hybrid design, which will advance the state of the art as it is capable of vertical take-offs and landings. The model is able to easily switch from airplane mode to vertical mode and vice versa.
The characteristic aircraft is controlled with six degrees of freedom, as opposed to the standard four, making it more stable and able to operate safely in stronger wind conditions.
Customers also demand a certain degree of safety, which is why the drone will also be independent.
In transit for the delivery of a product, the drone must be able to identify static and moving objects from any direction. The technologies used are multi-view stereo vision to detect static objects and the use of proprietary computer vision and machine learning algorithms for moving objects.

[82] https://www.aboutamazon.com/news/transportation/a-drone-program-taking-flight

For the drone to descend for delivery to a place clear of objects and people, explainable stereo vision is used in parallel with sophisticated AI algorithms.

Figure 45: New 'Prime Air' drone model

b) RFID TECHNOLOGY

A new technology used to manage logistics information is RFID or Radio-Frequency IDentification. [83]
This solution identifies a technology for the automatic identification and/or storage of information, based on the storage capacity of particular media called tags or transponders and their ability to respond to remote interrogations by special fixed or portable devices called readers.
Exploiting RFID technology as a logistical identification solution for the warehouse, rather than the traditional bar code, has several advantages.
Meanwhile, there is the possibility of reading the code of several products in the same container within a short period of time and transmitting it to the management information software. Other advantages include the reliability of the reading, the elimination of the need to 'see' the label and most of the paper media used in the warehouse, and a shorter duration of operations such as the recording of incoming loading units, control of what is picked up by the pickers, shipment control and inventory control.
RFID technology also has disadvantages, starting with the initial investment, the cost of the RFID tag is too high for consumer goods.

[83] https://www.logisticaefficiente.it/wiki-logistica/magazzino/rfid.html

Risk of uncertain readings in the case of aggregates of items, this can be due to interference caused by the presence of liquid masses or metal surfaces that do not allow the exchange of radio signals.
Because of this problem, the company must also incur expenses due to the replacement of metal trolleys with plastic ones.
Non 'digital' customers cannot use this product, the environmental impact of the tags is not negligible and finally there is a problem of violating the customer's privacy, the company could reconstruct the customer's purchase history.
This technology is widely used in the management of goods in the warehouse.
Operators thanks to RFID can know when an item is loaded in the warehouse and when it is removed, this allows them to know exactly when to order products that have reached their stock limit and to access a series of data and statistical information on the movement of goods.

This type of technology can be considered by companies in the luxury sector for warehouse management.
Fashion companies are optimizing their operations by using RFID tags to[84]:

- ***Fighting product counterfeiting.*** Fashion industries suffer huge losses due to counterfeiting activities.
  Salvatore Ferragamo has started using RFID technology precisely to combat fake products. The company started, back in 2014, to insert microchips inside its products, so they can check their authenticity by scanning them. For the same purpose, the company Moncler also started using this technology to provide its consumers with an app or web service through which they could scan their newly purchased products.

- ***Improving the in-store shopping experience***. British fashion brand Burberry is focusing heavily on increasing sales and customer satisfaction through the use of Big Data and AI.
  Through loyalty and rewards programmes, the company asks customers to voluntarily share certain data. This information is used to offer personalized recommendations, online and in-store. When an identified customer enters a shop, sales assistants use tablets to offer shopping suggestions based on the customer's purchase history and their social media activity. If Burberry knows that a customer has recently purchased a particular coat, for example, assistants

[84] https://www.launchmetrics.com/it/risorse/blog/la-tecnologia-rfid-5-modi-in-cui-i-brand-della-moda-la-stanno-utilizzando

can be encouraged by the app to show them a bag that is popular with other coat buyers.
Products in their 500 shops in 50 countries are also equipped with RFID tags that can communicate with shoppers' mobile phones, providing information on how the items were produced or advice on how they can be worn or used.
Ralph Lauren's store in Manhattan uses RFID technology to give customers information about the product they are trying on, such as whether it is available in other colors or sizes.

- ***Keeping stock under control and speeding up replenishment***. By tagging its products with RFIDs, Inditex, the global fast fashion giant, allows staff to know exactly where items are in the warehouse and control when it needs to be replenished. The warehouse is automatically informed of which products it needs to replenish when something is purchased, but those managing the stock can take inventory in much less time than before. Having this level of control over one's warehouse means knowing exactly what needs to be produced or reordered, thus avoiding misjudgments and unnecessary expenditure.

- ***Keeping track of samples.*** When fashion companies grow to the point where they start shipping samples a all over the world, e.g. for various editorial content or events, there is a significant risk of these items getting lost. Fortunately, there are sample tracking platforms that use RFID tags to control exactly which products have left the showroom, where they are, whether they are on their way back to the atelier or whether they have been lost. Thanks to this innovation, fashion companies have seen an 85% drop in lost samples.

c) GREEN LOGISTCS

The textile industry is the second most polluting industry in the world. The textile industry (including cotton cultivation) uses around 93 billion cubic meters of water each year, i.e. 4% of the global drinking water. Most of the cotton production is located in countries that already suffer from drinking water shortages such as China, India, the USA, Pakistan and Turkey.
In China, for example, 80% to 90% of textiles, yarns and plastic-based fibers are produced in regions suffering from water scarcity.
In addition, after-sales also involves an exaggerated use of resources; it is estimated that an additional 20 billion cubic meters of water are consumed annually for garment care.
Many companies today are increasingly moving towards green logistics to reduce pollution globally.

French group Kering, has managed to gain prestigious Leed platinum certification for its two buildings in the new logistics hub in Trecate, in the province of Novara, Italy, in a short space of time.
LEED[85] is a voluntary certification program that can be applied to any type of building (both commercial and residential) and covers the building's entire life cycle, from design to construction.
LEED promotes a sustainability-oriented approach, recognising building performance in key areas such as energy and water savings, CO2 emissions reduction, improved indoor ecological quality, materials and resources used, design and site selection. Developed by the U.S. Green Building Council (USGBC), the system is based on awarding 'credits' for each requirement. The sum of the credits makes up the four levels of certification: basic, gold, silver, platinum.
Kering's logistics hub is equipped with the second largest photovoltaic roof in Europe, with a capacity of 12.7 MWp, which far exceeds the energy needs of the entire site. In addition to the photovoltaic roof, the building has also achieved the highest level of LEED certification thanks to a sophisticated system for reducing water consumption, which allows water use to be reduced by 50%.[86]
The hub meets demand from regional warehouses, direct shops, wholesale distribution and ecommerce worldwide, significantly improving the group's shipping and warehousing capabilities. It will also reduce lead times by 50 per cent, increasing the speed of deliveries and further strengthening collaboration with the group's brands.[87]
Many companies are increasingly moving toward green logistics, even Golden Lady, as explained in the previous chapter is implementing a number of initiatives aimed at reducing waste and the emission of CO2 into the environment.

d) BLOCKCHAIN IN LOGISTICS

As mentioned earlier, blockchain can impact business logistics especially in the area of documents and traceability of goods.
With blockchain, documents and physical assets are transformed into digital objects that find a unique representation in the distributed ledger. This is a shared ledger that allows each actor in logistics to add the data generated by its own systems onto an infrastructure capable of storing all transactional information, as well as providing tracking of supply chain movements without the need for any intermediation and, above all, in a secure and automated manner.
The benefits of blockchain in connected logistics are several:

[85] https://www.certificazioneleed.com/edifici/
[86] https://www.mffashion.com/news/livestage/kering-campione-del-lusso-green-202205271907141372
[87] https://www.mffashion.com/news/livestage/kering-campione-del-lusso-green-202205271907141372

- **Origin of goods**, various mechanisms including long-term trust relationships, government regulations or strict certification processes act as proxies for provenance verification.
- **Data transparency,** the digital ledger allows all data to be recorded ensuring transparency and reliability of the information collected and sent.
- **Smart contracts,** on the blockchain platform contracts can be concluded automatically when conditions are met, saving time and costs.
- **Secure data through decentralisation**, blockchain networks can employ cryptographic measures to make it almost impossible to change the sequence of data.
- **Reliable permission-based access**, various levels of access to information are established.
- **Clarity in asset management**, assets can be tracked and ownership changes can be managed at any time, with information on pending transfers available.
- **Scalable solution for order management.**
- **Real-time asset tracking**, IoT peripherals installed on board trucks and integrated with blockchain platforms can automatically send confirmation of pick-up, transport temperature, unloading of goods and other data.
- **Virtual networks**, companies may be able to use blockchain to develop entirely new business models, such as virtual global networks, shared carrier fleets and on-demand personnel.

9.2 CONSUMER HABITS

The consumer is at the centre of every logistical decision, companies move and change according to consumer needs and habits to remain competitive in the global market. Most consumers make purchasing choices by considering the potential environmental impact of a product or service, hence one of the reasons why companies are increasingly moving towards green logistics.
After the Covid 19 pandemic, purchasing habits have changed, with consumers increasingly buying online and favoring digital payments and contactless deliveries. The luxury e-commerce sector has been one of the sectors most affected by this change due to the pandemic forced change in consumer buying habits.
Companies have to go beyond normal e-commerce, they have to be able to anticipate the changes of the future, mainly due to an ever faster technological evolution. Some companies are already starting to expand, or at least are planning to do so in the near future, into the virtual world, from virtual boutiques to video games to the metaverse.

a) GUCCI GARDEN VIRTUAL TOUR

Gucci garden virtual tour is the virtual tour of the Gucci world that allows lovers of the fashion house to visit the various exclusive areas that make up the space, physically set up in the old 'Palazzo della Mercanzia' in Florence.
The site presents various rooms that can be visited from the comfort of your own home with your own PC; it is possible to visit the control room, the boutique, the bookstore, and finally there is also a restaurant run by Massimo Bottura, the Italian restaurateur elected the best in the world in 2016 and 2018.
For the restaurant room, it is possible to view the menu and book a table.
In the boutique you can visit the various rooms, press where the Gucci clothes or accessories are and enter your details (name, email and phone number) if you want some more information about the item. It is possible to purchase some of these special pieces by email or phone, they are exclusive items that tell the story of the house.
This is a way conceived by Gucci to reach people from all over the world, there is no longer the need to physically go to the shop to buy the most exclusive products.[88]

b) LANCÔME VIRTUAL SHOP

In 2020, the L'Oréal beauty brand, Lancôme, debuted its first virtual pop-up shop, exclusively for Singapore.
Combining the online and offline shopping experience, the physical store is replicated through live chatbots and pulsating hotspots within the virtual flagship to guide the consumer across its five zones: Discover, Explore, Inspire, Live and Shop.
In the first 'Discover' zone, consumers are invited to take a 'Lancôme Strength-Finder Personality Test' designed by psychologist Dr. Perpertua Neo to understand their personality.
In the 'Explore' zone, consumers can upload a selfie and receive a skin diagnosis during a virtual consultation conducted via a live chatbot function. The journey continues with its third 'Inspire' zone, where 100 women share their narratives of their experiences. The fourth 'Live' zone is a live streaming section where celebrities and influencers make a special appearance to also discuss topics from their lifestyle and personal journey with their inner strength and empowerment.
Lastly, the experience ends with the 'Shop' where the full range of products and customization will be made available within this zone for purchasing.
The brand in this way is offering a customer service that goes beyond the simple purchase of the product, it is selling an increasingly personalised and immersive

[88] https://guccigarden.gucci.com/#/it/

consumer experience with digital services such as virtual testing, diagnostics and live streaming.[89]

c) LUXURY COMPANIES IN THE ESPORTS WORLD

Gucci is the first luxury fashion brand to make its debut in the world of esports (electronic sports). The project is called Gucci Gaming Academy and aims to turn young promising e-sports players into professional digital athletes.
At the end of May, Dolce & Gabbana also presented a format that will aim to involve various esports organisations around the world.
It will be called 'gooDGame', the new project created ad hoc by the Italian haute couture house. This project aims to address, and become a milestone, in the world of gaming and esports. Four global organisations will be part of it, all of them with their respective gaming houses, i.e. those places that will host gamers during training and preparation for major competitions.
The project is being developed through a series of initiatives, including a partnership with Mkers to create one of the first Gaming House twins ever documented, SKNUPS to create ad-hoc digital content and collections designed for gamers.
As part of the project, Dolce & Gabbana has also entered into a strategic partnership with SKNUPS, a digital collectibles platform for the metaverse, to create and integrate its own branded skins into major video games.

9.3 FINAL CONSIDERATIONS

The world is changing very fast, technology plays and will play a major role in our lives.
Demand forecasting no longer exists, the various events that have profoundly impacted our lives such as pandemic, war, financial collapse, climate change, show that the future cannot be predicted, that demand forecasts are now unreliable. It is no longer possible to aim for large-scale production and shipment, it is necessary to aim for speed of production, to wait for customer demand and to be able to produce in the shortest possible time.
Our increasingly frenetic daily lives, the end of a pandemic that forced us to stay isolated and shut indoors, have drastically changed our habits.
Our buying habits have changed, and all kinds of companies have had to take this into account, even those selling luxury products that until a few years ago relied on selling in

[89] https://www.forbes.com/sites/tiffanylung/2020/08/18/lancome-virtual-pop-up-reinvent-future-of-beauty-retail-post-covid/?sh=67a877717795

physical stores to offer a 360-degree customer experience, with physical people able to help and satisfy the customer's needs.
With the pandemic, this type of company also had to adapt, recreating the same experience offered to the customer in stores, in e-commerce. Even in the online shop, the customer must perceive the same attention, the same importance that is given to him in the boutique, because the purchase of the luxury product includes an experience, a service that distinguishes it from other, lower-end products, in addition, of course, to the high quality of the product itself.
The new frontier of technology is represented by the metaverse, a sort of virtual reality shared via the Internet, where one is represented in three dimensions through one's avatar.
The use of the metaverse has already begun with the purchase of virtual land, the creation of flagship shops, and even the first entirely virtual fashion shows.
In this sense, Nike recently launched 'Nikeland' on Roblox, where virtual customers are greeted by James LeBron's avatar, attracting some 7 million people from 224 countries. In Nikeland, all avatars wear Nike tracksuits, shoes and caps. The company's goal is to launch prototype shoes and have users try them on in the virtual world, before starting mass production in the real world.
In the same universe, Gucci created its 'Gucci Garden Experience', an event to attract Gen Z. And that is exactly what happened: a digital Gucci handbag sold for 350,000 Robux, about $4,115.[90]

What if instead of just testing products, real boutiques were not created where customers, through their avatars, which will be faithfully created, based on real characteristics (size, length, skin and hair color etc.), could try on and buy products? These products would then be shipped to the customers' homes and this would also decrease the effect of reverse logistics due to the online purchase of products in the wrong size or models that customers do not like when worn.
In this case, one would have the opportunity to look at and try on the product directly from home as if one were in the physical shop.
Moreover, for the consumer, online shopping is also a time gain, especially considering today's chaotic rhythms and working hours.
If AI were also used to recreate characters that could advise customers, such as chatboxes, shops in the metaverse could be open 24/7 and this would also increase productivity, sales and profit for brands.

[90] https://www.bitmat.it/blog/internet/metaverso/metaverso-e-ecommerce-cosa-ne-sara-dello-shopping-online/

The 'conquest' and creation of services in the virtual world of the metaverse is not such a far-fetched idea, but it will certainly be something that will be implemented in the very near future.
Thinking about it, we are already moving towards that prospect, even if only virtual stores are still being used, we are moving towards increasingly contactless product sales, where the consumer is able to try the product directly from home, an activity only possible until now for make-up products or in the eyewear sector.
Several companies in the eyewear sector, such as Luxottica, use Virtual Mirror technology on their website, which allows, thanks to augmented reality, an online shopping experience comparable to the real thing.
By looking into the camera, just as one would in front of a mirror, one can see oneself wearing the desired glasses. The reproduction accompanies your head movements and although it gives a digital reflection, the effect you get is very faithful to the effect you would have in person.
So, if it works for glasses, why couldn't one take the next step and extend this functionality for clothing as well? You could, for example, create avatars by entering your personal physical data to try on clothes and try them on from the comfort of home as if you were in a shop fitting room.

ANNEX

- CHINA[91]

ARTICLE	PERCENTAGE DUTY RATE (BEFORE 2018)	PERCENTAGE DUTY RATE (AFTER 2018)
Wool and leather clothing	23%	10%
Kashmir yarn and sweaters	14%	7%
Woolen men's clothing	16%	8%
Woolen woman's clothing	16%	8%
Wool men's suits	17.5%	10%
Wool woman's suits	17.5%	10%
Boots and shoes	24%	12%

Table 6: Change in the percentage of duties in China since 2018

- USA[92]

According to the HTSUS (Harmonized Tariff Schedule of the United States), the duties in the United States are as follows:

ARTICLE	PERCENTAGE DUTY RATE
Women's cotton dresses	14.9%
Women's wool dresses	14%
Man's cotton dresses	13.2%
Man's wool dresses	7.5%
Tie	7.2%
Wool gloves	3.5%
Cotton shirts for children	14.9%
Cotton shirts for men	8.7%

[91] https://svadvisory.com/dazi-doganali-cina-tagli-sui-beni-lusso/

[92] https://exportamericagroup.com/it/il-blog-di-export-america/esportare-articoli-di-abbigliamento-negli-usa/

Silk shirts for women	6.9%
Cotton pyjamas	8.9%

Table 7: Percentage of duties in the United States

- EUROPE[93]

	BEFORE 2021		**FROM 2021**	
ASSET VALUE	**TVA**	**CUSTOM DUTIES**	**TVA**	**CUSTOM DUTIES**
≤ 22 €	No	No	Yes	No
> 22 € ≤ 150 €	Yes	No	Yes	No
> 150 €	Yes	Yes	Yes	Yes

Table 8: Taxation in Europe

[93] https://support.packlink.com/hc/it/articles/208492135-Quando-vengono-addebitati-i-dazi-doganali-e-come-si-calcolano-

REFERENCES

WEB SITES AND OTHER DOCUMENTS

- 'What is the right supply chain for your product?', by Marshall L. Fisher, 1997 http://mba.teipir.gr/files/Fisher_What_is_the_right_SC_for_your_product.pdf

- 'Luxury & Premium 50 2021 ranking', 2021 https://brandirectory.com/rankings/luxury-and-premium/table

- Reverse logistic, 2020 https://economiacircolare.com/glossario/reverse-logistic/

- 'Esportare articoli di abbigliamento negli USA', 2021 https://exportamericagroup.com/it/il-blog-di-export-america/esportare-articoli-di-abbigliamento-negli-usa/

- 'Outsourcing's Repercussions on the luxury industry' https://fashionbi.com/newspaper/outsourcing-s-repercussions-on-the-luxury-industry

- 'Anche le grandi firme hanno i loro saldi' by Maddalena Roberta (staff writer, Forbes), 2019 https://forbes.it/2019/01/02/dove-trovare-lusso-firme-saldi-outlet-griffati/

- 'LVMH lance un service d'"engagemenr de livraison" avec OneStock', by Sandra Halliday, 2020 https://fr.fashionnetwork.com/news/Lvmh-lance-un-service-d-engagement-de-livraison-avec-onestock,1179016.html

- 'Come funzionano le consegne "contactless" di Tesla anti-Coronavirus', by Flavio Atzori, 2020 https://insideevs.it/news/407290/coronavirus-tesla-consegna-casa-contactless-model3-modely/

- 'Kering riorganizza in profondità la propria logistica', by Dominique Muret, 2021 https://it.fashionnetwork.com/news/Kering-riorganizza-in-profondita-la-propria-logistica,1293407.html

- 'Hainan is paradise island for Chinese duty-free shoppers' by Christophe Roulet, 2021 https://journal.hautehorlogerie.org/en/hainan-is-paradise-island-for-chinese-duty-free-shoppers/

- 'Luxury 2.0: alla scoperta del lusso' https://marketingtechnology.it/luxury-2-0-piramide-del-lusso/

- 'Who is the target audience for luxury brands?', 2019 https://mediaboom.com/news/target-audience-for-luxury-brands/

- 'Amazon Announces new shopping experience, "Luxury stores"', 2020 https://press.aboutamazon.com/news-releases/news-release-details/amazon-announces-new-shopping-experience-luxury-stores/

- ‘Dazi doganali: cosa sono e quando sono dovuti’https://www.packlink.it/dazi-doganali/?gclid=CjwKCAjwquWVBhBrEiwAt1KmwipcGPBO2ysiXzO9A_myUuspWEfi-avKqGSQpllxAdKgIiIkUz4bCxoCv_gQAvD_BwE

- ‘Dazi doganali Cina: tagli sui beni di lusso’ https://svadvisory.com/dazi-doganali-cina-tagli-sui-beni-lusso/

- ‘I robot di Amazon arrivano in Italia’, by Matteo Acitelli, 2017 https://tech.fanpage.it/i-robot-di-amazon-arrivano-in-italia/

- ‘A drone program taking flight’, by Jeff Wilke, 2019https://www.aboutamazon.com/news/transportation/a-drone-program-taking-flight

- ‘Luxury goods worldwide market study, fall–winter 2018’, by Bain & Company, 2019 https://www.bain.com/contentassets/8df501b9f8d6442eba00040246c6b4f9/bain_digest__luxury_goods_worldwide_market_study_fall_winter_2018.pdf

- ‘China’s Unstoppable 2020 luxury market’, by Bruno Lannes and Carrie Zhang, 2020 https://www.bain.com/insights/chinas-unstoppable-2020-luxury-market/

- ‘Luxury Goods Worldwide Market study, fall-winter 2017, by Claudia D’Arpizio, Federica Levanto, Marc-Amdré Kamel and Joëlle de Montgolfier, 2017 https://www.bain.com/insights/the-future-of-luxury-bouncing-back-from-covid-19/ https://www.bain.com/insights/luxury-goods-worldwide-market-study-fall-winter-2017/

- ‘The future of luxury: bouncing back from covid-19’ by Claudia D’Arpizio, Federica Levanto, Filippo Prete, Constance Gault and Joëlle de Montgolfier, 2021 https://www.bain.com/insights/the-future-of-luxury-bouncing-back-from-covid-19/

- Heterogeneous mix of 330 million consumers purchasing €217 billion in luxury goods globally, 2014 https://www.bain.com/migration/press-releases/2014/lens-on-the-worldwide-luxury-consumer/

- ‘Metaverso e ecommerce: cosa ne sarà dello shopping online?’, 2022 https://www.bitmat.it/blog/internet/metaverso/metaverso-e-ecommerce-cosa-ne-sara-dello-shopping-online/

- ‘Certificazione Leed’ https://www.certificazioneleed.com/edifici/

- ‘What is Amazon Prime Now?’, by Erika Rawes and Gia Liu, 2021 https://www.digitaltrends.com/home/what-is-prime-now/

- ‘Are you spending too much on logistics?’ by Fiona O’Connor, 2020 https://www.edesk.com/blog/are-you-spending-more-than-you-should-on-logistics/

- ‘Autoatore: the cube storage pioneer’ https://www.fivesgroup.com/smart-automation-solutions/technologies/as-rs/autostore

- ‘Lancôme’s Virtual Pop-Up To Reinvent The Future Of Beauty Retail Post-COVID’, by Tiffany Lung, 2020 https://www.forbes.com/sites/tiffanylung/2020/08/18/lancome-virtual-pop-up-reinvent-future-of-beauty-retail-post-covid/?sh=67a877717795

- ‘I progetti realizzati in Golden Lady Company: economia circolare e sostenibilità’, 2020 https://www.ilgiornaledellalogistica.it/case-history/i-progetti-realizzati-in-golden-lady-company-economia-circolare-e-sostenibilita/

- ‘Kering a Novara con il polo gigante che consegnerà il lusso nel mondo’, by Chiara Beghelli, 2021 https://www.ilsole24ore.com/art/kering-novara-il-polo-gigante-che-consegnera-lusso-mondo-ADKZ6EWB#U3012457688808HH

- ‘Gucci presenta la sua ‘Aria’ con Balenciaga e non solo’, by Federica Salto, 2021 https://www.iodonna.it/moda/news/2021/04/15/gucci-balenciaga-alessandro-michele-aria-sfilata-kering/

- ‘Kering rafforza le proprie attività logistiche con un nuovo sito nel nord Italia’, 2021 https://www.kering.com/it/news/kering-rafforza-le-proprie-attivita-logistiche-con-un-nuovo-sito-nel-nord-italia

- ‘La tecnologia RFID: 5 modi in cui i brand di moda la utilizzano’, 2017 https://www.launchmetrics.com/it/risorse/blog/la-tecnologia-rfid-5-modi-in-cui-i-brand-della-moda-la-stanno-utilizzando

- ‘CPFR: L’evoluzione dei sistemi di riordino’, 2016 https://www.logisticaefficiente.it/tesisquare/supplychain/scorte/cpfr-l-evoluzione-dei-sistemi-di-riordino.html

- ‘RFID (Radio Frequency Identification)’, 2022 https://www.logisticaefficiente.it/wiki-logistica/magazzino/rfid.html

- ‘Inbound, intra and outbound logistics’ https://www.logistiikanmaailma.fi/en/logistics/logistics-and-supply-chain/inbound-inhouse-and-outbound-logistics/

- ‘Versace to design H&M range’, by Rosie Backer, 2011 https://www.marketingweek.com/versace-to-design-hm-range/

- ‘China luxury report 2019, by McKinsey, 2019 https://www.mckinsey.com/~/media/mckinsey/featured%20insights/china/how%20young%20chinese%20consumers%20are%20reshaping%20global%20luxury/mckinsey-china-luxury-report-2019-how-young-chinese-consumers-are-reshaping-global-luxury.ashx

- ‘Kering campione del lusso green’ by Federica Camurati, 2022 https://www.mffashion.com/news/livestage/kering-campione-del-lusso-green-202205271907141372

- ‘Logistics and supply chain management in the luxury industry’, by Bin Shen, Stefan Minner, Hau-Ling Chan and Alessandro Brun https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7525258/

- ‘5 macro trend dell’industria del lusso nel 2021’, by Filippo D’Asaro, 2021 https://www.nssmag.com/it/fashion/24740/macro-trend-lusso-2021

- ‘Con l’outlet il brand fa il vero fatturato’ by Anna Ricca, 2020 https://www.radiocolonna.it/economia/con-loutlet-il-brand-fa-il-vero-fatturato/

- ‘Il lusso è già oltre la pandemia: nel 2021 più utili, più e-commerce e un’ondata di acquisizioni’, by Sara Bennewitz, 2021 https://www.repubblica.it/economia/2021/04/27/news/un_2021_effervescente_per_le_griffe_di_altagamma_piu_shopping_anche_di_marchi_piu_utili_e_piu_e_commerce-298365356/

- ‘Perché i marchi del lusso distruggono i loro prodotti’ by Silvia Schirinzi, 2018 https://www.rivistastudio.com/borse-gucci-louis-vuitton-burberry-usate-invenduto/

- ‘Feature article – Delayed differentiation skids & product variation efficiency’, 2020 https://www.specchemonline.com/feature-article-delayed-differentiation-skids-product-variation-efficiency#:~:text=Delayed%20differentiation%2C%20also%20known%20as,end%20of%20the%20manufacturing%20process

- ‘S&P Global Luxury Index’ https://www.spglobal.com/spdji/en/indices/equity/sp-global-luxury-index/#overview

- ‘The Armani Group and YOOX NET-A-PORTER GROUP come together to design distribution model for the future’, 2020 https://www.ynap.com/news/the-armani-group-and-yoox-net-a-porter-group-come-together-to-design-distribution-model-for-the-future/

- ‘Progettare un magazzino: come massimizzare selettività e densità’, 2021 https://www.youtradeweb.com/2021/03/progettare-un-magazzino-come-massimizzare-selettivita-e-densita/

- ‘Deloitte: nonostante la pandemia, il 100% degli investitori continuerà nel 2021 a investire nel settore del Lusso.’ https://www2.deloitte.com/content/dam/Deloitte/it/Documents/finance/CS_%202021DeloitteGlobalPEFashionLuxurySurvey.pdf

- ‘Global Powers of Luxury goods 2021’ https://www2.deloitte.com/global/en/pages/consumer-business/articles/gx-cb-global-powers-of-luxury-goods.html

THESIS AND OTHER ARTICLES

- ‘Le basi della logistica’, Balestri Gianfranco

- ‘La logistica dei trasporti e il vehicle routing problem’ by Alessandra Riccobono, 2014 https://core.ac.uk/download/pdf/79617932.pdf

- Analisi del settore dell’abbigliamento luxury nel mondo dell’e-commerce, by Andrea Lerda, 2020 https://webthesis.biblio.polito.it/16114/1/tesi.pdf

- ‘Logistics and supply chain management in luxury fashion retail: empirical investigation of Italian firms’, 2008 https://www-sciencedirect-com.docelec.insa-lyon.fr/science/article/pii/S0925527308000455?via%3Dihub#sec5, paragraphs: ‘Supply chain management choices in the luxury segment of the fashion industry’ and ‘Impact of critical success on supply chain configuration and management’

- V. Bini, La supply chain della moda. Strumenti per la gestione globale dell’impresa: dallo sviluppo del prodotto al negozio, Milano, Franco Angeli, 2011

- Webinar ‘KPI for logistics excellence’, Simco consulting

- Webinar ‘What automation to densify storage and gain area’