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Artificial Intelligence in the Luxury and Fashion Industry: How Communication of AI Impacts on Consumers' Perception of the Luxury of Products and Brand

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INTRODUCTION

Fashion is my biggest passion, a complex art which is sometimes defined as superficial. On the contrary, I am strongly convinced that fashion has always had a central role in society, since it is the reflection of cultural changes and revolutions. For example, Coco Chanel allowed women to wear for the first time what was considered as exclusively men's clothing: pants. Trousers wore by women gave power to women's right to be free both mentally and physically in a strongly masculine society. Or Gucci's gender-neutral shopping category on official website introduced in 2020 in order to "*set out to deconstruct preconceived binaries and question how these concepts relate to our bodies. Celebrating self-expression in the name of all gender equality, the House presents MX*" (Gucci official website, https://www.gucci.com/it/it/st/mx-landing). The fashion world has always had an avant-garde position, trying to give voice to the most hidden parts of a society.

The fashion industry, especially the luxury one, still remains one of the supporters and pioneers of ancient arts and crafts that are often forgotten or fallen into disuse. Dior organized its fashion show for its Cruise Collection 2021 in Lecce, having the garments sewn by local dressmakers who used ancient techniques and tools, such as the "*tombolo*", nowadays known to few. The show highlighted the beauty of garments' craftsmanship and brought to light a traditional craft of the Italian culture known only by a minority of the population. Another example in which arts and crafts are emphasized is "*Les journèes Particuluères*" organized every year from 2011 by LVMH, a worldwide event in which LVMH brands show customers the ancient techniques and the work of their craftsmen. The event brings together watchmakers, tailors, experts in the art of *baudruchage*, shoemakers, *chef de cave*, jewelers, trunk makers, *chef remueur*, *première d'atelier* and chefs.

However, how does technological innovation stand in this context? How does it integrate with an industry that has always been based on creativity and craftsmanship? Apparently very distant concepts, fashion and technology are two worlds that nowadays coexist, often creating heated debates. The purpose of this paper is to analyze the use of technology within the fashion industry, especially focusing on the role of Artificial Intelligence. In fact, Artificial Intelligence is the type of technology that most emulates the decision-making processes of the human being and that learns from experience. It is the type of technology that is able to perform jobs that involve social interactions and conversations, that are roles that once could only be performed

by humans. So, the purpose of my research is to understand how these two worlds, the luxury fashion and Artificial Intelligence, connect with each other and see what the impacts on consumer perception are. In particular, since craftsmanship is one of the main characteristics that define fashion brand as luxury, I would like to analyze how the use of the communication of Artificial Intelligence in the production processes of garments impacts the perception of the luxury of both the products and of the brand itself.

The research is structured in 4 chapters. The first one consists in an overview of the luxury and fashion industry, giving an analysis of it from a competitive landscape, geographical, and products point of view. The sector is analyzed in a situation prior to Covid-19. Then, with the second paragraph, there is a digression on what Artificial Intelligence is (its history and its evolution over time) and its role in the fashion industry. In this way, it is possible to define in which clothing production and distribution chain processes this technology is applied and highlights its role and impacts: from demand forecasting tool to fashion designer, from a garments manufacturer to a tool that improves consumer experience and sustainability. The second chapter, instead, focuses on what is the definition of luxury and all the elements that characterize it. In particular, there is an analysis of the role of craftsmanship and how it is communicated to consumers by luxury brands. I wanted to focus on the concept of craftsmanship because it is the characteristic of luxury brands that most clashes with the use of Artificial Intelligence. The third chapter represents the empirical section of this paper, with the aim of understanding how Artificial Intelligence impacts on the perception of luxury of the product and brand. The study was implemented through a questionnaire sent to a sample of 240 people. The paper, then, ends with the chapter dedicated to conclusions.

CHAPTER ONE

The objective of this chapter is both to analyze the use of Artificial Intelligence in the luxury industry with a focus on the fashion market and give stakeholders an overview and a food off thought about the actual debate. The analysis includes examples about real companies that are implementing Artificial Intelligence inside their business and the related consequences and benefits. The involved stakeholders are:

- Consumers, as people directed affected by the research. Indeed, most of consumers are not enough conscious about what is the role that Artificial Intelligence is playing in fashion and luxury businesses and what are the diverse uses that it can have inside the industry. Even today people still think that the luxury world is a sector that does not make use of new technologies, when, on the contrary, it is a constantly evolving industry.
- Luxury and fashion industry and producers, since they are the entities that implement this kind of technology. In one hand, some companies operating in the sector have a very limited use of Artificial Intelligence and therefore could draw positive or negative cues from the study. On the other hand, other companies apply in a consistent way Artificial Intelligence without communicating to the outside world their real use, perhaps for fear of affecting the consumer's perception of the brand.
- Suppliers of the fashion and luxury industry, since Artificial Intelligence can optimize the efficiency of the entire supply chain. The use of this technology can create synergies among all actors of the industry, maximizing revenues and minimizing both costs and wastes.
- All people interested in sustainability and planet preservation. As explained in the following paragraphs, the fashion industry is one of the most polluting one and Artificial Intelligence plays a significant role in contributing to eliminate garments and row material wastes.

Starting with an overview about the luxury and fashion industry analyzed in pre-Covid19 conditions, them all the use of Artificial Intelligence in the fashion market are explained. The interested technology affects all the garments' production process, from the design to the cutting and sewing, from the quality control to inventory management. Moreover, AI goes further: it impacts and enhances the customers' experience both online and offline, boosting the capability of companies to personalize and make the clients' experience unique.

1. The Luxury Industry Overview

The luxury market is one of the industries that has been subject to constant and exponential growth in the last decade (about 5% per year from 2015), achieving in 2017 US$ 247 billion of aggregate luxury goods sales[1]. Over the years, this market has been characterized by the presence of a number of corporate groups that dominate the industry. The main ones are LVMH, Kering, Richemont, all three French, and containing the following brands (respectively figure 1,2,3).

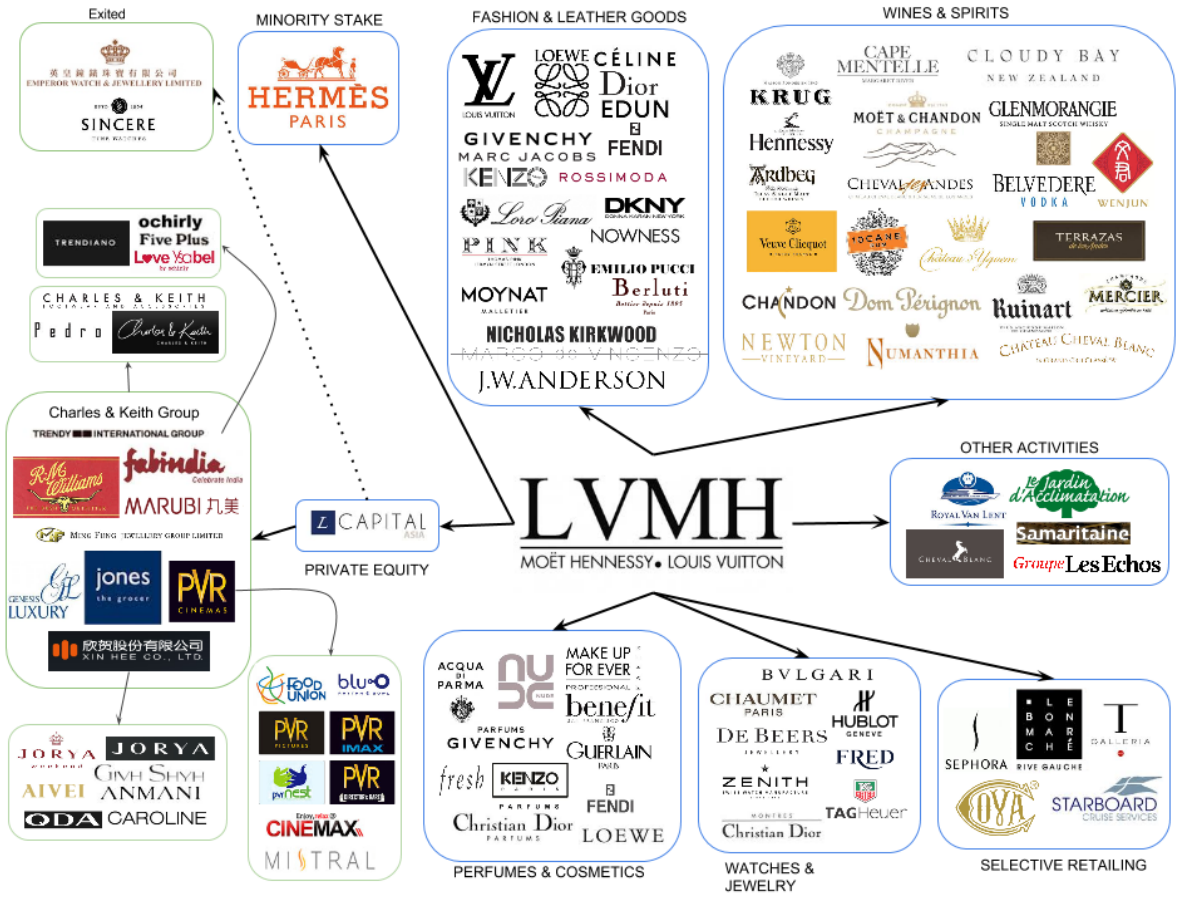


Figure 1. LVMH brands portfolio

[1]Deloitte., *Global Pawers of Luxury Goods 2019. Bridging the gap between the old and the new*, 2019, https://www2.deloitte.com/content/dam/Deloitte/ar/Documents/Consumer_and_Industrial_Products/Global-Powers-of-Luxury-Goods-abril-2019.pdf

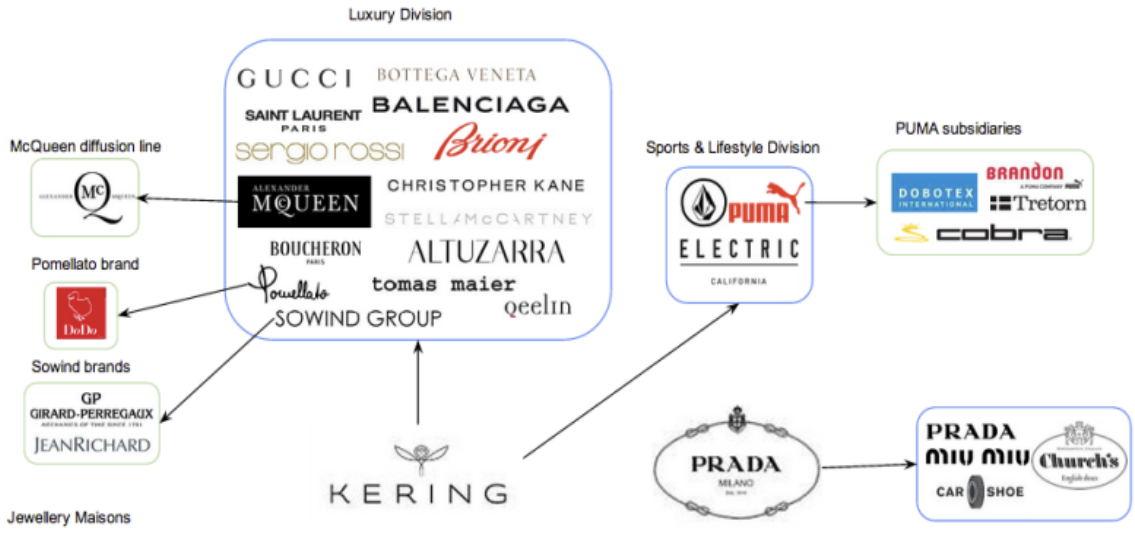


Figure 2. Kering brands portfolio

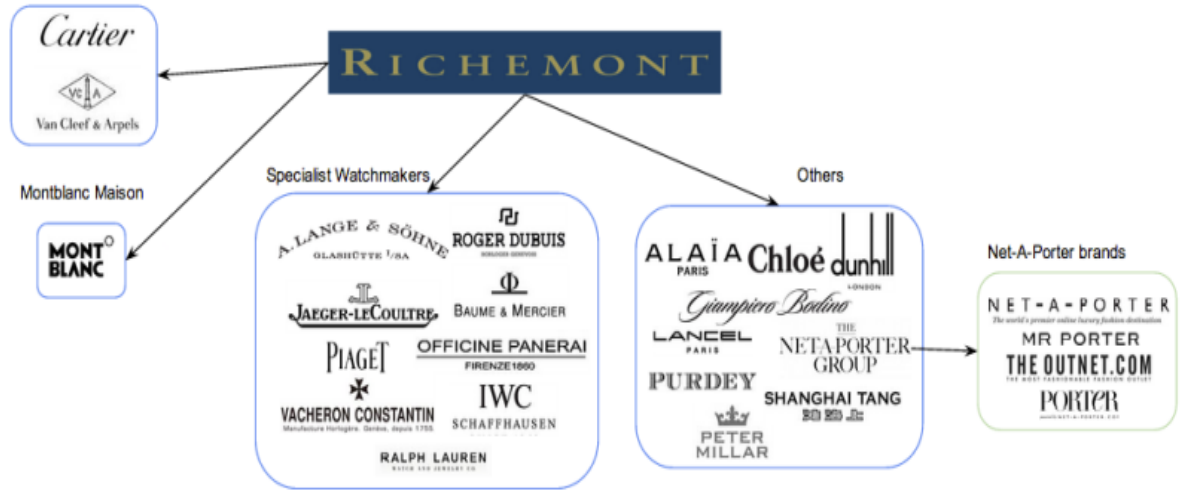


Figure 3. Richemont brands portfolio

In addition to the three giant luxury players, smaller groups compete such as the Prada Group and the MaxMara Group and some other independent brands that are mostly Italian, such as Salvatore Ferragamo, Brunello Cucinelli and Etro.

The consulting firm Deloitte, in the "Global Power of Luxury Goods 2019" report shows off the 10 top luxury companies ranked by sales based on FY2017 (Figure 4), giving a prospect of the market sizing of the luxury industry.

FY2017 Luxury goods sales ranking	Change in ranking	Name of company	Country of origin	FY2017 Luxury goods sales (US$m)	FY2017 Total revenue (US$m)	FY2017 Luxury goods sales growth*	FY2017 Net profit margin[1]**	FY2017 Return on assets**	FY2015-2017 Luxury Goods CAGR[2]*
1	⬌	LVMH Moët Hennessy-Louis Vuitton SE	France	27,995	48,057	17.2%	13.2%	8.2%	10.9%
2	⬌	The Estée Lauder Companies Inc.	US	13,683	13,683	15.7%	8.1%	8.8%	10.2%
3	⬌	Compagnie Financière Richemont SA	Switzerland	12,819	12,819	3.1%	11.1%	4.8%	-0.4%
4	⬆ +1	Kering SA	France	12,168	17,446	27.5%	12.1%	7.3%	17.2%
5	⬇ -1	Luxottica Group SpA	Italy	10,322	10,322	0.8%	11.4%	10.4%	1.8%
6	New	Chanel Limited	UK	9,623	9,623	11.5%	18.6%	19.6%	ne
7	⬇ -1	L'Oréal Luxe	France	9,549 e	9,549 e	10.6%	n/a	n/a	8.2%
8	⬇ -1	The Swatch Group Ltd.	Switzerland	7,819	8,082	5.4%	9.5%	5.6%	-2.9%
9	⬆ +1	Chow Tai Fook Jewellery Group Limited 周大福珠宝集团有限公司	Hong Kong	7,575	7,575	15.4%	7.1%	7.3%	2.2%
10	⬇ -1	PVH Corp.	US	7,355	8,915	10.7%	6.0%	4.5%	8.1%
Top 10				**118,909**	**146,071**	**14.2%**	**11.6%**	**7.8%**	**7.5%**
Top 100				**246,664**	**276,754**	**10.8%**	**9.8%**	**7.6%**	**5.3%**
Economic concentration of Top 10				**48.2%**	**52.8%**				

[1] Net profit margin based on total consolidated revenue and net income
[2] Compound annual growth rate
e=estimate n/a=not available ne=not in existence (created by reorganization)
*Top 100 sales growth rates are sales-weighted, currency-adjusted composites
**Top 100 net profit margin, return on assets and asset turnover ratio are sales-weighted composites
Source: Deloitte Touche Tohmatsu Limited. Global Powers of Luxury Goods 2019. Analysis of financial performance and operations for fiscal years ended through June 2018 using company annual reports and industry estimates.

Figure 4. Top 10 Luxury companies by FY2017 sales, SOURCE: Deloitte

The LVMH group dominates the industry thanks to its broad brand portfolio: a growth of 17.2% compared to the previous year. Its leadership position is also demonstrated by the fact that it holds 11.3%. share of the total Top 100 luxury goods sales. Moreover, it overperformed the average of the Top 10 by 3.0% and the Top 100 by 6.4%. In the same year, Kering performed the highest percentage growth (27.5%), overtaking Luxottica Group S.p.A. and placing fourth in the standings.

Deloitte developed the industry analysis also from a geographical point of view, determining how countries performed in the sector (Figure 5).

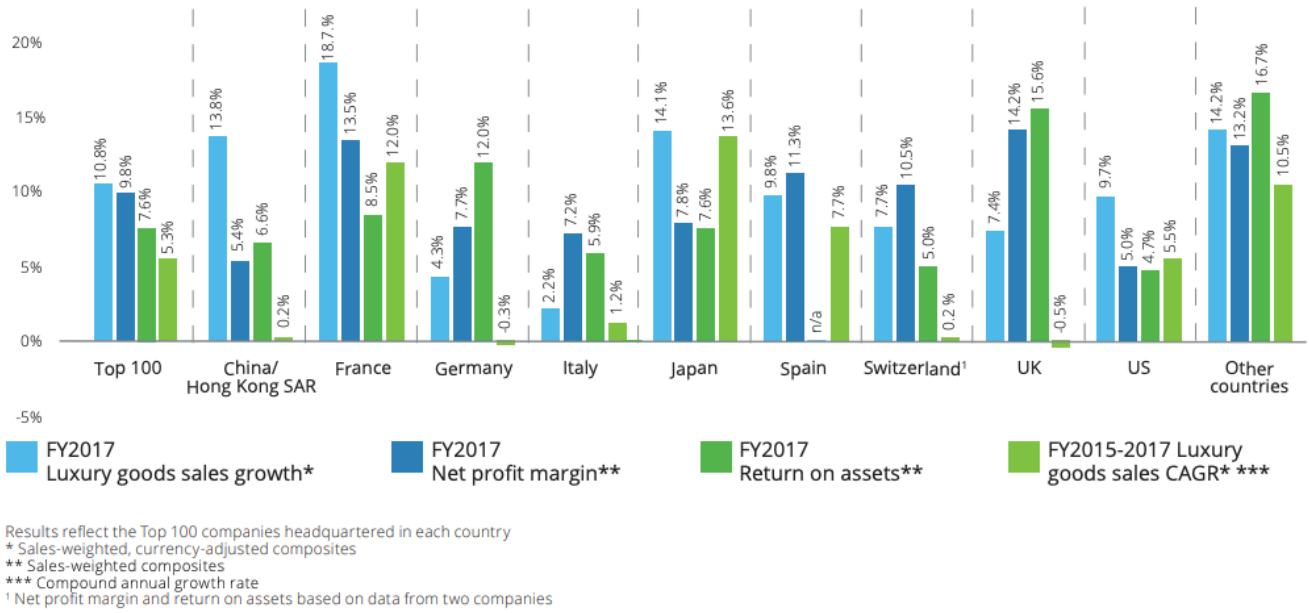


Figure 5. Performance by country FY2017, SOURCE: Deloitte

France has the greatest share (23.5%) of the total luxury goods sale, mainly due to LVMH, Kering SA, L'Orèal Luxe and Hermès. Obviously, the strong growth of both French groups and brands described above, had a strong and positive impact on the country's performance: a luxury goods sales growth rate of 18.7%.

A particular point of attention goes to China, with a luxury goods sales growth of 13.8%. This result is mainly due to the country's economic growth, increase of gold demand and an increase of purchasing power of both Millennials and women. The companies that contributed to this achievement are Chow Tai Fook Jewellery Group and Lao Feng Xiang, who represent nearly two out of three of their total luxury goods sales. China's profit margin grew up by 5.4%, underperforming the average of all countries but improving its results compared to past years.

Italy still remain the world-famous country for luxury, and "Made in Italy" is still perceived by consumers to be synonymous of elegance, craftsmanship, quality and taste. It holds the largest number of brands placed in the Top 100 ranking by Deloitte, among which more than 66% of the companies operate in the fashion industry (clothing and footwear). Italy confirms its global leadership for fashion luxury, so that Milan is also recognized as the "fashion capital of the world". According to the graph, this country was subjected to the lowest growth (2.2%)

in terms of luxury goods sales. This growth is mainly due to three Italian brands: Prada Group, Luxottica and Giorgio Armani.

Another interesting analysis developed by Deloitte in the "Global Power of Luxury Goods 2019" report is the study of the industry based on product sector, using five different luxury goods:

1. Clothing and footwear
2. Bags and accessories
3. Cosmetics and fragrances
4. Jewelry and watches
5. Multiple luxury goods

The figure below shows the performance for each product sector according to FY2017.

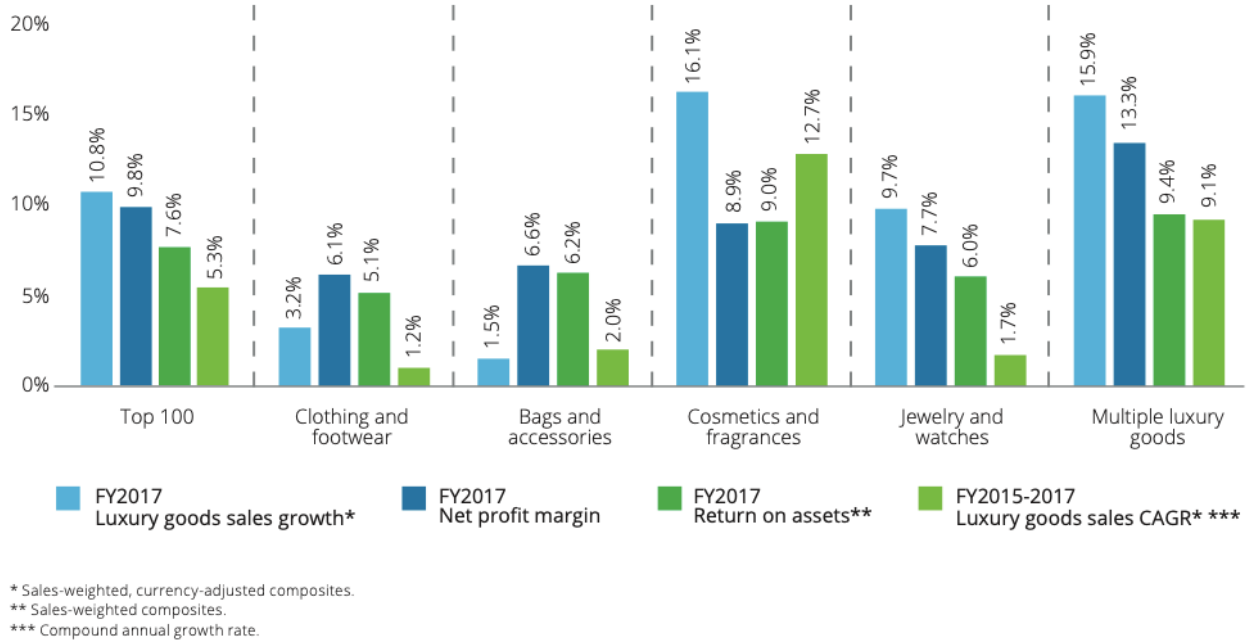


Figure 6. Performance by product sector FY2017, SOURCE: Deloitte

Starting from clothing and footwear, it is the sector in which the highest number of companies, present within the Top 100 ranking, operates (38), contributing to the 17% of the total luxury goods sales of 2017 mainly due to PVH Corp., Giorgio Armani, Ralph Lauren and Hugo Boss. The clothing and footwear sales growth (3.2%) was not so relevant compared to other sectors, positioning itself in fourth place. Even if most of the company operating in this market are

Italian (16 out of 38), the best performance was achieved by the American ones (Ralph Lauren and PVH Corp.).

Bags and accessories belong to the product category with the lowest number of companies operating in the luxury industry. The majority of them are located in Europe while the rest in USA. The sector net profit margin overperformed the clothing and footwear one reaching 6.6% and positioning in the fourth place according to overall performances. Moreover, from a sales growth point of view, this category was the less performant with 1.5 percentage growth.

Cosmetics and fragrances are the categories with the highest level of sales growth in 2017, achieving the 16.4% share of the Top 100 luxury goods sales. The market category is led by the two French group, Estée Lauder and L'Oréal Luxe, respectively in the second and seventh place according to Top 10 luxury companies by Deloitte. A relevant performance was detected in terms of growth rate: it was the sector with the fastest sales growth mainly due to the double-digit year-on-year growth of the company of the sector such as Shiseido Prestige & Fragrance and Coty Luxury.

Jewelry and watches represent the 29.6% shares of the Top 100 luxury goods sales in 2017, with Compagnie Financière Richemont SA, The Swatch Group, Chow Tai Fook, Rolex and Lao Feng Xiang as best performer companies. The sector is experiencing an ever-increasing expansion of Asian brands, which every year climb the Deloitte Top 100 ranking. For example, the Eastern Gold Jade company's growth between 2016 and 2017 of 40% thanks to the rise of purchasing power of Asian people and its related high-hand demand consumption. Moreover, China was characterized by a fluctuation of financial markets such as real estate and security markets which led to a rise in investment in physical gold products.

Multiple luxury goods represent the most profitable and performant category analyzed, with an average size company of US$ 7.59 billion. LVMH, Kering and Chanel whose cumulative share correspond to more than the 65% of the total. Companies that operates in this sector are mainly located in Europe (France and Italy). This sector achieved a 15.9% of goods sales growth, the highest level among other categories.

2. The use of Artificial Intelligence in the Luxury and Fashion Industry

Technology is gradually expanding into seemingly different and distant industries, including the fashion one. Today Artificial Intelligence, automation, Cybernetics have put themselves at the service of the fashion industry to change it forever. The most frequently asked questions are: how will the market change? How will the colors or shapes of the clothes be determined? Will the values of this industry change? All production processes have been impacted, questioning the most deeply rooted beliefs: creativity itself, which has always been considered as an exclusively human ability, becomes a technological competence. Just think that at Alexander Wang's Pre-Fall 2019 fashion show, in New York, among all special guests, the robot Sophia was sitting in the front row.

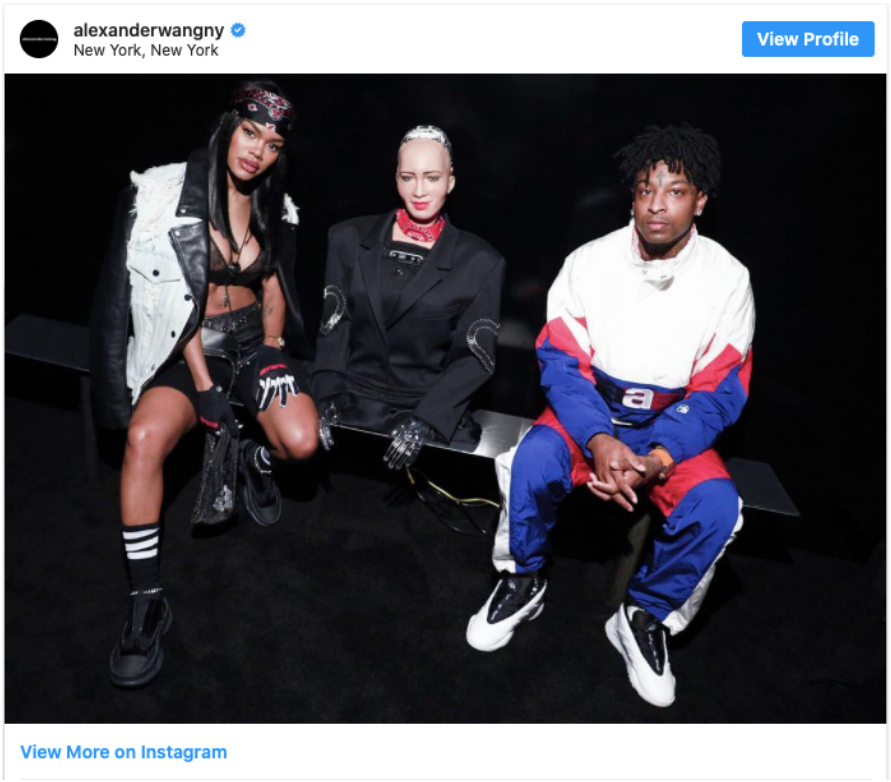


Figure 7. Photo posted on Instagram by Alexander Wang. At the center the robot Sophia, SOURCE: Elle.com

With 93 million followers, the robot was nominated as one of the most important fashion influencers of 2018 so much so that it is considered to be on a par with human beings. This is one of many tangible signs that an important technological revolution is taking place in the fashion industry, and the most relevant role is played by Artificial Intelligence. Artificial Intelligence can collect an almost unlimited amount of data, which, once sorted, can generate key business information. The analysis that fashion companies implement with so much data

can be both quantitative and qualitative, since consumers are studied in detail and in a so accurate way in order to offer a unique and completely tailored experience.

The following paragraphs start analyzing what is Artificial Intelligence, its history and how it works as well as a short study about its future implementation. Then, all the various uses of Artificial Intelligence throughout the production and value chain of fashion companies will be explained in detail. Some examples concern the fast fashion market, others the luxury one, also ranging from eyewear, makeup and accessories. This decision depends on the fact that this research aims to highlight critically and neutrally all the uses that this new technology has within a very broad industry.

2.1. What is artificial intelligence

2.1.1. How it all started

Today Artificial Intelligence (AI) has the potential to become the greatest and most impactful technological revolution in human history. This is because its implementation is not only feasible in most of businesses, but it is also becoming necessary in order to survive in a competitive landscape.

AI is defined as *"an area of study of computer science, concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning and self-correction."* [2] Nowadays AI includes also digital assistant, chatbots and machine learning among others.

The initial concept of Artificial Intelligence, presented as Logic Theorist, was introduced by Allen Newell, Cliff Shaw and Herbert Simon. It was developed as a computer program able to demonstrate some mathematical theorems, replicating human problem-solving skill. In 1956, the first Artificial intelligence program was presented in the conference named Dartmouth Summer Research Project on Artificial Intelligence (DSRPAI), led by John McCarthy and

[2] Joost N. Kok, Egbert J. W. Boers, Walter A. Kosters, Peter van der Putten and Mannes Poel, *Artificial Intelligence: Definition, trends, techniques, and cases*, Encyclopedia of Life Support System

Marvin Minsky. From this moment on, scholars from different field became interested about the Artificial Intelligence development: many universities and computer science companies started to invest in research and experimentation program of computer systems that replicated the human decision-making process. Despite the increasing development of more sophisticated software, Artificial Intelligence seemed not to have yet acquired the intuitive abilities typical of human reasoning. The main issue was that computers still could not store enough information and data, remaining something applicable only for mathematical problems and still far from the resolution of more realistic human problems. As a consequence, the initial enthusiasm for AI subsided as well as funding for its research and development decreased dramatically.

A new wave of interest about AI stated again in the '80s with the "deep learning" techniques, created by John Hopfield and David Rumelhart, that allowed computers to learn through experiences. Another big step forward for AI development was made by Edward Feigenbaum who introduced the "expert systems", the program able to reproduce human decision-making process. However, the event which gave to AI a more popular notoriety was the chess game won by the IBM's Deep Blue against the worldwide chess champion player. For the first time, everyone recognized the fact that a machine had reached a problem solving level more efficient than the human being's one.

2.1.2. How AI works

In order to make Artificial Intelligence able to replicate human thinking process, it has to have a non-sterile knowledge, a consciousness that allows to use also non-logical decisions-making process and the ability to solve problems in different ways, even in different contexts.

The system structure is composed by neural networks and algorithms that simulate humans' mind. More deeply, computer engineers focus their research by developing increasingly numerous types of algorithm in order to adapt AI decisions to the different stimulus of the environment. Nowadays, Artificial Intelligence is able to follow a decision-making process depending on the contest in which the decision is taken, but also to change it if environment conditions vary.

One of the main field of studies that allowed AI to become as sophisticated as today, was the "Knowledge Representation". Its concept stands on the idea that thinking can be useful understood as mechanical operations over symbolic representations[3]. For that reason, the knowledge representation works writing down, in some language or communicative medium, descriptions or pictures that correspond in some salient way to the world or a state of world[4]. Indeed, Artificial Intelligence has both a knowledge-based system and a deep-knowledge system which provides to the AI the capacity to learn new data and information starting from those already present in the knowledge system of the machine. This specific ability makes the Artificial Intelligence became a system that can live an experience and learn from it, as the human being does.

There are mainly two methods by which information is entered into the machine: the Formal Language Theory, based on the strings theory and differs depending on the approach used (e.g. generative, algebraic), and the Decision Theory. The latter works through decision trees, a model that allows to evaluate all the consequence of each decision considered. So, the program is able to understand the output of a specific decision process in a precise scenario. In this way, the Artificial Intelligence can maximize the results for each problem set.

As mentioned before, one of the main characteristics that equalize the AI thinking process to a human being's consists in the presence of algorithms that allows AI to learn from experiences and errors. As soon as it is able to learn autonomously, AI is also called machine learning since it has the capability of implement an action that was not programmed by a human being.

Nowadays, computer science defines four type of Artificial Intelligence depending on the interactions it has with humans and on what kind of system programmed has. Assisted Intelligence is defined when AI helps humans to take decision, but the system does not learn from its interaction with humans. Its opposite is the Autonomous Intelligence, which adapts itself to different scenario and do not have any interaction with the human beings. The third type of AI is defined as Augmented Intelligence, since it helps humans to improve their

[3] Hector J. Levesque, *Knowledge Representation and reasoning*, Department of Computer Science, University of Toronto, Toronto, Ontario M5S, Canada Ann. Rev. Comput. Sci. 1986. 1:255-87

[4] Hector J. Levesque, *Knowledge Representation and reasoning*, Department of Computer Science, University of Toronto, Toronto, Ontario M5S, Canada Ann. Rev. Comput. Sci. 1986. 1:255-87

decision-making process, always learning from each interaction. Finally, there is the Automation: the system autonomously implements existing tasks, without involve new ways of doing things. More easily, it is an automation of manual or cognitive tasks[5].

2.1.3. The future is AI

An interesting research conducted by the famous consulting firm PwC, called "*Sizing the Prize. What's the real value of AI for your business and how can you capitalize?*" shows off how Artificial Intelligence could impact the economy of a business within 2030.

Generally speaking, according to PwC, Artificial Intelligence represents the biggest opportunity for today businesses since it will contribute to an increase of the global GDP up to 14%, equal to $15.7 trillion. Of this, $6.6 trillion will be caused by an improvement of productivity efficiency, while $9.1 trillion by a consumption side effect. The countries that will benefit the most from AI implementation, will be China and North America.

What Artificial Intelligence in the short term will impact the most is productivity. And more the sector is capital-intensive, such as manufacturing and transport, more there will be productivity gains due to a higher presence of operational processes that can be automated. The figure below shows the value gains a business can achieve in terms of productivity once inserted Artificial Intelligence.

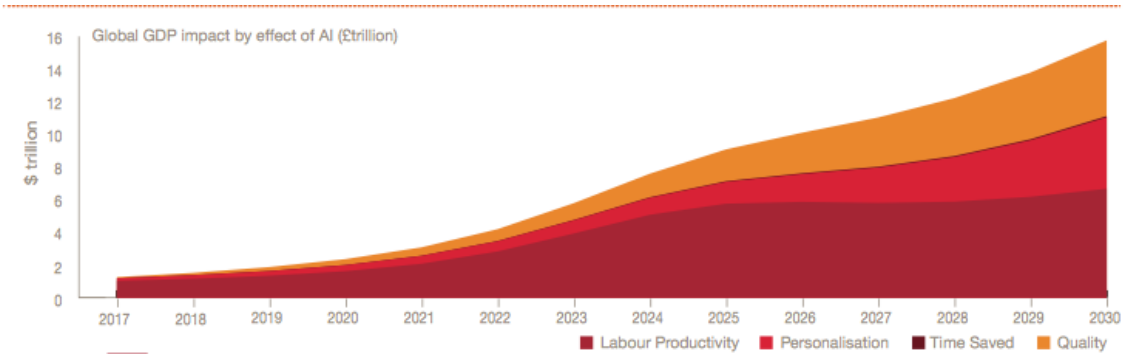


Figure 8. Where will value gains come from with AI?, SOURCE: PwC

[5] PwC, *Sizing the prize. What's the real value of AI for your business and how can you capitalize?*, 2017, https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

If in one hand automatization involve job displacement, PwC research highlights how it could be the opportunity for employees to focus on more creative and more value adding works. Moreover, a new equipment of employees will be required in order to maintain, fix and implement this new technology.

Another important consequence of the AI spreading implementation, will be a shift in consumer demand. As previously mentioned, Artificial Intelligence can gather thousands of consumer data and consumer insight, creating data-driven business that can better fit clientele's needs. Implementing AI means not only to produce the perfect product needed by consumer, but also to tailor their experience depending on their expectations and preferences. A more customized Customer Decision Journey and the presence of products with higher quality (Figure 1) will encourage clients to purchase products, increasing consumer demand.

The PwC research concludes with an estimation of AI impact for sector, using a "AI impact index" ranging from 1 to 5, where 1 indicates a very low potential impact and 5 a very high potential impact. The criteria from which the researchers developed the index are five:

- Potential to enhance personalization;
- Potential to enhance quality (utility value);
- Potential to enhance consistency;
- Potential to save time for consumers;
- Availability of data to make these gains possible.

The consulting firm backed up that there will be eight different sector that will benefit the most from Artificial Intelligence implementation. Firstly, the healthcare and the automotive sectors with the highest impact index, 3.7. Following, the Financial Service, the Transportation & Logistic and Technology, Communication & Entertainment sectors, with respectively 3.3, 3.2, 3.1. With a lower but still significant impact, the Retail, the Energy and Manufacturing industries scored 3.0, 2.2 and 2.2.

PwC strongly defines the impact that Artificial Intelligence has and will have in our society as disruptive and impressive. It will be driving force that will set new competitive standards for businesses in most of industries. According to the consulting firm, the implementation of Artificial Intelligence for business is necessary in order to survive in the next 10 years. A late or a wrong implementation could imply the entire loss of market size and the inability to

compete. All companies should understand that AI is not only a tool that simplifies or accelerates existing capabilities with the automatization, but it allows to things never thought before. It is the possibility to forecast customers' needs and to respond to their demand with an efficiency and precision never existed before.

2.2. AI for Fashion Demand Forecasting

Inventory has always played a central role in fashion industry, since it is considered as a fairly challenging element to manage and forecast. Indeed, fashion industry is characterized by short products lifecycle due to both customers volatility and fast changing sector trends. Therefore, a correct prediction of the inventory avoids producing excess goods remaining unsold or producing too little, losing the possibility of potential revenue.

Until AI introduction, inventory management was mainly based on statistic approaches feasible for a small data set. With the digitalization of most of supply chain processes, the amount of data available increases day by day so that fashion business needs a tool able to provide reliable information.

There are different kinds of AI-based methods for sales forecasting. Most of them are mainly adopted by fast-fashion industries, such as Zara, Mango and H&M. One of the most common AI-based method is the Artificial Neural Networking (ANN) methods. What makes this AI so popular is its precision and efficiency in prediction outputs. Indeed, the number of information it manages to store and process is unparalleled to any of the learning machines. However, its biggest limitation is that is time-consuming. Compared to other kind of AI instrument, it takes hours to complete the forecasting task. Another kind of sales forecasting tool is the Fuzzy Logic-Based Methods, appreciated for its capability of forecasting sales of new product launched. This branch of inventory is particularly difficult to evaluate since historical data are limited. This method can also improve itself through experience and training, but scholars suggest to use it together with other AI-based methods that work with a larger data-set. The Support Vector machines (SVMs) have a strong mathematical approach and are particularly efficient in training sets. However, it has a high error rate in the forecasting tasks.

The amount of data to be processed is not the only problem that fashion businesses deal with. Indeed, data are not only too numerous for humans' minds, but also incomplete, obscure and

random. Therefore, storing information is only a part of the work that AI does. AI-methods in fashion sales system works following these steps:

1. Data filtering: the chaos and confusion generated by the important amount of data and information has to be eliminated. All the stored information is filtered in order to maintain only the valid and relevant ones.
2. Feature Extraction: the method consists in determining what features of the data set is relevant or irrelevant for the forecasting task. Artificial Intelligence selects all the useful information with the related statistical features and then uses in the training data step.
3. Data Training for Forecasting: machine learning is applied to model training and fitting. It can be in the form of unsupervised, supervised or reinforcement.
4. Forecast Output: forecasting systems are developed in order to improve once for once. Indeed, updated information can be added into the dataset and so, improve the output precision.

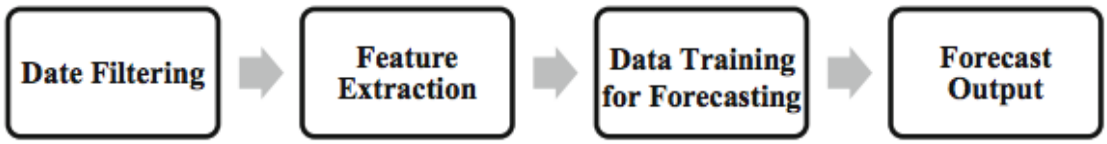


Figure 9. AI-based forecast process in fashion sales system, SOURCE: S. Ren, C. P. Hui, T. J. Choi (2008), AI-Based Fashion Sales Forecasting Methods in Big Data Era, Springer Series in Fashion Business

2.3. AI as a fashion designer and stylist

Generally, we are used to think about Artificial Intelligence as something that can help human being only in technical-scientific fields. People have always thought that technology could never be associated with a purely human characteristic: creativity. Nevertheless, the increasing complexity of the algorithms, used by the Artificial Intelligence, seems to give the machine the possibility to create drafts of drawings of clothes. And nowadays, several brands are using this technology to create their new collections.

Yoox, founded in 1999 and owned by the group Yoox Net-a-porter, is one of the most popular fashion luxury online retailers where customers can buy every kind of fashion product category from luxury brands, such as Valentino, Gucci and Prada. The company launched in 2018 its own label brand, 8 by Yoox, which combines humans and Artificial Intelligence capability in order to create garments and accessories both for women and men. AI stores all information and customer insight of past 18 years from its website, social media and online magazines and

determines main customers' preferences related to garments shapes, colors, fabrics and textures. The machine, then, generates a mood board representing future fashion trends that is the starting point for designers. As Paolo Mascio explained in an interview conducted by Tommaso Palazzi (*Milano Finanza*) "*the garments made are mathematically created to meet the needs of a curious, passionate and aware e-shopper*"[6]. After only one year, 8 by Yoox entered the top 20 most sold brand offered by the group, with USA, Russia and Italy as main markets. One of the key elements of the brand success is a very low return rate. Indeed, the data driven strategy allows Yoox to offer to its client products that correspond to their preferences in terms of quality and style.

Another interesting case in which AI played a key role in the design of clothes, was Tommy Hilfiger's project in collaboration with IBM and The Fashion Institute of Technology (FIT) Infor Design and Tech Lab. FIT students had to create a new design signed Tommy Hilfiger using data and information given by IBM company. Thanks to Artificial Intelligence, 15,000 Tommy Hilfiger's product image, 600,000 runway images and 100,000 patterns from fabric sites were elaborated to create the source of inspiration for brand's designers. However, what makes this case unique is the fact that the machine output were garments that not only matched customers' needs and preferences but also Tommy Hilfiger DNA and style. Among all 3D digital creation, the tech jacket proposed by FIT senior Grace McCarty was chosen by the brand.

Figure 10. Tommy Hilfiger tech jacket created by using AI. SOURCE: Forbes.com

[6] Tommaso Palazzi, *Yoox accelera sull'Intelligenza Artificiale*, Milano Finanza, 2018, https://www.milanofinanza.it/news/yoox-accelera-sull-intelligenza-artificiale-201811061931492399

"*As a brand, we are always pushing the boundaries of what's possible through innovation and disruption. These young designers truly embody this spirit by showcasing the successful integration of fashion, technology and science*" wrote Tommy Hilfiger's chief brand officer, Avery Baker, in a blogpost for IBM[7]. This project has laid the foundations for an important debate in the fashion industry: whether Artificial Intelligence can somehow cancel out human creativity or not. Steve Laughlin, general manager of IBM Global Consumer Industries, highlights how this case represents an efficient interaction between man and technology, which does nothing but increases human capabilities and not annihilate them. He also affirmed "*AI can assist design teams by enhancing and reducing overall lead times, and expand their creative discovery by analyzing and remembering insights from thousands of images and videos using computer vision. These designers can also more easily find how they can integrate trending colors, key patterns, and styles*"[8].

Stitch Fix is an online styling service founded in 2011 by Katrina Lake. This website uses Artificial Intelligence as personal stylist, combining garments and accessories of different brands depending on consumers' preferences and tastes. Clients accessing the platform fill out a style quiz and judge a series of outfits. Stitch Fix stores all data about clients, merchandise and clients' feedback (Figure 4) and creates personalized style. It is another efficient collaboration between the creativity of human being and the mathematical approach of the machine, since every outfit generated by AI is then corrected and improved by a human stylist. The company reached in 2019 $1,578 million revenues with 3,236 thousands of active clients.

Figure 11. Meaningful and highly actionable data analyzed by Stitch Fix, SOURCE: Stitchfix.com

[7] https://www.forbes.com/sites/rachelarthur/2018/01/15/ai-ibm-tommy-hilfiger/#52d24f3978ac
[8] https://www.forbes.com/sites/rachelarthur/2018/01/15/ai-ibm-tommy-hilfiger/#52d24f3978ac

2.4. AI in garments manufacturing

The complexity of the fashion industry is mainly due to the great variety of products offered that changes frequently because of seasonality and variations in terms of trends and styles. Production processes are very long even though they have to respond to high and constantly changing demand. Based on the present apparel industry these processing steps can be categorized as:

1. pre-production: sampling, sourcing of raw material, cost analysis, and approving the proposed product;
2. production: cutting and sewing;
3. postproduction processes: thread trimming, pressing, checking, folding, packing, and shipment inspection[9].

An efficient production planning, scheduling and control is essential for a fashion business to survive in a such competitive industry. Indeed, it determines the supply of raw materials, the management of employees and equipment and allows that the final product is delivered to customers. However, the organizational efficiency is quite often altered by production difficulties and absenteeism. As a result, the pre-established order schedules are often shifted after the production starts, which may lead to decreased production efficiency[10]. Computer engineers have been able to develop a real-time and multi-objective model that finds solutions to every production problem that arises.

Among scheduling problems, the cut-order planning is one of the most difficult to manage. It is the first step of production processes and has to be organized considering three main factors: machines, labor and raw materials. Moreover, the cut-order planning strongly depends on sales, inventory levels, raw material supply and availability of employees. All the process is made more complex by the variety of colors, fabrics, shapes and size of garments produced. A solution derived by Artificial Intelligence which uses adaptive evolutionary strategies in the

[9] Yanni Xu, Sébastien Thomassey, Xianyi Zeng (2018), *AI for Apparel Manufacturing in Big Data Era: A Focus on Cutting and Sewing*, Artificial Intelligence for Fashion Industry in the Big Data Era, Singapore, Springer Series in Fashion Business, Springer Nature Singapore

[10] Yanni Xu, Sébastien Thomassey, Xianyi Zeng (2018), *AI for Apparel Manufacturing in Big Data Era: A Focus on Cutting and Sewing*, Artificial Intelligence for Fashion Industry in the Big Data Era, Singapore, Springer Series in Fashion Business, Springer Nature Singapore

decision-making process of the cut-order planning. The implementation of this technology can minimize costs and respond promptly to consumers' demand.

The Maker Making is the process in which all shapes are drawn and then cut out on a fabric. One of the main issues in this step of production is the amount of fabric between each shape that remains unused and wasted. In fact, the marker making efficiency strongly depends on how well the various shapes to be cut out fit together, so as to leave material waste to the minimum. In addition to considerably reducing costs for raw materials, an intelligent system that minimizes this type of waste allows the company to have a sustainable economy, considering that the fashion industry is one of the most polluting in the world. Moreover, it is important to consider that a machine learning not only allows to optimize the row material, but also does it in a shorter time than the human being. The maker making seems to be the smallest part of a series of complex productions process. However, AI by optimizing and making more efficient this small production process can improve production speed, material utilization, and reduce staff work.

The sewing process is the most characteristic process of the fashion industry and, at the same time, the one which takes most of the time and labor costs. As mentioned before, the demand of the fashion market is subjected to continuous changes, due to trends and styles and an increasing demand, which require time savings in all the production steps. Sewing automated equipment is becoming popular among fashion business and, if in one hand, it could eliminate activities typically done by humans, in the other hand, it could contribute to human labor exploitation in poor countries. This theme generated a strong debate on pros and cons that Artificial Intelligence implementation can have in a so complex industry as the fashion one.

One of the latest steps of garment production is the quality control and inspection. This process is now fully automated due to different factors. Firstly, it is highly time consuming both for the number of garments to control and for different standards that each product has. Secondly, employees assigned to this task are generally subjected to fatigue and boredom, causing inaccuracy, inefficiency and inattention. AI used in quality control step is going to completely substitute manual inspection due to the higher number of benefits and lower error rate level. Moreover, a defect identification should be recognized as soon as possible to avoid a further production process extension and time-money expenditure. It is easy to understand how difficult is to determine a fault through visual inspection, especially when it is imperceptible to

human eyes. Intelligence Machines are able to locate seams and determine the standardized characteristics of garments, finding all imperfections not in line with its dataset and algorithm.

2.5. AI and the customer experience

Over the past 20 years, typical luxury and fashion market consumer has changed both in terms of shopping habits and in term of interactions with brands. In fact, nowadays fashion costumers are getting younger and diverse[11], so that loyal clients are becoming a rarity, especially in the luxury industry. The main reasons why this industry has been subjected to so important changes are analyzed by Bain & Company in the report "*The Future of Luxury: A Look into Tomorrow to Understand Today*" (2019). In the study, the consulting firm affirms that Generation Y and Z accounted for 47% of luxury consumers in 2018, and for 33% of luxury purchases (Figure 5). Moreover, from a geographical point of view, China contributed to the 33% of total purchases worldly, making luxury sales grew 20% to €23 billion (Figure 6).

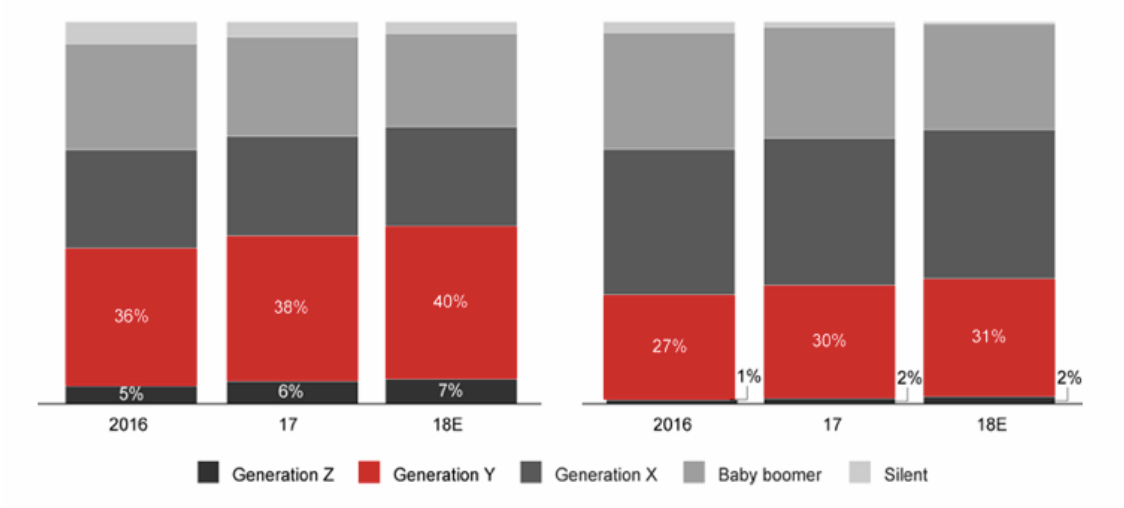


Figure 12. Share of global luxury goods consumer by generation, SOURCE: Bain

[11] Claudia D'Arpizio, Federica Levato, Filippo Prete, Elisa Del Fabbro and Joëlle de Montgolfier (2019), *The Future of Luxury: a Look Into Tomorrow to Understand Today*, Bain & Company, https://www.bain.com/insights/luxury-goods-worldwide-market-study-fall-winter-2018/

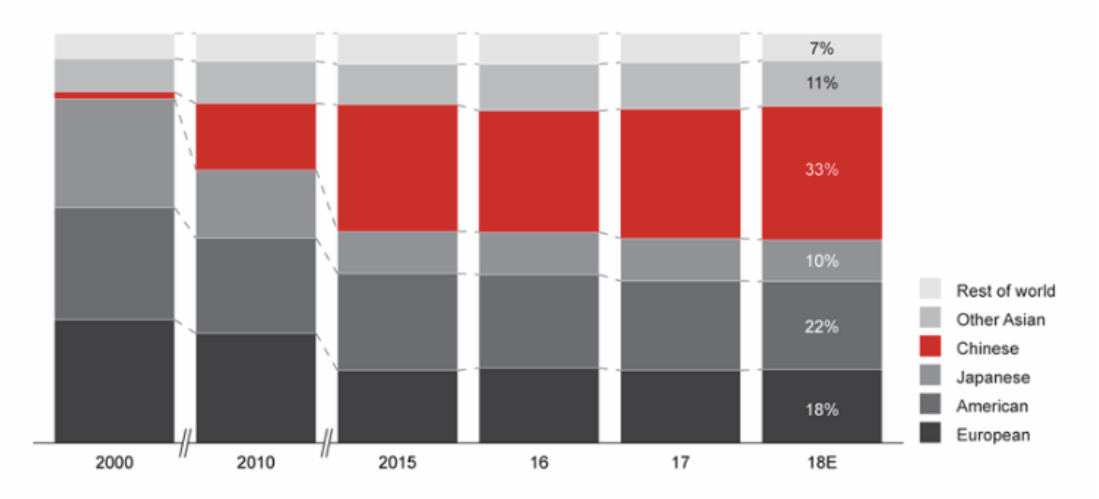


Figure 13. Share of personal global luxury goods market value by nationality, SOURCE: Bain

The youth of consumers and an ever-increasing rise in purchases by Asian customers have led to an increase in demand for online shopping experience. Therefore, luxury and fashion brands faced the need to focus their attention in making online customer experience as much unique and personalized as the offline one. However, if in one hand fashion businesses tried to make e-commerce platforms as similar as possible to a physical store, in the other hand retail must be enhanced and made more attractive and innovative to encourage people to buy offline as well. In this contest, Artificial intelligence played a significant role: according to a study conducted by IMRG and Hive, 3 out of 4 fashion retailers will invest in Artificial Intelligence in 2021[12].

2.5.1. AI enhancing the online customer experience

As mentioned before, online experience is fundamental part of the customer decision journey. The "human touch", typical of the physical store become useless and insufficient when speaking about online shopping. "*It is an uncomfortable truth, but for online fashion retailers with large product ranges the inability to create experiences that delight every customer is costing time, money and sales- and the tried and trusted, manual approach to merchandising is the problem, not the solution*" affirmed Andrew Fowler (UK Country Manager of Apptus). It is easy to see how difficult is to manage customers on an online channel, both for the number

[12] Beatrice Yang (2008), *Intelligenza Artificiale al servizio del fashion: l'algoritmo è di moda*, Spindox, https://www.spindox.it/it/blog/intelligenza-artificiale-al-servizio-del-fashion-lalgoritmo-e-di-moda/

of people who could be on the platform at the same time and for the impossibility of direct contact. Artificial Intelligence is the best solution to this fulfill these criticalities, allowing brands in the creation of chatbots, voice recognition and image recognition.

There are two types of chatbots: scripted and Artificial Intelligence. The scripted chatbots can answer only to a limited set of programmed questions, while the Artificial Intelligence ones are able to interpret human languages and establish logic conversations. Their role is to imitate the sale assistant's actions and to deal with customer care, covering the lack of personalization and human interactions that clients can find only in physical stores. If necessary, AI chatbots are also capable of respond with image instead of words text. AI chatbots are now used both in fast fashion but also in the luxury industry. Tommy Hilfiger was one of the groundbreaking brands using this kind of technology, implementing a Facebook chatbot in 2016. In figure 7, an example of human interaction with a Tommy Hilfiger bot is given: the perception of the consumer is to be assisted by the salesforce.

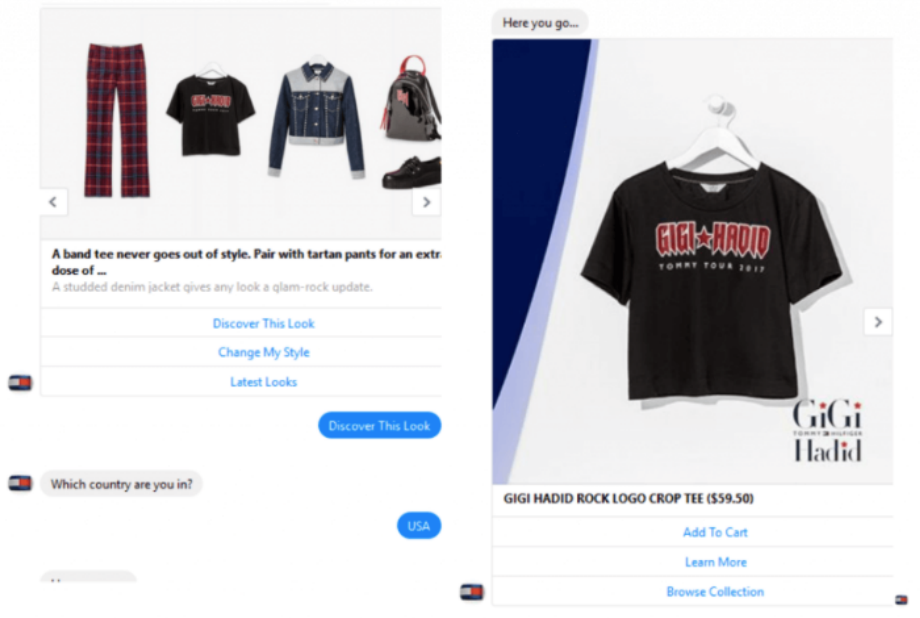


Figure 14. Tommy Hilfiger's chatbot that proposes a complete outfit for the customer

More specifically, Tommy Hilfiger's chatbot starts the conversation presenting itself and asking the customer some questions about taste and preferences that allows to filter all products. The chatbot can offer to the client different options: see a precise collection, search for available items, stylish advisory and, of course, show specific product category. After

chosen the option, the bot carries out the command. In case of showing a product category, it does not only let the client see the product asked but also proposes a complete style with matched garments and accessories. At the end of the conversation, the chatbot allows to choose the "Add To Cart" option, which bring the clients to Tommy Hilfiger's official website with the shopping cart ready for the payment. Dior launched in 2017 "Dior Insider", the AI chatbot for Dior Beauty. In the conversation, the chatbot has a funny and friendly approach with the aim of both propose and show the latest product but also to give beauty tips and information about the brand. Some chatbot are also used to answer to FAQs about delivery and return information. The benefits that chatbots can bring to fashion brands are many and diverse: firstly, it is available 24/7 independently of stores open hours; it is extremely quickly and can serve more than one person at time. It is also the most efficient tool able to personalize online customer experience, to boost customer engagement and increase customer satisfaction. And last but not least, it is cheap.

Image processing and image recognition is an important ability of Artificial Intelligence that consists in recognizing same pattern or similar characteristics of different images. This function covers one of the main services that the sales assistant does: proponing similar items or product that the costumer may like based on the image he or she is looking at. Image processing and recognition can, in one hand, drastically reduce the client's time in finding what he or she prefers and, in the other hand, create up sale opportunity for the brand itself. Nowadays, in the fashion industry images are the most used communication vehicles since social network are consolidated marketing channels. Asos, the famous e-commerce platform, developed with Artificial Intelligence the visual similarity recognition. It allows the costumer to download an image (e.g. a screenshot from Instagram) or take a picture on the spot in order to find similar product that the brand offers that are present on the image.

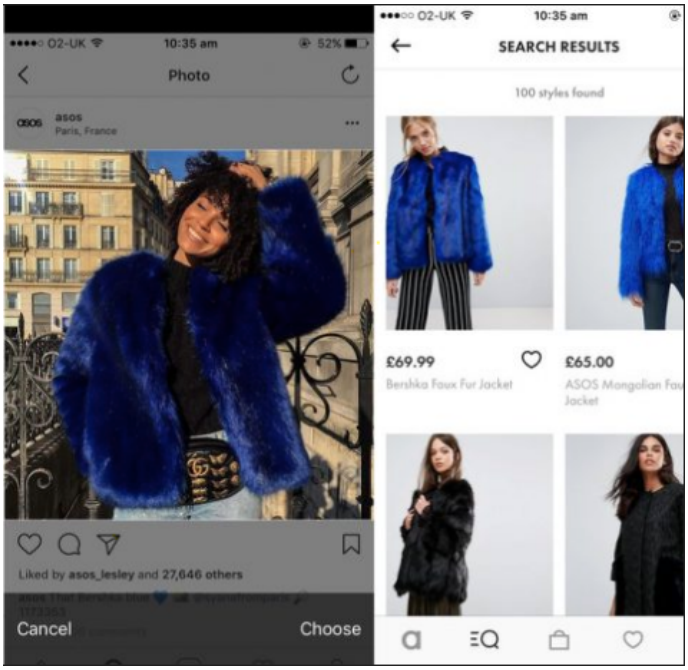


Figure 15. Image processing on Asos App, SOURCE: Spindox

Image processing become essential specially for brands with a wide range of product: it would take consumers a very long time to find the product they are looking for, even if filters are available.

The vocal recognition is mainly used by luxury online retailers which implemented this system in order to allow people to start a search through personal voice instead of typing it. It has the aim of simplify and speed up both information and search processes.

2.5.2. AI enhancing the offline customer experience

Customer experience has to be unique and personalized not only online but also in physical stores. For that reason, new technologies were developed in order to create innovative elements that could integrate the online with the offline experience such as Virtual Reality and Augmented Reality. More specifically, Artificial Intelligence has been used in order to integrate online and offline experience: data gathered online are collected and utilized with the aim of enhance the in-store customers' experience. One of the most interesting cases of that AI use was implemented by luxury English brand, Burberry, that in 2006 reinvented itself as "end-to-end" digital enterprise, and that exploited AI in order to boost sales and clients' satisfaction. Burberry's customers just needed to sign a number of loyalty and reward program, which give the consensus to share personal data and information with sales assistant present in physical stores. In this way, once the client entered the store, sales assistants have on their personal

tablet all client's information about history purchases and preferences, so that they can propose items and products that match with the most recent purchase history or something that the customer liked on social media. Burberry's investment in Artificial Intelligence, which powered personalized customer management programs, has resulted in a 50% increase in repeat custom[13].

Some brands use Artificial Intelligence to enhance Smart Mirror technology. A Smart Mirror, also called Digital Mirror, can both reflect an image and augment it. Generally, it is placed in dressing room as well as in hair stylists' and makeup artists' seats. This technology was created mixing Artificial Intelligence, Augmented Reality, and Gesture Recognition Technologies. The MemoMi Labs Inc developed the world's first AI and AR mirror software, powering customers' experience for brands such as Sephora, Luxottica, Giorgio Armani, Este Lauder, Dior and Yves Saint Laurent. The application industries are manifold: from beauty to fashion, from eyewear to hair care, from footwear to accessories. The MemoMi mirror uses physical and pixel-based algorithm, providing a realistic and personalized Augmented Reality experience and works across platforms including web, iOS and Android. Artificial Intelligence guarantees to precisely map and analyze data in order to provide accurate and personalized recommendation in real time[14]. Resuming, MemoMi mirror not only recommends clients garments that fit better both customers' physicality and preferences, but also allows to change clothes', colors and patterns without taking off what the client is wearing.

Luxottica implemented MemoMi mirrors in its shops. The Artificial Intelligence technology is able to analyze consumers' faces and to match them with the perfect eyewear frames. Moreover, the mirror has videocams that record the customer while is trying on glasses, allowing the client to compare all the models. Videos can be sent on personal smartphones or shared on social media. The system also features includes:

- Virtual backgrounds show alternate settings such as at the beach or on the street;
- Live stream calls directly from the mirror for input from others—as if they were in the store;
- Smart filters show how products look in different lighting conditions;

[13] https://www.forbes.com/sites/bernardmarr/2017/09/25/the-amazing-ways-burberry-is-using-artificial-intelligence-and-big-data-to-drive-success/
[14] https://memorymirror.com/

- Multi-brand recommendations virtually apply other products to complete a look;
- Real-time distortion correction gives shoppers an accurate perspective even as they move around[15].

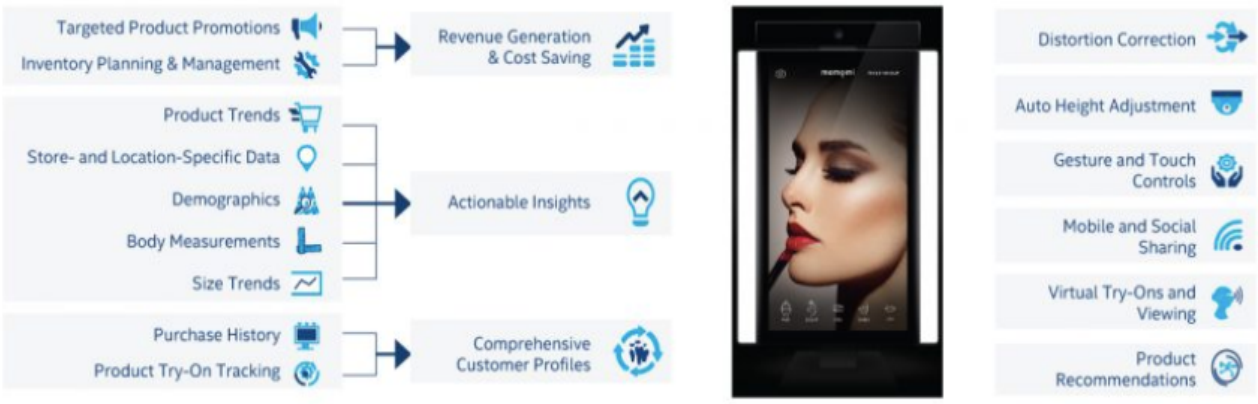


Figure 16. How AI enhance in-shop experience and create new insight for retailers, SOURCE: Insight.tech

This AI implementation helps Luxottica to develop not only a more detailed and accurate shopper profile but also an analysis of trends and preferences. It is a perfect tool that makes the lifetime customer value with personalized recommendations and promotions.

The American department store Macy's launched in 2016 an in-store mobile tool, "Macy's On Call", using Artificial Intelligence, able to replicate sale assistants' role since it gives costumers customized answers depending on the store they are in. This cognitive mobile web tool was developed by IBM Watson, in partnership with Satisfi, with the aim of analyzing and deeply learning about people who frequent the department store. The most frequently asked questions to the salesforce were collected and a consequent system of answers to them was developed. More specifically, clients just need to input questions in natural language about the placement of a product or a brand. In this way, Artificial Intelligence allows sales assistants to deal with more complex customer issues and leave the simplest ones to the platform on the store's website. In addition, the IA is also able to perceive the customer's mood from the structure and type of questions: if the costumer is annoyed or dissatisfied, the system calls an assistant room for assistance. As Serena Potter, Macy's group vice president of digital media strategy told The Associated Press, "*We want to improve the shopping experience. We want the customers to*

[15] https://www.insight.tech/content/retail-gets-personal-with-ai-and-deep-learning

shop at Macy's and come back"[16]. Indeed, Macy's trayed to differentiate itself from other department stores and online retailers by simplifying and optimizing the salesforce's work and by make customer shopping experience more enjoyable. Macy's investment in AI technology has been able to make stronger customer relationship between the brand and costumer and boost loyalty.

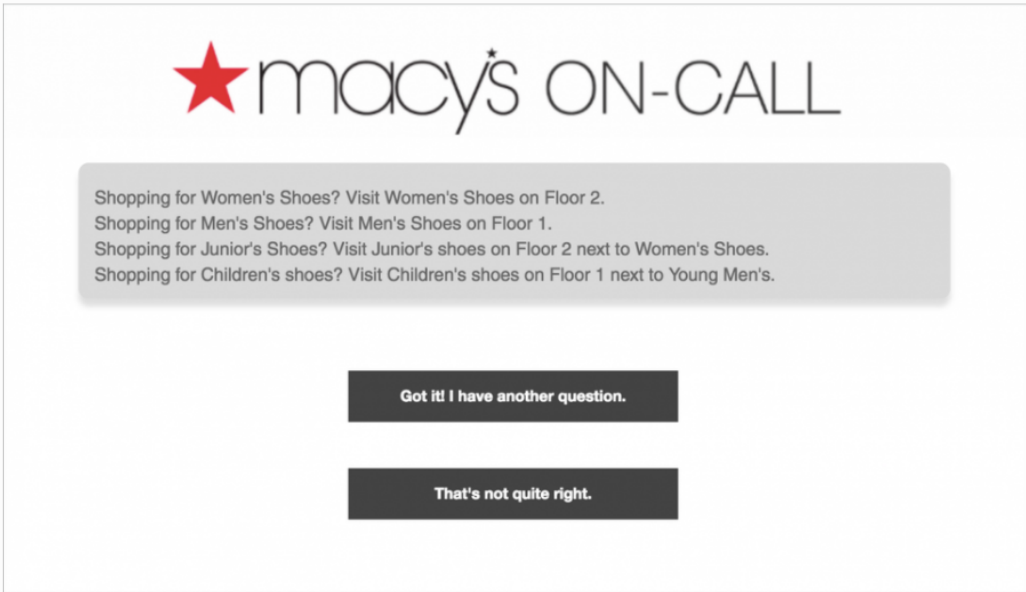


Figure 17. The new AI-powered Macy's On Call mobile tool from IBM Watson and Satisfi (Image: Macy's), SOURCE: Forbes.com

[16]Anne D'innocenzio, Associated Press, Macy's has launched an in-store shopping assistant powered by IBM's Watson AI tech, 2016, https://www.businessinsider.com/ap-macys-tests-artificial-intelligence-tool-to-improve-service-2016-7?IR=T

2.6. AI and sustainability

A recent crisis has hit the fashion industry: sustainability. In fact, in past years, most people thought that the causes of global pollution were due to the use of plastics, intensive livestock farming or air transport. Nowadays, on the contrary, people are becoming increasingly aware of how the fashion industry has always been played a significant role in our planet pollution. According to an article by Business Insider (2019) fashion production makes up 10% of humanity's carbon emissions, dries up water sources and polluter rivers and streams[17]. Conditions have deteriorated considerably over time, since clothing production double from 2000 to 2014 and the number of garments purchased each year by the average consumer increased by 60%[18]. Moreover, the growing expansion of fast fashion industry has led people not only to increase their wardrobe but also to change it frequently and quickly, treating garments as nearly disposable. The production of such amount of clothes requires the use of lot of water and chemicals and the emission of greenhouse gases. Resuming, two different aspects have characterized the sustainability crisis of fashion industry: the emissions generated from productions and the disposal of unfashionable or worn-out garments.

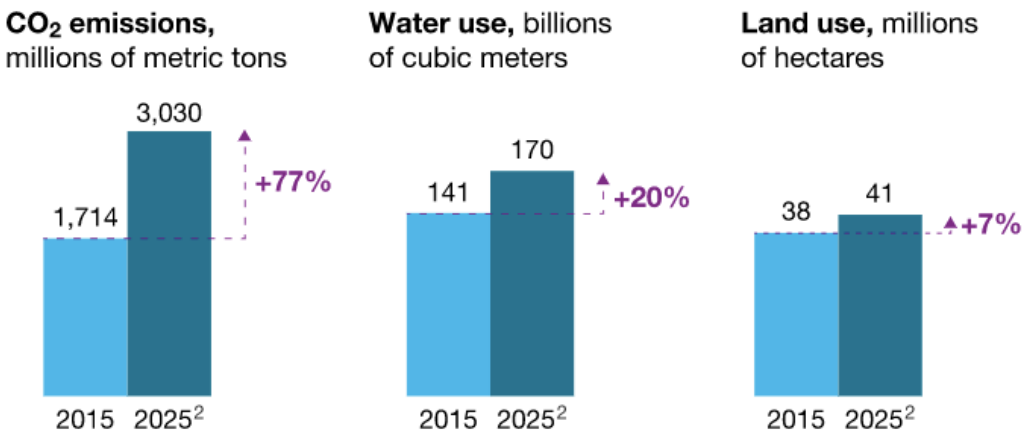
The reason why fast fashion has been subjected to a such important growth relies on the abrupt reduction in production costs. As a consequence, clothing prices fell down increasing the affordability for people to constantly buy new garments. Giving an example, Zara offers 24 different collections per year while H&M from 12 to 16 ones.

Not in all countries, garments purchases have growth with the same rhythm: developing countries such as Brazil, China, India Mexico and Russia have recorded an apparel sales growth eight times faster than in Canada, Germany, United Kingdoms and United States. The consulting firm McKinsey & Company estimated that if 80% population living in the before

[17] https://www.businessinsider.com/fast-fashion-environmental-impact-pollution-emissions-waste-water-2019-10?IR=T

[18] Nathalie Remy, Eveline Speelman, and Steven Swartz (2016), *Style that's sustainable: a new fast fashion formula, McKinsey & Company*, https://www.mckinsey.com/business-functions/sustainability/our-insights/style-thats-sustainable-a-new-fast-fashion-formula

mentioned developing countries achieve the western clothing-consumption level by 2025, the environmental footprint of the apparel industry will be extremely larger than today (figure 18).



[1]Rest of world maintains its current levels of per capita consumption.
[2]Estimated.

Figure 18. Increases in environmental impact if 80% of emerging markets achieve Western per capita consumption level, SOURCE: Mckinsey.com

However, a positive element of this sustainability crisis of the fashion industry is that most of consumers is becoming much more interested and careful about planet preservation: as a consequence, people are becoming more attentive to what they buy and the related brand. Nowadays, fashion brands, both from the fast fashion and luxury industry, have to develop a transparent communication about sustainability of production processes and the supply of raw materials for commercial and competitive issues. Indeed, in a survey conducted by IBM United Kingdom in February 2020, 60% of British people consider themselves as more environmentally conscious than past five years and avoid stores and brands which seem not to respect environmental standards.

In this context, Artificial Intelligence can play an important role given its enormous potential to reduce the environmental impact of the fashion industry. In the previous paragraphs the uses of AI in the luxury and fashion industry have been explained and analyzed: each of them has the potential of drastically decrease the wastes and the emissions of the market. More deeply, Artificial Intelligence's effects on fashion industry pollution related to its uses are:

1) Demand forecasting: businesses can easily avoid producing unsold clothes and accessories. A more accurate and precise inventory management allows brands to not overproduce and

adopt a more efficient use of raw materials. The consequences resulted are less emissions and less use of water in production processes.

2) Traceability: it is the ability to identify and trace the history, distribution, locations and applications of products, parts, materials and services[19]. It involves the three sustainability pillars (societal, economical and environmental) since it results in transparency of the supply chain for all the actors. Data and information are easily shared among all the product chain contributing to high quality of productions' steps.
3) Personalization of online and offline customer experience: generally, customization allows brands to offer an experience cut shaped on client preferences and tastes. It results in a more efficient production of both products and services, avoiding waste and reducing pollution.

[19] Tarun Kumar Agrawal, Ajay Sharma and Vijay Kumar (2018), *Blockchain-Based Secured Traceability System for Textile and Clothing Supply Chain*, Artificial Intelligence for Fashion Industry in the Big Data Era, Singapore, Springer Series in Fashion Business, Springer Nature Singapore

CHAPTER TWO

1. Definition of Luxury

What is a luxury brand and how can be defined? This question does not have a response for the moment. The concept is so subjective that its meaning can have thousands of definitions, shades and perceptions. Many scholars have tried to attribute a specific meaning to this word, but without ever reaching a univocal definition for all. It is now a well-established notion among scholars that for 20 years now there has been a lack of consensus on the definition of luxury. For instance, the American Marketing Association's dictionary does not contain any definition as "luxury", "luxury brand", "luxury marketing".

A research conducted by the Journal of Business Research in 2019 has collected all the definitions of luxury that have been developed throughout history by leading scholars. The definitions that have been selected, match three established criteria:

1. the definition should be based on a sound conceptual foundation, as its characteristic of academic definitions in general;
2. its definition must be broadly applicable to luxury brands in general, and not just a subset such as only products or services, or one product category (e.g., fashion goods or automobiles);
3. the theoretical definition should be capable of being operationalized in a way that allows the construct to be measured[20].

All the selected definitions are shown in the table below.

Authors	Definition
Berthon et al., 2009	Luxury is more than a characteristic or set of attributes. Rather than define a luxury brand in terms of its attributes, the authors conceptualize it in terms of what it does in three spheres: the objective (material), the subjective (individual), and the collective (social). The material consists of exquisite material and craftsmanship, high functionality, and impressive performance. The subjective dimension relates to the consumers personal hedonic value of a brand. The collective element is the value a brand signals to others and the value of that signal to the signaler.

[20] Eunju Ko, John P.Costello, Charles R.Taylor, *What is a luxury brand? A new definition and review of the literature*, Journal of Business Research, Elsevier, June 2019, pages. 405-4013

Keller, 2009	Luxury brands have ten defining characteristics: (1) maintaining a premium image, (2) creation of intangible brand associations, (3) aligned with quality, (4) logos, symbols, packaging are drivers of brand equity, (5) secondary associations from linked personalities, events, countries, and other entities, (6) controlled distribution, (7) premium pricing strategy, (8) carefully managed brand architecture, (9) broadly defined competition, and (10) legal protection of trademarks
Dubois et al., 2001	Six facets define and structure the concept of luxury (1) excellent quality (2) high price (3) scarcity and uniqueness (4) aesthetics and polysensuality (5) ancestral heritage and personal history (6) superfluousness
Tynan, Mckenchie, & Chuon, 2010	Key identifiers of luxury brands are high quality, expensive and non-essential products and services that appear to be rare, exclusive, prestigious, and authentic and offer high levels of symbolic and emotional/hedonic values through customer experiences.
Vickers & Renand, 2003	Luxury goods are different than non-luxury goods by the extent to which they exhibit a distinctive mix of three important dimensions of instrumental performance: functionalism, experientialism, and symbolic interactionism.
Heine, 2012	Luxury brands are associated with consumer perceptions of a high level of price, quality, aesthetics, rarity, extraordinariness, and a high degree of non-functional associations.
Nueno & Quelch, 1998	Luxury brands are those whose ratios of functional utility to price is low and ratio of intangible and situational utility to price is high (ten more specific characteristics of luxury brands are also provided)
Hagtvedt & Patrick, 2009	Luxury brands offer premium products, provide pleasure as a central benefit, and connect with consumers emotionally.

This set of definitions is the proof that giving an objective meaning to "luxury" is extremely complicated. However, it is possible to trace the most common elements that define a brand as luxury:

1. the perception of consumers, that is the consumers' evaluation of a brand. For the scholars, a brand can not be defined as a luxury unless it is perceived by people as such. It is what ultimately defines a product, brand or experience as luxury, regardless of their objective characteristics.
2. products dimensions that are consistent in most of definitions, that are high quality, rarity, premium pricing, high level of aesthetics.

After having conducted the analysis of the various definitions of luxury of the above-mentioned authors, the scholars Eunju Ko, John P. Costello, Charles R. Taylor tried to give their own definition that contains a resume of the one in the table overhead. "*A luxury brand is a branded product or service that consumers perceive to:*

1. *be high quality;*
2. *offer authentic value via desired benefits, whether functional or emotional;*
3. *have a prestigious image within the market built on qualities such as artisanship, craftsmanship, or service quality;*
4. *be worthy of commanding a premium price; and*
5. *be capable of inspiring a deep connection, or resonance, with the consumer*[21]."

2. Valuing Craftsmanship for luxury brands

Globalization and the global economic crisis of 2008 have stimulated companies to seek solutions to reduce production costs while maintaining an adequate level of quality, favoring the production of standardized products. However, this business strategy does not reflect the current consumer demand that is characterized by requests of customized products and services. In fact, in recent years and especially in the luxury landscape, the role of the craftsman, able to create unique and customized pieces, is being revalued. Some scholars, including Stefano Micelli, argue that craftsmanship and "Made in Italy" are the key to success for Italian businesses of the future. Craftsmanship is defined as "*the skill at making things, or the skill with which something was done or made*[22]". It represents the knowledge, that has ancient roots, and is transferred from generation to generation and the word is also contained within the hypothetical "luxury" definition that was tried to give in the previous chapter[23]. On this line of thinking, a "Craftsmanship index" has been developed by three Italian scholars, Giampaolo Campana, Barbara Cimatti and Francesco Melosi, in order to calculate the value of a business' craftsmanship. The index is based on three different taxonomies that determine the level of performance of a craftsman and are:

- Skills and creativity;
- Culture, history and tradition;
- Territory vocation.

The "Craftsmanship index" has been tested among different manufacturing firms around Florence (Tuscany, Italy), where lots of different leather goods enterprises are located: bags (35%), wallets (15.3%), belts (2.4%) and other leather accessories. 2,500 companies took part

[21] Eunju Ko, John P.Costello, Charles R.Taylor, *What is a luxury brand? A new definition and review of the literature*, Journal of Business Research, Elsevier, June 2019, pages. 405-4013

[22] https://dictionary.cambridge.org/dictionary/english/craftsmanship

[23] It is always necessary to take into account that there is no universal definition for "luxury", however in this paper the definition given in Chapter 2, Paragraph 2 "Definition of luxury" will be taken into account.

in the test, involving 17,000 employees. Most of them are famous luxury brands both Italian, such as Dolce & Gabbana, Gucci, Salvatore Ferragamo or Prada, and non-Italian as Dior and Louis Vuitton. The index's structure is:

$$CI = \frac{\sum_{k=1}^{n} F_k * w_k}{\sum_{k=1}^{n} w_k}$$

and represents the weighted (W_K) sum of a number of factors (F_K). The weight depends on the importance that the factor has in a given industry sector. The four mentioned factors are summarized and explained in the table below:

Factor environment	**Relationship with**
CRAFT SKILLS	Acquired skills and competences. An apprenticeship is necessary. Passion is useful but not necessary.
CREATIVITY SKILLS	Natural skills and predisposition. An apprenticeship is not necessary. Passion is useful and helpful.
CULTURE, HISTORY AND TRADITIONS	Culture, History and Tradition influence the human activity.
TERRITORY VOCATION	A territory may influence the human activity depending on its richness in natural resources and other features.

The empirical test has been developed by assigning weighs and factors values[24] based on a survey that the participant enterprises filled in. 87 surveys were sent to companies operating in the luxury leather goods production, and 25 were completed and sent back. The work roles investigated in the survey are:

- Stylists or pattern makers of leather goods, who design the product and plan the production phases, realizing the first prototype. Stylists may perform a number of operations on the leather: cutting, sewing, assembling, repairing, finishing and embellishing with ornaments.
- Cutting machine operators and manual cutters, who decide the way the leather must be cut into pieces before assembly. The cutters need a deep knowledge of the raw material.
- Sewing machine operators, hand sewers and leather goods manufacturers, who assemble all the cut pieces into the final product. They usually repair, finish and decorate the item.
- Packaging operators and leather goods dealers, who respectively prepare the product and commercialize it.

[24] All values can not be calculated in an objective way since they all are not quantitative elements.

- Quality control and supervisor, who control and check operations[25].

Data gathered were then organized and the results are reported in the graph below:

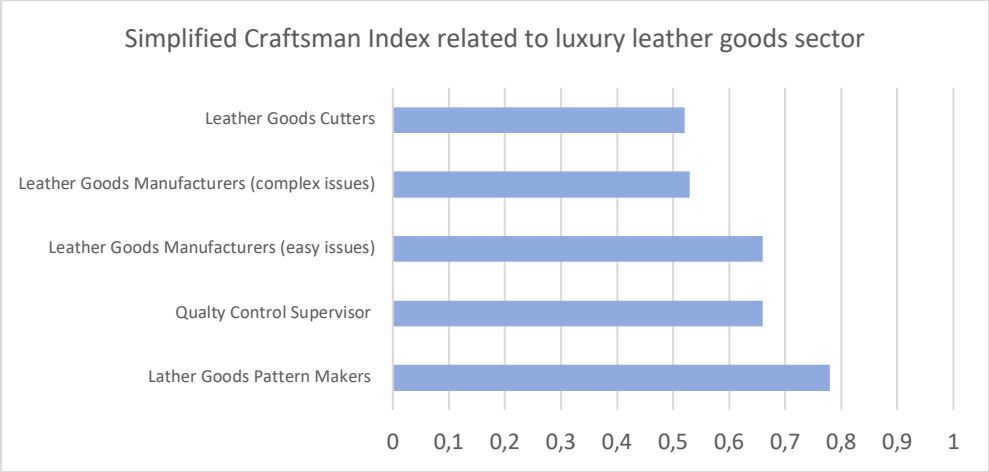


Figure 19. Craftsmanship Index output, SOURCE: G. Campana, B. Cimatti, F. Melosi (2016), A Proposal for Evaluation of Craftsmanship in Industry, Elsevier

The results show an interesting fact. The highest value is attributed to the roles that most depend on crafts jobs and have a limited use of machines, which in our case are the leather goods pattern makers. On the contrary, roles to which a lower value has been attributed require less relevant skills since most of the operations are carried out by machines.

Nowadays, luxury brands use to communicate their craftsmanship traditions, as they protect and preserve their history and heritage. It is also used as a synonym of unicity, rarity and high quality of products and services offered to consumers. Several marketing strategies have been implemented in order to show off to people the importance of craftsmanship in their business and to enhance the perception that consumers have of the brand itself. Some cases will be analyzed below.

In 2019, the French Maison Hermès organized the itinerant event "*Hermès. Dietro Le Quinte*" at the Ara Pacis Museum in Rome and at the Pelota of Brera in Milan: a true celebration of French craftsmanship and savoir-faire, aimed at emphasizing the care, quality and attention to detail that the brand has in the production of luxury goods. The exhibition was structured in 10

[25] Giampaolo Campana, Barbara Cimatti, Francesco Melosi (2016), *A Proposal for Evaluation of Craftsmanship in Industry*, Bologna, Science Direct, Elsevier

modules, each related to a product category that Hermes deals with, including bags, saddles, yoke, ties, jewelry, watches, gloves and porcelain. Each section was characterized by the presence of a craftsman from the French Maison dedicated to the creation of Hermes products. Visitors, once inside the museum, had the opportunity to walk around the various modules and to observe the employees at work and ask them some questions about their craft.

Figure 20. "Hermès. Dietro Le Quinte" (Milan), SOURCE: ilmessaggero.it

Visitors are introduced to the craftsmen of ancient and unfamiliar professions such as fine silk printers, setters, engravers, hemmers, decorators, ceramists and professionals of fine jewelry, but also master watchmakers and glass masters. It is therefore possible to know the secrets of the whole creative and productive process. A very interesting event capable of emotionally connecting visitors to the brand values and history. Indeed, among all professions there was also a section about the production of saddles for horses, the product category with which Hermès began its fame.

In Piazza del Duomo, in the beautiful Lecce (Italy), Maria Grazia Chiuri staged the fashion show for the presentation of the Dior Cruise Collection 2021. The fashion show was a hymn to tradition and Italian craftsmanship, since many local associations of ancient and not very well-known professions were called to participate. Among all, Le Costantine foundation, founded in 1982 by Giulia and Lucia Starace and Lucia de Viti de Marco to make their mothers' textile

arts traditions survive over time. Maria Grazia Chiuri has decided to assign part of Dior collection to the foundation, in order to evoke again the ancient Italian traditions that risk to disappear forever.

Figure 21. Le Costantine working fabric with Tombolo for Dior Fashion Show in Lecce, SOURCE: fashionpress.it

Once again, Dior brings the consumer closer to the world of handicrafts by evoking professions and tools of the craft, such as the "*tombolo*" (figure 8) now forgotten by many. Unlike the case of "*Hermès. Dietro le Quinte*", where the brand tries to communicate its history, savoir-fair and traditions, here Maria Grazia Chiuri connects the brand to the concept of uniqueness, quality and attention to detail using the value of craftsmanship, but without referring to the Dior's history and tradition. Indeed, with the fashion show in Lecce, neither the French nor the history of Dior were highlighted, but, on the contrary, Italian traditions that are much closer to Dior creative director's values.

Every year, LVMH organizes "*Les journèes Particuluères*", a worldwide event in which LVMH brands open the doors of their factories to show luxury lovers the work of their craftsmen. The event started in 2011 to pay tribute to the European craftsmanship, considered the symbol of the continent's cultural identity. During the visits, people have the opportunity to have a closer look at watchmakers, tailors, experts in the art of baudruchage, shoemakers,

chef de cave, jewelers, trunk makers, chef remueur, première d'atelier and chefs in their work. The visit generally offers guided tours, demonstrations, lectures and interactive routes, giving people a unique and entertaining experience. In 2018, "*Les journèes Particuluères*" has gathered more than 180,000 people to discover the professions that characterize the most important luxury brands of the world.

Figure 22. Les Journées Particulieres , Fendi, 2018, SOURCE: Bussoladiario.com

As demonstrated by the examples above, for the vast majority of luxury brands, craftsmanship plays a significant role. It is the tool through which the history of the brand, the attention to detail, the high level of quality of the products is communicated to people. Craftsmanship represents a stimulus that the brand evokes in order to establish a strong connection both emotionally and intellectually with the client.

3. What gives value to luxury brands

The three scholars, Caroline Tynan, Sally McKechnie and Celine Chhuon from Nottingham University Business School (UK), analyzed in the "Co-creating Value for luxury brands" how luxury brands owners try to enhance the value perceived by customers in order to compensate for the high price of their products. More deeply, they focused on all the processes that are part of the value creation framework. Firstly, a conceptualization of luxury brand is needed. For economists, luxury goods are all the products whose demand increases in greater proportion than income (elasticity greater than 1). However, nowadays luxury consumption can not be

related only with personal but also with sociological conditions: people have started to consume luxury goods with the aim of ostentatiously communicating wealth.

The value creation process has not a unique direction. On the contrary, value is developed by using a co-creation process generated by different actors, such as consumers, members of brand communities, suppliers, stakeholders and the company. These phenomena happen in "multiple points of interaction" (Prahalad and Ramaswamt, 2004, p.13) that rise with experience. Nonetheless, not all the experiences can have the ability of generating value. Indeed, it has to have personal relevance for the customer, be novel, offer and element of surprise, engender learning and engage customer (Caroline Tynan, Sally McKechnie and Celine Chhuon, 2009).

The research has been developed by collecting information from three luxury British brands, one from the fashion industry, one from the automotive sector and the last one is a department store. Data were gathered with different methods, such as customers and brands' manageres interviews, analysis of official brand websites and a netnography[26] of brand-related blogs. The output of the analysis has led to a comparison between all luxury brands values defined by other scholars (table 2) and the ones actually perceived by consumers.

Types of value[27]	Theoretical sources
Utilitarian	Excellence (Holbrook, 1999), craftsmanship (Kapferer, 1997)
Symbolic/Expressive	Conspicuous consumption (Veblen 1899); bandwagon, snob and Veblen effects (Leibenstein, 1950;Vigneron and Johnson, 1999); perfectionism effect (Vigneron and Johnson, 2004); signs (Levy 1957;Kapferer, 1997); status/esteem (Holbrook, 1999; O'Cass and McEwen, 2004); prestige (Dubois andCzellar 2002); social identity (Vickers and Renand, 2003); uniqueness (Ruvio 2008; Kapferer, 1997);authenticity (Beverland 2006) Bandwagon effect (Vigneron and Johnson, 2004); personal identity (Vickers and Renand, 2003);aesthetics (Holbrook, 1999); self-gift giving (Mick and DeMoss 1990; Tsai, 2005); uniqueness (Ruvio,2008); nostalgia (Holbrook and Schindler 2003); authenticity (Beverland 2006)
Experiential/ Hedonic	Hedonic effect (Hirschman and Holbrook, 1982; Vigneron and Johnson 1999); aesthetics (Holbrook,1999); the experience (Holbrook and Hirschman, 1982; Carbone and Haeckel, 1994;Pine and Gilmore, 1998; Schmitt 2003; Poulssonand Kale, 2004; Prahalad and Ramaswamy, 2004; Prahalad, 2004:Carù and Cova, 2003)

[26] Netnography is used in order to study the attitudes and behavior of online market-oriented communities.

[27] Table 2: Customer Value framework. Source: Smith and Colgate (2007) and Caroline Tynan, Sally McKechnie and Celine Chhuon (2009), *Co-creating Value for luxury brands*, Nottingham University Business School, United Kingdom, Journal of Business Research, Elsevier

Relational	Consumer–brand relationships (Fournier, 1998; Grönroos, 2006; Veloutsou and Moutinho, 2009);brand community (Kozinets, 2002; Cova and Cova, 2001; Muñiz and O' Guinn, 2000)
Cost/Sacrifice	Perfectionism effect (Vigneron and Johnson, 1999); exclusivity (Catry, 2003); Rarity (Catry, 2003)

Two results were given:

- consumers do not consider money as a valuing element due to their status as ultra-high net worth individuals, so that the cost/sacrifice value category was associated with rarity and exclusivity. The concept of craftsmanship was underlined as one of the main valuable attributes;
- the symbolic/expressive and experiential/hedonic values were confirmed mainly by informants, who evidenced the importance of the signs and symbols associated with luxury brands. Moreover, one of the persons interviewed said "*Whenever I see his signature on a product or paper bag, I feel naturally connected to the brand itself. I am always mesmerized by his artistic sophistication and creativity*." (Blog: Carrie, Brand Y) [28].

According to the scholars, the consumers' awareness of values has been created during different points of interaction, many of which do not directly include the customer. There may be collaborations between brands from different sectors, with compatible or consistent identities. For example, fashion brands often partner with organizations from the art world or take part in cultural events. Therefore, brands must be able to create their own network in which they create a variety of interactions that are then perceived as a kind of experience by the customer. The overall luxury brand experience not only allow to enhance the clients' perception of the brand values, but also to gather customers' information.

Concluding, the research has established that the cost/sacrifice value is not relevant for customers anymore. On the contrary, what really matters is the experiential and the hedonic values that are the one that distinguish the luxury from non-luxury industry. Luxury companies co-create luxury brand experience with "*dialogue and complex interactions between the brand owner, employee, customer and other social groups including the customer brand communities, those experts or agencies who are part of the brand owners' network and the industry itself. The experience only creates value when the parties engage and market with*

[28] Caroline Tynan, Sally McKechnie and Celine Chhuon (2009), *Co-creating Value for luxury brands*, Nottingham University Business School, United Kingdom, Journal of Business Research, Elsevier

each other, that is, when no separation between production and consumption occurs, which traditionally serves to divide the parties" (Caroline Tynan, Sally McKechnie and Celine Chhuon, 2009).

4. The Brand Experience

In the previous paragraph, the relevance the experiential value has in luxury brands has been underlined. Now, it is important to explain what brand experience is and what are the dimensions that characterize it in order to understand consumers' behavior and their profile. The scholars Lia Zarantonello and Bernd H. Schmitt described it in the "*Using the brand experience to profile consumers and predict consumers' behavior*" (2010) and made a deep analysis about the experiential marketing aspects. More specifically, the study starts addressing two key questions:

1. Can we create a typology of consumers that prefer different experiential appeals? Are there, for example, consumers that prefer sensory/affective versus more action-oriented experiences, or "low experiential" versus "high experiential" consumers?
2. Do these experiential types moderate the relationships between brand attitude and purchase intention (for example, for some types the relation is stronger; for others it is weaker)?

In order to answer these two questions, two elements were examined: on one hand, the brand experience and, on the other, the brand attitude and purchase intention.

For the scholars, the brand experience includes all the different kinds of experience already known in marketing, that are consumption experiences, product experiences, aesthetic experiences, service experiences, shopping experiences and the consumer experience. It is defined by Brakus et al. as "subjective, internal consumer responses (sensations, feelings, and cognitions) as well as behavioural responses evoked by brandrelated stimuli that are part of a brand's design and identity, packaging, communications and environment". It can impact both positively and negatively on consumers' loyalty and satisfaction. However, the revolutionary concept of this study is to identify four different dimensions of the brand experience:

1. the sensory dimensions, which involves all the five senses stimulated by the brand, the sight, smell, taste, hearing and touch;
2. the affective dimension, that consists in all the feelings and the emotional bonds that the brand has with the consumers;

3. the behavioral dimensions, that is the bodily experience, the lifestyle and the interactions that the customer has with the brand;
4. the cognitive dimension, that includes the ability of the brand to make the consumer think in a divergent way.

The consumer attitude is defined by Mitchell and Olson as "*an individual's internal evaluation of an object*". Therefore, an attitude (1) refers to a state that is internal to the individual; (2) consists of an evaluation, which can occur on a cognitive, affective, or behavioural level; (3) is directed towards an object[29]. On the other hand, the brand attitude is defined as "*a relative enduring, unidimensional summary evaluation of the brand that presumably energizes behaviour*" and has the power to forecast consumers' behavior. Luxury brands, in which the experiential and the hedonic values are boosted, results in a higher affection of consumers' purchasing intentions.

The methodology of the research was based on a survey divided into two sections. The first one analyzing the brand experience and using the brand experience scale (Brakus et al.), with three questions for each brand dimension explained before: the sensory dimension ("I find this brand interesting in a sensory way", "This brand makes a strong impression on my visual sense or other senses" , "This brand does not appeal to my senses"), the affective dimension ("This brand induces feelings and sentiments", "I do not have strong emotions for this brand" , "This brand is an emotional brand"), the intellectual dimension ("This brand stimulates my curiosity and problem solving" , "I engage in a lot of thinking when I encounter this brand" , "This brand does not make me think"), and, finally, behavioural dimension ("I engage in physical actions and behaviours when I use this brand" , "This brand results in bodily experiences" , "This brand is not action oriented"). The second section included three simple questions on brand attitude ("Bad/Good", "Unpleasant/Pleasant", "Unattractive/Attractive") and one about purchase intention ("I would like to try a product of this brand"). All the questions were based on a 7-point scale and were related to different brands from different sectors, such as the automotive or the food and beverage industry. 1134 people completed the survey correctly, both female and male population with an average age of 25 years old.

[29] Lia Zarantonello and Bernd H. Schmitt (2010), "*Using the brand experience to profile consumers and predict consumers' behavior*", Brand Management, Vol I7, 7, pp. 532-540, Macmillan Publisher

In the analysis, a SPSS was used and two different approaches were used. Firstly, a cluster analysis was conducted in order to create different consumers' typology based on the answers given to the brand experience. Five different clusters were identified:

- Cluster 1, including all people that attributed quite high values to all dimensions but with higher grades to the sensory and the affective dimensions. They represent the cluster which gives more importance to the emotional side of a brand and the one which scholars defined as "hedonistic" consumers.
- Cluster 2, which included the participants with values below the average but with the sensory and behavioral dimensions close to the average. They represent consumers that are not really involved emotionally with brands, but instead are interested in the sensory and actions stimulation. They were called by the scholars as the "action-oriented" consumers.
- Cluster 3, that gave high value to all the dimensions. They are the clients which are looking for experiences and want to be stimulated both in sensory, emotional, intellectual and behavioral terms. They are defined as the "holistic" consumers.
- Cluster 4 included all the people that attributed high values to all the dimensions, except the behavioral one. As a consequence, they are interested in emotional brands which do not engage them physically, so they are called "inner-directed" costumers.
- Cluster 5 involved participants that gave below-average to all the dimensions. Since they are not interested in brand experience, they are defined as "utilitarian" customers.

The sample was divided into two sub-groups as well, the female and the male population. The first analysis can be resumed with the figures below:

Cluster no.	*Means (SD)*			
	Sensory	*Affective*	*Intellectual*	*Behavioural*
1	5.732 (0.707)	5.921 (0.650)	5.385 (0.682)	5.249 (1.022)
2	2.517 (1.368)	1.881 (0.747)	2.295 (1.081)	2.260 (1.055)
3	3.957 (0.957)	4.217 (0.905)	3.779 (0.861)	3.169 (0.961)
4	5.041 (0.791)	4.746 (0.749)	4.128 (0.862)	4.870 (0.775)
5	3.567 (1.068)	2.816 (0.677)	2.776 (1.017)	5.005 (0.928)
Total	4.385 (1.445)	4.250 (1.543)	3.917 (1.357)	4.146 (1.472)

Figure 23. Means and standard deviations of clustering variables in the male sub-sample, SOURCE: Lia Zarantonello and Bernd H. Schmitt (2010), "Using the brand experience to profile consumers and predict consumers' behavior", Brand Management, Vol I7, 7, pp. 532-540, Macmillan Publisher

Cluster no.	Means (SD)			
	Sensory	Affective	Intellectual	Behavioural
1	4.194 (1.158)	4.095 (0.869)	3.658 (0.851)	3.214 (0.771)
2	5.222 (0.772)	5.225 (0.884)	4.969 (0.735)	4.436 (0.911)
3	6.455 (0.406)	6.030 (0.727)	6.152 (0.445)	6.136 (0.606)
4	2.552 (1.265)	1.920 (0.768)	2.144 (1.078)	2.055 (1.102)
5	4.369 (0.782)	3.167 (1.185)	2.738 (0.788)	5.167 (0.932)
Total	4.382 (1.473)	4.104 (1.556)	3.892 (1.461)	3.747 (1.460)

Figure 24. Means and standard deviations of clustering variables in the male sub-sample, SOURCE: Lia Zarantonello and Bernd H. Schmitt (2010), "Using the brand experience to profile consumers and predict consumers' behavior", Brand Management, Vol I7, 7, pp. 532-540, Macmillan Publisher

After considering the clusters and the sub-samples, a regression analysis has been made in order to understands the correlation model between the brand attitude and purchasing intentions. Even if the overall predictive power of the brand attitude is moderate, the two extreme clusters, the holistic and the utilitarian ones, had completely different results. Indeed, Cluster 3 had the highest results in terms of beta coefficient (correlation between brand attitudes and purchasing intentions), while cluster 5 had the lowest grade.

Concluding, this research led to an important outcome. There are two extreme typologies of consumers, the first one excited and stimulated by brand experiences in all four dimensions (sensory, affective, behavioral and intellectual) and the second one, the utilitarian that are not interested in experiential values. In the middle, it is possible to find hybrid consumers. For the ones who get more involved in the brand experience, there is a higher probability to conclude the purchase of a brand, while the opposite type of consumers will be more hostile towards buying the brand's offer.

5. Arts and Crafts and Artificial Intelligence: a possible integration?

In Chapter one, Artificial Intelligence was introduced and an overview about its use in the luxury and fashion industry has been explained. It can be integrated within different fields, from philosophy to statistics and mathematics, from medicine to finance. Even if AI seems to be extremely distant from the artistic creations of human beings, it has recently started to interact with more "creative" sectors, such as the luxury and fashion one.

At their origins, arts and crafts were the key of a society's core production. In modern society, it becomes more and more a marginal market, most of the time associated with luxury products. One of the main issues that arts and crafts have always faced is the inability of innovation so that to be considered as resources of current production capacity. This step has not yet been taken, but somehow, art and crafts have become a tool of analysis for Artificial Intelligence and vice versa. Giving an example, if on one hand various types of art graphics and images can be converted into data files, on the other hand new kinds of arts and crafts can be created. Virtual Reality can be considered one of them, as well as the 3D environment and language and image recognition.

Arts and crafts integrated with AI can be a source of creativity and inspirations. Indeed, AI can easily and quickly generate visual effects, combining materials, colors, styles and structures. Moreover, AI is characterized by the ability to process large amounts of data, often very complex. Designers and artists can arrive through its use at completely new aesthetic and design forms that have a scientific basis. Thus, an infinite number of combinations of different artistic elements never "created" before are generated. In addition to this, it is important to underline the capacity of AI to come to a final decision or output in a very short time compared to the human mind. The decision-making ability, well described yet in chapter one, allows AI to process a series of inputs (human requests) and to reach the exact result desired by humans being.

We must learn to understand the potential that the union of technology and craftsmanship have and, above all, that their interaction does not represent arts' destruction but its evolution. Artificial Intelligence can be a tool for a sustainable promotion of art and craftsmanship since it succeeds in advancing cultural and aesthetic forms instead of eliminating them. The interaction between humans and computers can be seen as an extension of the traditional form of creation, since AI are interested in human habits and choices and arts and crafts represent the historical evolution of culture. The human-computer collaboration helps in reaching models and styles that users need.

Another element in which Artificial Intelligence will interact with humans creating new opportunities for development, is the change of teaching models of arts and crafts. "*With the advent of the intelligent era, the rapid development of arts and crafts in the new generation of information technology will have a revolutionary impact on traditional educational concepts,*

its educational systems and teaching modes, and focus more on the cultivation of teachers' innovation and assistance ability[30]" (Jiang Pu, 2020).

The key for this process is a more diversified intelligent guidance and evaluation system. The innovation in training mode should be implemented by considering intelligent technology as a guiding light for arts and crafts education. This would bring changes in the traditional training mode such as innovation in academic research, teaching methods, development of professional features. Colleges and universities will benefit both arts and crafts and AI strong points. AI can count on multiple tools such as virtual simulation, intelligent wearable, big data which can innovate the way we see the world and the educational universe. To be open to new experiences in such field means also open your mind and implement the potential of imagination. AI's resources will increase the value of arts and crafts' educational environment through high-quality teachers, experience sharing, practice exchange and will create a new class of well-prepared students and human beings. We must recognize that arts and crafts education should open itself to new opportunities starting from the learning methods, so that this integration can bring massive innovations in such field.

AI should not be seen as a lack of creativity in human contribute to design and art, but as an opportunity for this industry to keep up with the times, since it will become a fundamental part of society and life.

[30] Jiang Pu (2020), *Integration of Arts and Crafts in Artificial Intelligence Environment*, Journal Of Physics: Conference Series, IOP Publishing

CHAPTER THREE: MARKETING ANALYSIS

The research started with an overview about the luxury industry, continuing with the use of Artificial Intelligence in production and distribution processes of garments. After this descriptive section, a luxury definition has been given. In defining a brand as luxury, the literature often mentions craftsmanship. We observed how craftsmanship plays a central role in most of luxury brand and how it is communicated to the external. Indeed, craftsmanship is generally associated with quality, uniqueness and refinement. The aim of this thesis is to understand if the communication of the use of Artificial Intelligence, especially for garments production, will impact consumers' perception toward the luxury of the product and the brand.

The analysis was implemented using a survey which showed the participants a visual stimulus: an image representing two products of a luxury brand, a woman and a man's knitwear. There were also two different image descriptions, but only one of them was randomly shown to participants. All the questions were aimed at answering the following hypothesis:

- *Hypothesis 1*: the communication by the brand of the presence of AI in their production of luxury products, compared to the communication of crafted production (absence of AI) leads to a lower perception of the luxury of the product by the consumer;
- *Hypothesis 2*: the communication by the brand of the presence of AI in their production of luxury products, compared to the communication of crafted production (absence of AI) leads to a lower perception of the luxury of the brand by the consumer;
- *Hypothesis 3*: in the case of younger consumers (Millennials) the effect is weakened, i.e. the perception is not negatively influenced by the communication of the presence of AI.

Resuming, the survey's questions try to acknowledge if a product and a brand can be both considered as luxury, when the role of its craftsmanship is resized, or if the artisanship element, that most of brands considers important for their business, is not as much relevant as for consumers. The age of consumers has been added as a moderator. In other words, a different perception of the luxury of the product and the brand in the case of communication of the use of Artificial Intelligence instead of craftsmanship, does not occur in the case of young consumers.

1. Research design

The research was implemented with the realization of a questionnaire created with Qualtrics XM that was shared between 14th September 2020 and 16th September 2020, through social channels (e.g. Facebook, WhatsApp and Instagram) and via email. 243 people answered the survey.

The survey was structured in 5 sections:

- Introduction to the questionnaire and the visual stimulus with randomization of its description;
- customers' perception of the luxury of the product scale
- customers' perception of the luxury of the brand scale
- attention check
- socio-demographic questions.

The survey was written in Italian so that also non-English speakers could answer the questions (see the Appendix section).

As just explained, the survey started with a visual stimulus accompanied by a description. The image showed two cashmere sweaters, one for women and one for men.

Figure 25. The image showed to participants in the questionnaire, SOURCE: Qualtrics XM

The picture was taken from Brunello Cucinelli 2021 Winter Collection mainly for two reasons: firstly, the lack of logo and recognizable signs on products, secondly because of the refinement and the luxury generally attributed to the brand. Participants could receive randomly one of two short illustrations, which gave a different type of information about the product shown. The first one was aimed to highlight the craftsmanship and the consequential uniqueness of both products: "*A famous luxury brand, specialized in the production of knitwear, has launched the new winter collection for men and women. The products were made in precious cashmere, cut and sewn by tailors who, with a slow and meticulous work, have hand woven the threads. The craftsmanship may cause small production imperfections, mostly imperceptible to the human eye. After carefully observing the images of the products in question, answer the following questions*" (Un famoso brand di lusso, specializzato nella produzione di maglieria, ha lanciato la nuova collezione invernale uomo e donna. I prodotti sono stati realizzati in prezioso *cachemire*, tagliati e cuciti da sarti che, con un lavoro lento e meticoloso, hanno intrecciato a mano i fili. La lavorazione artigianale potrebbe comportare delle piccole imperfezioni di produzione, perlopiù impercettibili all'occhio umano. Dopo aver osservato attentamente le immagini dei prodotti in questione, rispondi alle seguenti domande). On the contrary, the second statement, related to the same image, informs the participant that the products have not been made by craftsmen but by a sewbot, a robot developed with artificial intelligence: "*A famous luxury brand, specialized in the production of knitwear, has launched the new winter collection for men and women. The products have been realized in precious cashmere, whose threads have been woven by a sewbot (robot developed with Artificial Intelligence). The automated processing allows to eliminate any imperfection imperceptible to the human eye, making the product of extreme quality. After having carefully observed the images of the products in question, answer the following questions*" (Un famoso brand di lusso, specializzato nella produzione di maglieria, ha lanciato la nuova collezione invernale uomo e donna. I prodotti sono stati realizzati in prezioso *cachemire*, i cui fili sono stati intrecciati da un *sewbot* (robot sviluppato con Intelligenza Artificiale). La lavorazione automatizzata permette di eliminare ogni imperfezione impercettibile all'occhio umano, rendendo così il prodotto di estrema qualità. Dopo aver osservato attentamente le immagini dei prodotti in questione, rispondi alle seguenti domande). The two short descriptions try to highlight to consumers some objective aspects that concern craftsmanship and the use of AI in garments' production: the probability of production errors. In fact, if in the first case the beauty and the uniqueness of the product are related to the small imperfections due to humans' limits, on the other hand, Artificial Intelligence is able to produce perfect clothes without any errors.

However, the second case lacks the charm and the preciousness given by craftsmanship. This first section, with randomized descriptions, was so structured in order to study the impact on consumers' perception of the communication of AI in production processes and how it changes compared to the communication of artisan production. To do that, results were divided according to randomization to see the changes in the luxury perception of both product and its brand.

The second section involved different questions from Jonathan S. Vickers and Franck Renand's scale (2003), in order to analyze the perception of the luxury of the products showed. The scale is based on a Likert scale (7-points scale), from "*totally disagree*" to "*totally agree*". It was developed in the report "*The Marketing of Luxury Goods: an explanatory study – three conceptual dimensions*" in which the scholars demonstrated what distinguish luxury products from other kind of products. More particularly, the luxury of a product is identified by three dimensions: the symbolic interactionism, the experientialism and functionalism. The functional symbolic involves all the motivations that lead the consumer for search for a specific product in order to satisfy personal needs; the experiential need is the sensory pleasure, variety and cognitive stimulations desired by the consumers; the symbolic interactionism describes desires for products that fulfil internally generated needs for self-enhancement, role position, group membership or ego-identification. Work on symbolic consumer behavior (Levy 1959, Aron and Frost 2002, Bhat and Reddy 1998) illustrates the important relationship between symbolic interactionism and consumption[31]. In the questionnaire, people had to valuate from 1 (totally disagree) to 7 (totally agree) the following statement related to the products shown:

- Purchased by a very wealthy person
- Investment purchase
- Special richness and tone of decoration
- Traditional and exclusive designs
- Superior quality and strength
- Exquisitely hand crafted (with care)
- Whiteness and durability

[31] Jonathan S. Vickers and Franck Renand (2003), *The Marketing of Luxury Goods: an explanatory study – three conceptual dimensions*, The Marketing review, pp. 459-478, Westburn Publishers Ltd.

The third section was structured using Vigneron and Johnson's scale (1999) in order to analyze the perception of the luxury of the brand. Also in this case, a 7-points scale that was previously validated by scholars was used. According to Vigneron and Johnson, the luxury of a brand is based on five factors: conspicuousness, uniqueness, quality, hedonism and extended self. Conspicuousness involves the desire of people of search social representation and it is generally associated with price. Indeed, the latter is used as a proxy of luxury and quality. Uniqueness represents the rarity of the brand, that is implemented by trying to avoid similar consumption. Quality is generally perceived by consumers considering technology, engineering, design, sophistication and craftsmanship[32]. Nowadays, it seems impossible for a brand be defined as luxury without a strong commitment with quality. The hedonism reflects the emotional benefits of a brand; it is the plus that a luxury brand offers beyond the functional benefits. The last but not the least feature is the extended self, that is the need to distinguish yourself from others. It also relates to the desire of belonging to a social context and get a specific identity. Participants to the survey had to vote from 1 (totally disagree) to 7 (totally agree) the following statement in relation to the randomized description and image: "This brand is for rich people", "This is a very expensive brand" and "This is an elitist brand" for analyze the conspicuousness feature; "This is a select brand", "This is a precious brand", "This is a unique brand" and " This is a rare brand" for uniqueness dimension; "This is a luxurious brand", "This is a sophisticated brand", "This is a superior brand" and "This is a top-quality brand" to classify the level of quality and finally "This is a refined brand", "This is an attractive brand" and "This is a dazzling brand" for refinement.

Before responding to the socio-demographic question, a check point block was inserted in order to verify if respondents were attentive to the description of the images proposed at the beginning of the questionnaire, so as to determine the answers valid for the statistical analysis.

The fifth section involved socio-demographic questions: age, gender, education, occupation and personal income. Participants could select an age range (0-18, 19-30, 31-50, 50-70 and over 70). This structure was implemented to verify the third research question, i.e. that in the

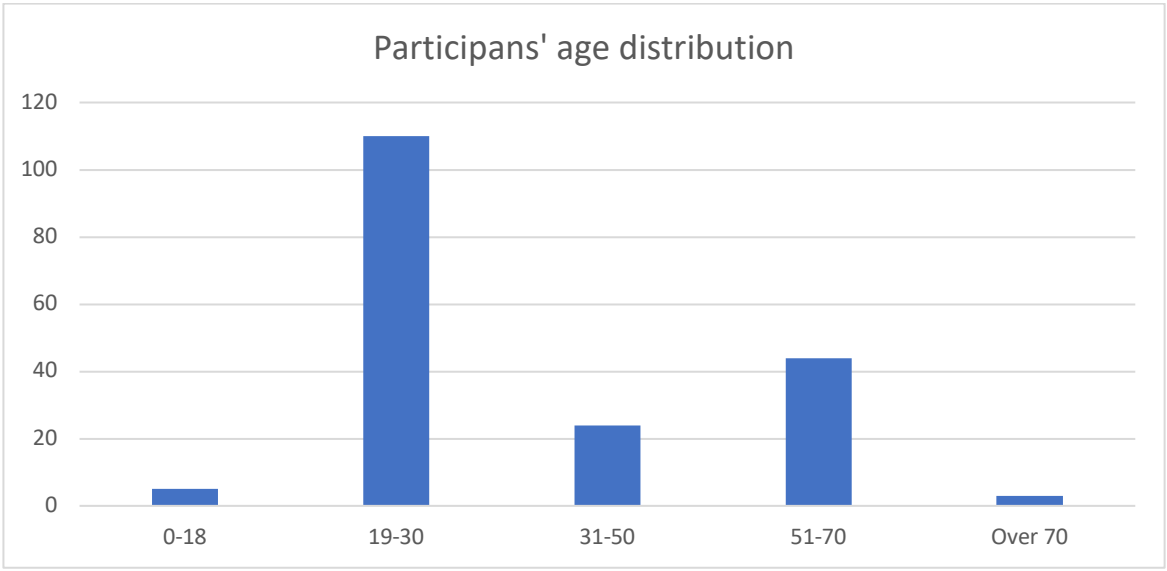
[32] Franck Vigneron and Lester W. Johnson, Measuring perception of brand luxury, Brand Management Vol II, No. 6, pp. 484-506, Henry Stewart Publications, January 2004

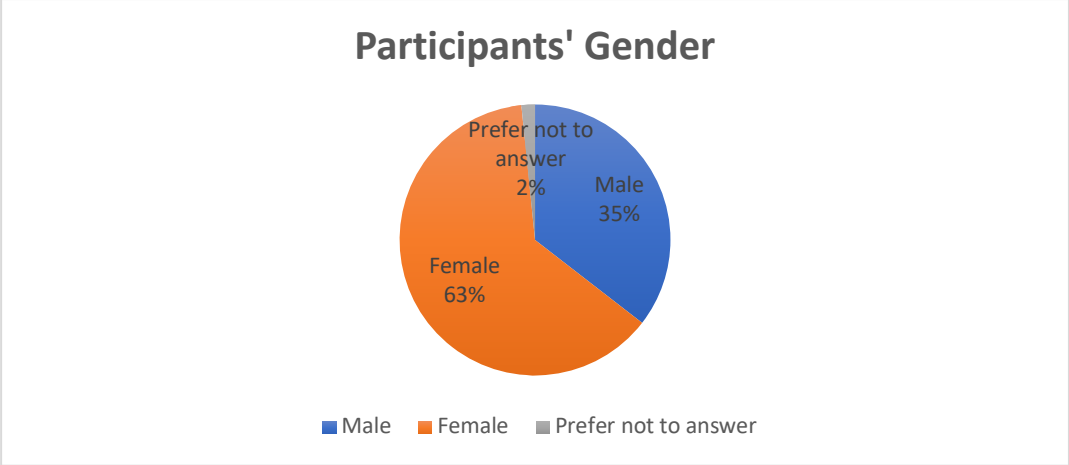
case of young respondents the communication of the use of AI does not impact on the perception of luxury of the product and brand. Therefore, the age of the participants has a moderating function that could weaken the hypotheses one and two of the research. The remaining questions have been inserted to verify and study the existence of further possible moderators.

2. The questionnaire and measurement

The questionnaire was filled in by 243 people, 186 of whom passed the check point and therefore, whose answers were validated and considered for academic research purposes. The questionnaire was structured in 27 multiple-choice closed questions, written in Italian language to make it understandable to the whole sample especially for those who were non-English speakers.

Most of the sample was aged between 19 and 30 years old (59.1%) and with a University degree as educational level (47.8%). The gender of the population was mainly female, 117 people (62.9%), with 66 males (35.5%) and only 3 respondents which preferred to not specify personal sex, as shown in the graph below.





In order to study both the perception of the luxury of the product and the luxury of the brand, the statements were submitted to an evaluation on Likert scale from totally disagree (1) to totally agree (7).

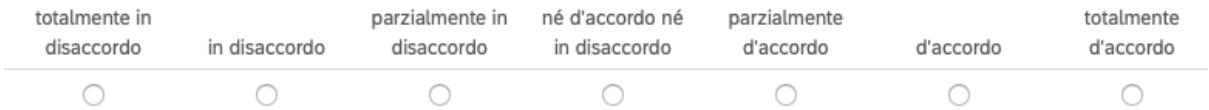


Figure 26. The Likert scale. Source: Qualtrics XM

For the evaluation of the perception of luxury of the product, was originally made up of 7 statements but since the reliability statistic of all items resulted in a Cronbach's alpha of 0.718, the second statement "Investment purchase" was delated in order to improve it up to 0.724. In the second section, instead, all the items have been maintained since the Cronbach's alpha was 0.882 and no elimination resulted in an improvement of this value.

3. Results Obtained

Results of the questionnaire were analyzed using the SPSS software developed by IBM. Before starting the analysis of data in order to verify hypothesis 1, 2 and 3 a preliminary test has been conducted in order to validate the reliability of data set. Both data gathered for the valuation of the perceived luxury of the product and the perceived luxury of the brand had a positive Cronbach's alpha higher that 0.7, respectively 0.718 and 0.882, verifying the internal consistency of data.

Reliability Statistics

Cronbach's Alpha	N of Items
.718	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PLP_Q1	29.33	26.299	.311	.712
PLP_Q2	30.46	22.920	.339	.724
PLP_Q3	29.25	22.501	.598	.642
PLP_Q4	29.51	26.046	.304	.715
PLP_Q5	29.00	24.605	.503	.670
PLP_Q6	28.98	23.886	.571	.655
PLP_Q7	29.25	24.966	.471	.677

Figure 27. SPSS output: Reliability test and Cronbach's Alpha for the perception of the luxury of the product

In the case of the perception of the luxury of the product, Cronbach's Alpha is higher than 0.7 so that it can be considered reliable. However, as shown in the figure above, the Alpha value increase if statement two (PLP_Q2) is delated, gathering a score of 0.724.

Reliability Statistics

Cronbach's Alpha	N of Items
.882	14

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PLB_Q1	58.25	147.009	.397	.881
PLB_Q2	58.03	145.313	.469	.878
PLB_Q3	58.43	143.046	.454	.879
PLB_Q4	59.13	143.172	.434	.880
PLB_Q5	58.05	141.402	.632	.872
PLB_Q6	59.24	134.141	.639	.870
PLB_Q7	59.49	132.338	.658	.869
PLB_Q8	58.25	139.184	.607	.872
PLB_Q9	58.29	140.521	.592	.873
PLB_Q10	58.71	136.056	.615	.871
PLB_Q11	57.78	141.611	.601	.873
PLB_Q12	57.76	142.022	.661	.871
PLB_Q13	58.74	136.952	.576	.874
PLB_Q14	59.62	141.025	.474	.879

Figure 28. SPSS output: Reliability test and Cronbach's Alpha for the perception of the luxury of the brand

In case of data collected for the perception of the luxury of the brand, the Alfa obtained was of 0.882 make the output highly reliable. No items had to be delated in order to improve its value.

3.1.How the communication of AI impacts the perception of the luxury of the product

In completing the questionnaire, 95 people were subjected to the "craftsmanship condition", i.e. the vision of the image of luxury products manually sewn by tailors, while 91 people were subjected to the "Artificial Intelligence condition", i.e. the products observed were sewn by a robot developed with Artificial Intelligence.

The analysis started with the study of the first independent variable of the research, the perception of the luxury of the product, with the aim of evaluating the hypothesis 1: "the communication by the brand of the presence of AI in their production of luxury products, compared to the communication of crafted production (absence of AI) leads to a lower

perception of the luxury of the product by the consumer". Firstly, the t-test was carried out, implementing descriptive statistics.

Group Statistics

	Condizione	N	Mean	Std. Deviation	Std. Error Mean
Mean	Craftsmanship	95	5.2421	.70408	.07224
	Artificial Intelligence	91	4.9029	.85529	.08966
Mean2	Craftsmanship	95	4.5767	.86422	.08867
	Artificial Intelligence	91	4.4286	.94838	.09942

Figure 29. SPSS output. T-Test based on groups statistics

As shown in the figure above, the mean value attributed by participants to the 6 statements (after delated the second statement) of the perception of the luxury of the crafted product is 5.24. This output results higher compared to the mean value attributed to the same scale under Artificial Intelligence condition, 4.90. Although the first comparison gives power to the first hypothesis formulated, it is necessary to check its significance to judge it as verified. For this purpose, the statistical Significance 2-tailed has been implemented trough the Indipendent Sample Test.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean	Equal variances assumed	4.574	.034	2.958	184	.004	.33917	.11466	.11296	.56539
	Equal variances not assumed			2.946	174.405	.004	.33917	.11514	.11193	.56642
Mean2	Equal variances assumed	.175	.676	1.114	184	.267	.14812	.13295	-.11418	.41042
	Equal variances not assumed			1.112	180.672	.268	.14812	.13321	-.11473	.41097

Figure 30. Output SPSS. The Independent Samples Test for the Sig. (2-tailed)

In the case of the perception of the luxury of the product, the difference between the two means can be considered significant since the value attributed to the Sig. 2-tailed is lower than 0.05.

Therefore, the perception of the luxury of the product is higher for consumers who came into contact with products with craftsmanship features, while it became lower if the product is developed with the use of Artificial Intelligence (i.e. when craftsmanship is absent). So, hypothesis 1 is verified with a Sig 2-tailed of .004 both with equal variances assumed and with equal variances not assumed.

3.2.How the communication of AI impacts the perception of the luxury of the brand

After validating hypothesis 1, we continue with the analysis of the second dependent variable of the research, the perception of luxury of the brand. 95 people in the sample were subjected to the "Craftsmanship condition", while the remaining 91 to the "Artificial Intelligence condition". With the aim of evaluating the second hypothesis of the research, i.e. the communication by the brand of the presence of AI in their production of luxury products, compared to the communication of crafted production (absence of AI) leads to a lower perception of the luxury of the brand by the consumer, t-test was carried out, implementing descriptive statistics.

Group Statistics

	Condizione	N	Mean	Std. Deviation	Std. Error Mean
Mean	Craftsmanship	95	5.2421	.70408	.07224
	Artificial Intelligence	91	4.9029	.85529	.08966
Mean2	Craftsmanship	95	4.5767	.86422	.08867
	Artificial Intelligence	91	4.4286	.94838	.09942

Figure 31 SPSS output. T-Test based on groups statistics

Again, the first result seems to be positive. The scale of perception of the luxury of the brand has an average value of 4.58 in case of presence of craftsmanship, while 4.43 in case of presence of Artificial Intelligence and therefore in absence of craftsmanship. However, it is necessary to implement the Independent Test to validate the significance of the difference in values of the two averages. As in the previous analysis, the variation of the averages will be significant if Sig. 2-tailed has a value less than 0.05. Below is shown the output from the SPSS software.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean	Equal variances assumed	4.574	.034	2.958	184	.004	.33917	.11466	.11296	.56539
	Equal variances not assumed			2.946	174.405	.004	.33917	.11514	.11193	.56642
Mean2	Equal variances assumed	.175	.676	1.114	184	.267	.14812	.13295	-.11418	.41042
	Equal variances not assumed			1.112	180.672	.268	.14812	.13321	-.11473	.41097

Figure 32. Output SPSS. The Independent Samples Test for the Sig. (2-tailed)

From a statistical point of view, the difference in averages has no significance since Sig. 2-tailed results 0.267 in case of equal variances assumed, and 0.268 in case of equal variances not assumed, both values higher than 0.05. For that reason, the hypothesis 2 is rejected: the presence of AI in the communication of luxury products production does not have impact on the perception of the luxury of the brand.

In support of this result, i.e. the fact that the introduction of Artificial Intelligence seems to have no negative effects on the perception of the luxury of the brand, there is the study developed by Nadine Hennigs, Klaus-Peter Wiedmann, Stefan Behrens and Christiane Klarmann in the "*Unleashing the power of luxury: Antecedents of luxury brand perception and effects on luxury brand strength*" (2013). This report defines the antecedents that allow a brand to be perceived as luxurious. In particular, scholars cite four latent antecedent dimensions: the financial dimension which refers to the monetary aspects, functional dimension that involves cores functionalities of luxury products, the individual dimension i.e. the consumer's orientation towards luxury consumption and the social dimension which is the personal utility in consuming luxury goods. In order to define what contributes to the overall luxury brand perception, the scholar took into consideration only three of the previously mentioned dimensions thar are the Financial Brand Perception, the Functional Brand Perception and the Social Brand Perception. These elements then determine the perception of luxury of the brand, which then materializes with the strength of the luxury brand, composed by Cognitive Brand Strength, Affective Brand Strength and Conative Brand Strength.

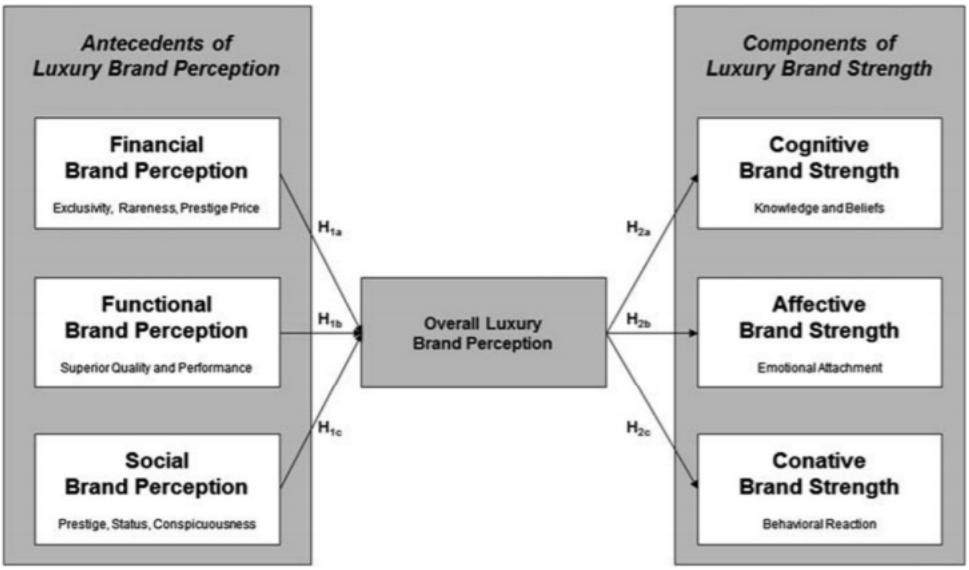


Figure 33. Luxury perception antecedents. SOURCE: Nadine Hennigs, Klaus-Peter Wiedmann, Stefan Behrens and Christiane Klarmann in the "Unleashing the power of luxury: Antecedents of luxury brand perception and effects on luxury brand strength" (2013)

The research therefore demonstrates how the perception of luxury of brands derives from a series of elements including the characteristics of the product offered. However, precisely because of the multiple aspects that characterize it, the stimulus proposed to the participants of this research is not enough to decrease or change the perception of the brand, but only that of the product.

3.3.The age effect on the perception of the luxury of the product and the brand scale

Having accepted the hypothesis 1 and rejected 2, we will now study hypothesis 3, according to which a moderator item is introduced: the age of consumers. In fact, in hypothesis 3 is mentioned that the negative effect of the presence of Artificial Intelligence, in communication strategy, on the perception of the luxury of the product and brand does not occur in the presence of young consumers, the Millennials. Since the effect of AI on the luxury perception of the brand has been rejected, the third hypothesis will be analyzed only in relation to the perception of the luxury of the product.

To see if the perception of the luxury of the product with AI changes according to the age of the survey respondents, it is necessary to implement the ANOVA calculation. Also in this case, the dependent variable is the perception of the luxury of the product, the control factor remains

the craftsmanship and the Artificial Intelligence conditions, but the age category is introduced as covariate.

Tests of Between-Subjects Effects

Dependent Variable: Mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5.660[a]	2	2.830	4.619	.011	.048
Intercept	548.856	1	548.856	895.817	.000	.830
Età	.313	1	.313	.511	.475	.003
Condizione	5.013	1	5.013	8.181	.005	.043
Error	112.122	183	.613			
Total	4910.528	186				
Corrected Total	117.782	185				

a. R Squared = .048 (Adjusted R Squared = .038)

Figure 34. SPSS output. ANOVA calculation

Even if the condition is significant and therefore verified, the difference in age category has no statistically significant value. In fact, following the Univariate analysis of the Variance, the Sig. of the age moderator element is 0.475 and higher than 0.05. So, also the hypothesis 3 is rejected: the negative effect of Artificial Intelligence presence (i.e. absence of craftsmanship) remains unchanged also in case of younger consumers.

4. Managerial implications

Results obtained show that communicate the use of Artificial Intelligence negatively affects the perception of the luxury of the product, but not that of the brand. In addition, this phenomenon occurs for all socio-demographic groups analyzed, underlining the importance that craftsmanship has in the definition of luxury for consumers as synonym of quality and rarity. Indeed, the craftsmanship of luxury products represents for brands a value to strongly communicate to the outside world, but which does not reflect the reality of the fashion and luxury industry. Given the high demand for luxury products, companies have long since introduced automated production processes, reserving craftsmanship mainly for the production of Haute Couture collections or for special events. However, never as before, modern consumers are increasingly attentive to brands' internal policies and explicitly demand

transparency in communication. Moreover, when Artificial Intelligence, as well as other technologies, will become tools to support everyone's everyday life, consumers will be more aware of the capabilities and possibilities of using this kind of technology. So that, luxury brands will then have to adopt strategies to show the role of AI within their business. This paper can help to implement a communication strategy about the evolution of the luxury industry and the use of new technology such as AI, which will not lead to a decrease of the perception of the luxury of the product. In particular, given the results of research, it has been found that for consumers of all ages, craftsmanship is essential in order to define a product as luxury. Brands will, therefore, have to find and implement a storytelling of products that enhance the integration between craftsmanship and Artificial Intelligence, showing what improvements the integration between the two worlds can bring in production processes such as the elimination of production imperfections. Marketing strategies will have to show Artificial Intelligence as a support tool for human activity, which is valued and not destroyed by new technologies, underlining the willingness to maintain alive cultural traditions of arts and crafts.

We have seen how Artificial Intelligence is a powerful support for the production of luxury products and how often leads to product improvement since it lowers the probability of manufacturing defects to zero. However, the questionnaire highlighted how the consumer is poorly informed about this technology and its potential. Therefore, it could be a managerial strategy to start informing and educating consumers about new technologies and how they are integrated with production processes. In fact, as highlighted by the research experiment, consumers are not at all aware of what Artificial Intelligence is and, for this reason, they usually are skeptical when it is used in an industry that has always been based on craftsmanship. A good information campaign that starts to bring the consumer closer to Artificial Intelligence, and more generally to technological innovations, could eliminate the currently negative prejudice about its use.

5. Limitations and directions for future research

As all academic research, this study also reveals some limitations that could be overcome in future research. The first issue is the limited socio-demographic distribution of the sample. Firstly, most respondents are between 19 and 30 years old (59.1%), that is a high percentage compared to people between 31-50 years old (19.9%), 51-70 (23.7%) and over 70 years old (1.6%). Future research should stratify more accurately the age of respondents, increasing the

sample size, in order to have more precise feedback on the effect of the use of Artificial Intelligence on the perception of luxury products and brands. In this way, it is also possible to analyze in a more accurate way potential differences on perceived luxury of the product and of the brand between one age range and another. In addition, the experiment should also be extended to a geographically point of view, involving diverse populations. The sample selected was exclusively from Italy, and therefore certainly strongly attached and fond of its traditions of art and craftsmanship. Populations of other continents, such as China that has become the country with the highest consumption of luxury goods, could define luxury through different attributes and items. In addition, Chinese consumers may react extremely differently to the use of technology, being also much more accustomed than the European population to an interaction between automation, Artificial Intelligence and humans. The second limitation is related to the distribution of the questionnaire, i.e. through email and social networks (WhatsApp, Instagram and Facebook). In order to have a more precise reaction of consumers, field interviews could be organized in which research participants could observe closely the work in production laboratories, seeing in person the integration of Artificial Intelligence with the work implemented by employees. The visual stimulus of the image and the short storytelling associated with it could lead to misunderstandings or not give a 360° view of the product manufacturing processes. In fact, the third limitation of the research related to the second is that, although the images were taken from the official website of Brunello Cucinelli, the belonging of the products to the brand was not recognizable by the survey participants. Trying the same analysis on an existing luxury brand, about which consumers have a high awareness, could lead to even different and more precise results with respect to the change in the perception of the luxury of the product.

CHAPTER FOUR: CONCLUSIONS

The luxury and fashion industry is an extremely competitive market, characterized by the presence of three large groups whose portfolios hold most of the brands competing with each other. In addition to this, the demand for luxury goods, with a greater share coming from China, constantly grows and is subjected to very fast changes. In fact, companies must meet consumers' requests of a customized and tailored Customer Decision Journey. To cope with this landscape, companies are in one hand trying optimizing and making more efficient all production processes and all steps of their supply chain, and in the other hand ,trying to collect and analyze as much as possible customers' information and data in order to satisfy different kind of needs. Artificial Intelligence represents the most efficient and valid support to achieve these goals, thanks to the wide range of uses that the company can implement. In fact, all businesses operating in this market have already implemented an important technological revolution in which Artificial Intelligence is the main protagonist.

What distinguishes Artificial Intelligence from other technologies is the ability to imitate, or rather emulate, the decision-making processes of the human mind. For this reason, it is able to replace roles that have always been considered to belong to the human being, such as social interaction and creativity. As a result, the main processes in which Artificial Intelligence is integrated and used in these businesses are:

- Forecasting of future demand and inventory management;
- Fashion design;
- Automation of production processes, such as the sewbot;
- Data processing in order to improve the shopping experience both online and offline;
- Support to CSR, as it minimizes waste of raw materials and pollutants.

However, such a vast implementation of this technology clashes with one of the main elements that literature attributes to the concept of luxury: craftsmanship. It reflects the quality, the uniqueness and the rarity of the products offered by luxury and fashion brands, which in turn give it enormous value by communicating it to consumers. Indeed, several marketing strategies implemented by the biggest brands in the industry have been analyzed in order to give craftsmanship a central role within their businesses. In addition, we have seen how experience is of fundamental part to define a brand as luxury and how, also in this case, the role of craftsmanship is central: LVMH organizes every year from 2011 "*Les journèes Particuluères*", a worldwide event in which brands show customers the ancient techniques and the work of

their craftsmen or the Dior Cruise Collection 2021 in Lecce in which garments were sewn by local dressmakers who used ancient techniques and tools, such as the "*tombolo*", nowadays known to few.

The literature analyzes abundantly the various aspects that distinguish luxury brands, but they have not yet analyzed what could be the consequences that the introduction of Artificial Intelligence could have on consumers. For this reason, the purpose of this research is to understand what could be the impacts and effects of AI on consumers' perception of the luxury of products and of brands once they become aware of it. To do that, a questionnaire was structured and completed by 243 people. Participants were subjected to a visual stimulus representing two luxury products accompanied by a short storytelling related to the image. Two different description were formulated, that appeared randomly: the first one was aimed to highlights the craftsmanship and the consequential uniqueness of both products, while the second statement informs the participant that the products have not been made by craftsmen but by a sewbot, a robot developed with Artificial Intelligence. Two scales were used in order to define the perceived luxury of the products and the of the brand, respectively the Jonathan S. Vickers and Franck Renand's scale (2003) and the Vigneron and Johnson's scale (1999). From 243 questionnaires have been validated 186 responses.

Data were analyzed through SPSS software by IBM in order to obtain statistical results. Before starting the study of data, a Reliability Test was implemented. Both data gathered for the valuation of the perceived luxury of the product and the perceived luxury of the brand had a positive Cronbach's alpha higher that 0.7, respectively 0.718 and 0.882, verifying the internal consistency of data. The study, then, continued with the Independent Samples Test for both scales. The statistics analysis accepted the first hypothesis with a Sig. of 0.004 and rejected the second hypothesis with a Sig. of 0.267. Consumers judge negatively the use of Artificial Intelligence in the production processes, so that the perceived luxury of the product lowered. The same reaction did not happen in relation to the perception of the luxury of the brand. This result can be explained by consider that the luxury of the brand is a concept more rooted in consumers' mind and depends on antecedents which are explained by the scholars Nadine Hennigs, Klaus-Peter Wiedmann, Stefan Behrens and Christiane Klarmann in the "*Unleashing the power of luxury: Antecedents of luxury brand perception and effects on luxury brand strength*" (2013). In fact, this work highlights how the perception of the luxury of the brand derives from a set of antecedents, in which the characteristics of the products constitute a part

of them. For this reason, the visual and descriptive stimulus shown to the participants of the questionnaire is not powerful enough to negatively influence the perception of luxury of a brand, but only that of the product.

The luxury and fashion industry is undergoing a significant technological transformation and it is important to make consumers aware of these changes. In fact, we have seen how consumers attribute a very high value to arts and crafts and consider them a fundamental element to define a product as luxury. For that reason, customers consider essential that companies deny the more traditional aspects of this sector alive so that they do not appreciate the use of Artificial Intelligence in the luxury and fashion industry. The main reasons for this repulsion to the integration of new technologies into fashion brands lies in a lack of information and knowledge about the benefits, both in terms of quality and sustainability, that IA brings to companies. Therefore, it is necessary for brands to inform consumers about what Artificial Intelligence is and what are pros and cons of its usage, eliminating bias and so the negative effect that this technology has on the perception of luxury products. On the other hand, fashion is considered as an art and for this reason it must not lose its fundamental characteristics. We have understood in the "Integration of Arts and Crafts in Artificial Intelligence Environment" by Jiang Pu (2020) how also arts and crafts can evolve, without compromising them. Businesses can easily learn to introduce AI as support tool and not a replacement for humans, implementing a constructive integration which leads to overperformance of creation of products and optimization of resources.

APPENDIX

The questionnaire

Default Question Block — Block Options

Q1

Ciao! Sono Camilla, una studentessa laureanda dell'università Luiss Guido Carli di Roma. Questo questionario è stato strutturato come supporto alla mia tesi di laurea, con fini esclusivamente accademici. Ti chiedo qualche minuto del tuo tempo per rispondere ad alcune domande dopo aver letto **attentamente la descrizione delle immagini** che osserverai.
Il questionario è in forma anonima e non esistono risposte giuste o sbagliate: quello che conta è solo la tua opinione!

Block 2 — Randomized — Block Options

Q2

Un famoso brand di lusso, specializzato nella produzione di maglieria, ha lanciato la nuova collezione invernale uomo e donna. I prodotti sono stati realizzati in prezioso *cachemire*, **tagliati e cuciti da sarti** che, con un lavoro lento e meticoloso, hanno intrecciato a mano i fili. La lavorazione artigianale potrebbe comportare delle piccole imperfezioni di produzione, perlopiù impercettibili all'occhio umano. Dopo aver osservato attentamente le immagini dei prodotti in questione, rispondi alle seguenti domande.

Q3

Un famoso brand di lusso, specializzato nella produzione di maglieria, ha lanciato la nuova collezione invernale uomo e donna. I prodotti sono stati realizzati in prezioso *cachemire*, i cui **fili sono stati intrecciati da un *sewbot*** (robot sviluppato con Intelligenza Artificiale). La lavorazione automatizzata permette di eliminare ogni imperfezione impercettibile all'occhio umano, rendendo così il prodotto di estrema qualità. Dopo aver osservato attentamente le immagini dei prodotti in questione, rispondi alle seguenti domande.

Block 4 Block Options

Q4 Credo che gli abiti visti sopra siano:

	totalmente in disaccordo	in disaccordo	parzialmente in disaccordo	né d'accordo né in disaccordo	parzialmente d'accordo	d'accordo	totalmente d'accordo
generalmente acquistati da persone facoltose	○	○	○	○	○	○	○
una forma di investimento: il valore del bene rimane/aumenta nel corso del tempo	○	○	○	○	○	○	○
particolarmente preziosi, si distinguono per la loro fattezza	○	○	○	○	○	○	○
dal design classico ed esclusivo	○	○	○	○	○	○	○
di qualità e resistenza superiori	○	○	○	○	○	○	○
prodotti con cura e savoir-faire	○	○	○	○	○	○	○
di elevata durabilità	○	○	○	○	○	○	○

Block 5 Block Options

Q5 In riferimento alle immagini che hai osservato, pensi che:

	totalmente in disaccordo	in disaccordo	parzialmente in disaccordo	né d'accordo né in disaccordo	parzialmente d'accordo	d'accordo	totalmente d'accordo
è un brand per persone facoltose	○	○	○	○	○	○	○
è un brand molto costoso	○	○	○	○	○	○	○
è un brand di nicchia	○	○	○	○	○	○	○
è un brand che ti rispecchia	○	○	○	○	○	○	○
è un brand ricercato	○	○	○	○	○	○	○
è un brand unico	○	○	○	○	○	○	○
è un brand raro	○	○	○	○	○	○	○
è un brand di lusso	○	○	○	○	○	○	○
è un brand sofisticato	○	○	○	○	○	○	○
è un brand che si distingue	○	○	○	○	○	○	○
è un brand di elevata qualità	○	○	○	○	○	○	○
è un brand raffinato	○	○	○	○	○	○	○
è un brand che mi attrae	○	○	○	○	○	○	○
è un brand che mi impressiona	○	○	○	○	○	○	○

Block 3 Block Options

Q6 I prodotti appena osservati, sono stati realizzati:

- ○ Artigianalmente
- ○ Con utilizzo di Intelligenza Artificiale

Block 6 Block Options

Q7 Sesso:

- maschio
- femmina
- preferisco non specificare

Q8 Età:

- 0-18
- 19-30
- 31-50
- 51-70
- più di 70

Q9 Qual è il tuo titolo di studio?

- Nessun titolo
- Licenza elementare
- Diploma scuola media inferiore
- Diploma scuola media superiore
- Laurea
- Master/Dottorato

Q10 Qual è attualmente la tua occupazione?

- Studente
- Lavoratore a tempo pieno
- Lavoratore part-time
- Disoccupato
- In pensione

Q11 A quale fascia di reddito appartieni?

- < € 15.000
- tra € 15.001 e € 28.000
- tra € 28.001 e € 55.000
- tra € 55.001 e € 75.000
- tra € 75.001 e € 100.000
- > € 100.000

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EXECUTIVE SUMMARY

AI and the Luxury and Fashion Industry

Art and crafts represent an important part of the traditions and cultures of the world, most of which are now unknown and forgotten by many. Slow and meticulous production and creations have mostly been replaced by automated processes that make tasks faster and easier. However, among all industries, the luxury and fashion one still seems to support and enhance ancient arts and crafts, that become the object of marketing and communication strategies. But, how does technological innovation stand in this context? How does it integrate with an industry that has always been based on creativity and craftsmanship? Apparently very distant concepts, fashion and technology are two worlds that nowadays coexist, often creating heated debates. The purpose of this research is to analyze the use of Artificial Intelligence within the fashion industry and understand the effects of the communication of the use of AI on the consumers' perception of the luxury both of the product and the brand.

The luxury and fashion industry is an extremely competitive market, characterized by the presence of three large groups whose portfolios hold most of the brands competing with each other: LVMH, Kering and Richemont. The remaining share of the market is divided into smaller groups such as the Prada Group and the MaxMara Group and some other independent brands that are mostly Italian, such as Salvatore Ferragamo, Brunello Cucinelli and Etro. Moreover, the demand for luxury goods, with a greater share coming from China, constantly grows and is subjected to very fast changes. In fact, companies must meet consumers' requests of a customized and tailored Customer Decision Journey. To cope with this landscape, companies are in one hand trying optimizing and making more efficient all production processes and all steps of their supply chain, and in the other hand ,trying to collect and analyze as much as possible customers' information and data in order to satisfy different kind of needs. Artificial Intelligence represents the most efficient and valid support to achieve these goals, thanks to the wide range of uses. In fact, all businesses operating in this market have already implemented an important technological revolution in which Artificial Intelligence is the main protagonist. Just think that at Alexander Wang's Pre-Fall 2019 fashion show, in New York, among all special guests, the robot Sophia was sitting in the front row. With 93 million followers, the robot was nominated as one of the most important fashion influencers of 2018 so much so that it is considered to be on a par with human beings.

AI is defined as *"an area of study of computer science, concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning and self-correction."* (Joost N. Kok, Egbert J. W. Boers, Walter A. Kosters, Peter van der Putten and Mannes Poel, *Artificial Intelligence: Definition, trends, techniques, and cases, Encyclopedia of Life Support System*). Nowadays AI includes also digital assistant, chatbots and machine learning among others. The system structure is composed by neural networks and algorithms that simulate humans' mind and that allows AI to work according to different stimulus of the environment and learning from experience. Indeed, Artificial Intelligence is able to follow a decision-making process depending on the contest in which the decision is taken, but also to change it if environment conditions vary. The consulting company, PwC propose in the report "*Sizing the prize. What's the real value of AI for your business and how can you capitalize?*" an estimation of AI impact for sector, using the "AI impact index" ranging from 1 to 5, where 1 indicates a very low potential impact and 5 a very high potential impact. The criteria from which the researchers developed the index are five:

- Potential to enhance personalization;
- Potential to enhance quality (utility value);
- Potential to enhance consistency;
- Potential to save time for consumers;
- Availability of data to make these gains possible.

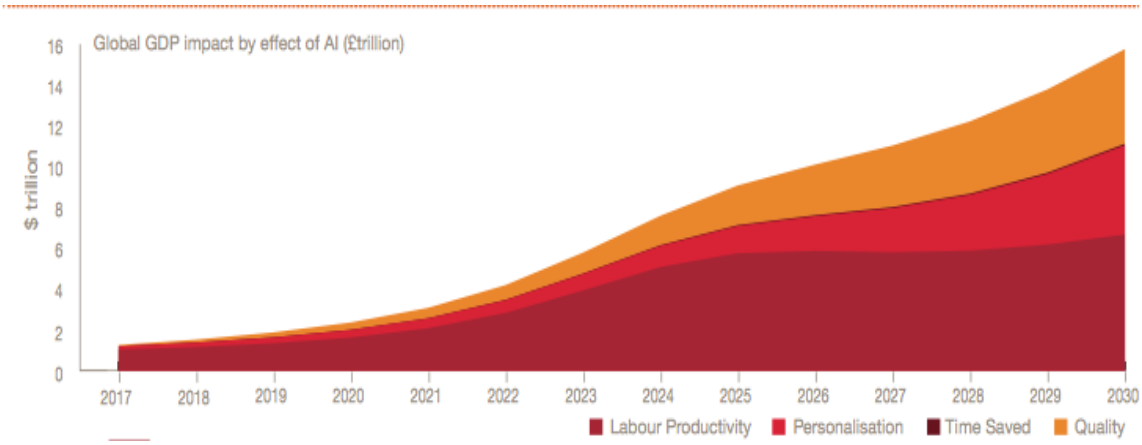

Figure 1. Where will value gains come from with AI?
Source: https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

The consulting firm backed up that there will be eight different sector that will benefit the most from Artificial Intelligence implementation. Firstly, the healthcare and the automotive sectors with the highest impact index, 3.7. Following, the Financial Service, the Transportation & Logistic and Technology, Communication & Entertainment sectors, with respectively 3.3, 3.2, 3.1. With a lower but still significant impact, the Retail, the Energy and Manufacturing industries scored 3.0, 2.2 and 2.2. PwC defines the impact that Artificial Intelligence has and will have in our society as disruptive and impressive. It will be driving force that will set new competitive standards for businesses in most of industries. Indeed, according to the consulting firm, the implementation of Artificial Intelligence for business is necessary in order to survive in the next 10 years. A late or a wrong implementation could imply the entire loss of market size and the inability to compete. All companies should understand that AI is not only a tool that simplifies or accelerates existing capabilities with the automatization, but it allows to forecast customers' needs and to respond to their demand with an efficiency level and precision never existed before.

As all industries, the luxury and fashion one is now integrating AI into their businesses in order to improve productivity and consequently financial results. Among all types of implementation, AI is mostly used as a tool for forecasting future demand and thus as an inventory management tool. Inventory has always played a central role in fashion industry, since it is considered as a fairly challenging element to manage and forecast. More deeply, the fashion industry is characterized by a short lifecycle of products due to both customers volatility and fast changing sector trends. Therefore, a correct prediction of the inventory avoids producing excess goods, that remain unsold, or producing too little, losing the possibility of potential revenues. Until AI introduction, inventory management was based on statistic approaches, mainly feasible for a small data set. With the digitalization of most of supply chain processes, the amount of data available are increasing day by day and fashion business needed a tool able to give a sense to all information. There are different kinds of AI-based methods for sales forecasting mainly adopted by the fast-fashion industries, such as Zara, Mango and H&M. The most common AI-based methods are the Artificial Neural Networking (ANN) methods the Fuzzy Logic-Based Methods, appreciated for its capability of forecasting sales of new product launched, and the Support Vector machines (SVMs).

Generally, we are used to think about Artificial Intelligence as something that can help humans only in technical-scientific fields. People have always thought that technology could never be

associated with a purely human characteristic: creativity. Nevertheless, the increasing complexity of the algorithms, used by the Artificial Intelligence, seems to give the machine the possibility to create drafts of drawings of clothes. And nowadays, several brands are using this technology to create their new collections. Yoox, founded in 1999 and owned by the group Yoox Net-a-porter, is one of the most popular fashion luxury online retailers where customers can buy every kind of fashion product category from luxury brands, such as Valentino, Gucci and Prada. The company launched in 2018 its own label brand, 8 by Yoox, which combines humans and Artificial Intelligence capability in order to create garments and accessories both for women and men. AI stores all information and customer insight of past 18 years from its website, social media and online magazines and determines main customers' preferences related to garments shapes, colors, fabrics and textures. The machine, then, generates a mood board representing future fashion trends that is the starting point for designers. As Paolo Mascio explained in an interview conducted by Tommaso Palazzi (*Milano Finanza*) "*the garments made are mathematically created to meet the needs of a curious, passionate and aware e-shopper*". After only one year, 8 by Yoox entered the top 20 most sold brand offered by the group, with USA, Russia and Italy as main markets. One of the key elements of the brand success is a very low return rate. Indeed, the data driven strategy allows Yoox to offer to its client products that correspond to their preferences in terms of quality and style. Another interesting case in which AI played a key role in the design of clothes, was Tommy Hilfiger's project in collaboration with IBM and The Fashion Institute of Technology (FIT) Infor Design and Tech Lab. FIT students had to create a new design signed Tommy Hilfiger using data and information given by IBM company. Thanks to Artificial Intelligence, 15,000 Tommy Hilfiger's product image, 600,000 runway images and 100,000 patterns from fabric sites were elaborated to create the source of inspiration for brand's designers. However, what makes this case unique is the fact that the machine output were garments that not only matched customers' needs and preferences but also Tommy Hilfiger DNA and style. Among all 3D digital creation, the tech jacket proposed by FIT senior Grace McCarty was chosen by the brand. "*As a brand, we are always pushing the boundaries of what's possible through innovation and disruption. These young designers truly embody this spirit by showcasing the successful integration of fashion, technology and science*" wrote Tommy Hilfiger's chief brand officer, Avery Baker, in a blogpost for IBM (R. Arthur, Artificial Intelligence Empowers Designers In IBM, Tommy Hilfiger And IBM Collaboration, Forbes, 2018). This project has laid the foundations for an important debate in the fashion industry: whether artificial intelligence can somehow cancel out human creativity or not. Steve Laughlin, general manager of IBM Global Consumer

Industries, highlights how this case represents an efficient interaction between man and technology, which does nothing but increase human capabilities and not annihilate them. He also affirmed "*AI can assist design teams by enhancing and reducing overall lead times, and expand their creative discovery by analyzing and remembering insights from thousands of images and videos using computer vision. These designers can also more easily find how they can integrate trending colors, key patterns, and styles*" (R. Arthur, Artificial Intelligence Empowers Designers In IBM, Tommy Hilfiger And IBM Collaboration, Forbes, 2018).

Fashion manufacturing processes have been strongly integrated with machines developed with Artificial Intelligence. In this research the most important ones have been analyzed.

The Maker Making is the process in which all shapes are drawn and then cut out on a fabric. One of the main issues in this step of production is the amount of fabric between each shape that remains unused and wasted. In fact, the marker making efficiency strongly depends on how well the various shapes to be cut out fit together, so as to leave material waste to the minimum. In addition to considerably reducing costs for raw materials, an intelligent system that minimizes this type of waste allows the company to have a sustainable economy, considering that the fashion industry is one of the most polluting in the world. Moreover, it is important to consider that a machine learning not only allows to optimize the row material, but also does it in a shorter time than the human being.

The sewing process is the most characteristic process of the fashion industry and at the same time the one which takes most of the time and labor costs. As mentioned before, the demand of the fashion market is subjected to continuous changes, due to trends and styles and an increasing demand, which require time savings in all the production steps. Sewing automated equipment is becoming popular among fashion business and if in one hand it could eliminate an activity typically done by humans, in the other hand it could contribute to reduce human labor exploitation in poor countries. This theme generated a strong debate on pros and cons that Artificial Intelligence implementation can have in a so complex industry as the fashion one.

One of the latest steps of garment production is the quality control and inspection. This process is now fully automated due to different factors. Firstly, it is highly time consuming both for the number of garments to control and for the different standards that each product has. Secondly,

employees who are assigned to this task are generally subjected to fatigue and boredom, causing inaccuracy, inefficiency and inattention. The AI use in quality control step is going to completely substitute the manual inspection due to the higher number of benefits and lower error rate level. It is easy to understand how difficult is to determine a fault through visual inspection, especially when is imperceptible to the human eye. Intelligence Machines are able to locate seams and determine the standardized characteristics of the garments, so that can find all imperfections that are not in line with its dataset and algorithm.

One of the main parts of the CDJ is represented by the purchase experience, that can occur online or in physical stores. Both types of retail were enhanced by Artificial Intelligence. In one hand, Artificial Intelligence perfectly fulfills all the limits that e-commerce has, such as the lack of human interaction or advisory services, through chatbots, voice recognition and image recognition. In the other hand, it brings innovative elements to physical stores enhancing customer experience, such as Virtual Reality and Augmented Reality. In addition to that, Artificial Intelligence can also allow to integrate the two different distribution channels: data gathered online are collected and then utilized with the aim of personalization of in-store customers' experience. One of the most successful cases of that specific AI use was implemented by luxury English brand, Burberry, that in 2006 reinvented itself as "end-to-end" digital enterprise, that exploited AI in order to boost sales and clients' satisfaction. Burberry's customers just needed to sign a number of loyalty and reward program, which give the consensus to share personal data and information with sales assistant working in physical stores. In this way, once the client entered the store, sales assistants have on their personal tablet all client's information about history purchases and preferences, so that they can propose items and products that match with the most recent purchase history or something that the customer liked on social media. Burberry's investment in Artificial Intelligence which powered personalized customer management programs has resulted in a 50% increase in repeat custom (Bernard Marr, The amazing ways Burberry is using Artificial Intelligence and big data to drive success, Forbes, 2017).

Fashion is actually crossing an environmental crisis. The growing expansion of fast fashion industry has led people not only to increase their wardrobe but also to change it frequently and quickly, treating garments as nearly disposable. The production of such amount of clothes requires the use of lot of water and chemicals and the emission of greenhouse gases. In this context, Artificial Intelligence can play an important role given its enormous potential to reduce

the environmental impact of the fashion industry. In the previous paragraphs the uses of AI in the luxury and fashion industry have been explained and analyzed: each of them has the potential of drastically decrease the wastes and the emissions of the market. More deeply, Artificial Intelligence's effects on fashion industry pollution related to its uses are:

1) Demand forecasting: businesses can easily avoid producing unsold clothes and accessories. A more accurate and precise inventory management allows brands to not overproduce and adopt a more efficient use of raw materials. The consequences resulted are less emissions and less use of water in production processes.
2) Traceability: it is the ability to identify and trace the history, distribution, locations and applications of products, parts, materials and services (T. K. Agrawal, A. Sharma and V. Kumar (2018), *Blockchain-Based Secured Traceability System for Textile and Clothing Supply Chain*, Artificial Intelligence for Fashion Industry in the Big Data Era, Singapore, Springer Series in Fashion Business, Springer Nature Singapore). It involves the three sustainability pillars (societal, economical and environmental) since it results in transparency of the supply chain for all the actors. Data and information are easily shared among all the product chain contributing to high quality of productions' steps.
3) Personalization of online and offline customer experience: generally, customization allows brands to offer an experience cut shaped on client preferences and tastes. It results in a more efficient production of both products and services, avoiding waste and reducing pollution.

The Value of Craftsmanship for Luxury Brands

The concept of luxury is so subjective that its meaning can have thousands of definitions, shades and perceptions. Many scholars have tried to attribute a specific meaning to this word, but without ever reaching a univocal definition for all. The scholars Eunju Ko, John P. Costello, Charles R. Taylor tried to give their own definition of luxury brand that involves all the meanings given to "luxury" by the literature: "*A luxury brand is a branded product or service that consumers perceive to:*

- *be high quality;*
- *offer authentic value via desired benefits, whether functional or emotional;*
- *have a prestigious image within the market built on qualities such as artisanship, craftsmanship, or service quality;*
- *be worthy of commanding a premium price; and*
- *be capable of inspiring a deep connection, or resonance, with the consumer*."

Nowadays, luxury brands use to communicate their craftsmanship traditions, as they protect and preserve their history and heritage. It is also used as a synonym of unicity, rarity and high quality of products and services offered to consumers. Several marketing strategies have been implemented in order to show off to people the importance of craftsmanship in their business and to enhance the perception that consumers have of the luxury of the brand itself.

In 2019, the French Maison Hermès organized the itinerant event "*Hermès. Dietro Le Quinte*" at the Ara Pacis Museum in Rome and at the Pelota of Brera in Milan: a true celebration of French craftsmanship and savoir-faire, aimed at emphasizing the care, quality and attention to detail that the brand has in the production of luxury goods. The exhibition was structured in 10 modules, each related to a product category that Hermès deals with, including bags, saddles, yoke, ties, jewelry, watches, gloves and porcelain. Each section was characterized by the presence of a craftsman from the French Maison dedicated to the creation of Hermès products. Visitors, once inside the museum, had the opportunity to walk around the various modules and to observe the employees at work and ask them some questions about their craft. Visitors are introduced to the craftsmen of ancient and unfamiliar professions such as fine silk printers, setters, engravers, hemmers, decorators, ceramists and professionals of fine jewelry, but also master watchmakers and glass masters. It is therefore possible to know the secrets of the whole creative and productive process. A very interesting event capable of emotionally connecting visitors to the brand values and history. Indeed, among all professions there was also a section about the production of saddles for horses, the product category with which Hermès began its fame.

In Piazza del Duomo, in the beautiful Lecce (Italy), Maria Grazia Chiuri staged the fashion show for the presentation of the Dior Cruise Collection 2021. The fashion show was a hymn to tradition and Italian craftsmanship, since many local associations of ancient and not very well-known professions were called to participate. Among all, Le Costantine foundation, founded in 1982 by Giulia and Lucia Starace and Lucia de Viti de Marco to make their mothers' textile arts traditions survive over time. Maria Grazia Chiuri has decided to assign part of Dior collection to the foundation, in order to evoke again the ancient Italian traditions that risk to disappear forever. Once again, Dior brings the consumer closer to the world of handicrafts by evoking professions and tools of the craft, such as the "*tombolo*" now forgotten by many. Unlike the case of "*Hermès. Dietro le Quinte*", where the brand tries to communicate its

history, savoir-fair and traditions, here Maria Grazia Chiuri connects the brand to the concept of uniqueness, quality and attention to detail using the value of craftsmanship, but without referring to the Dior's history and tradition. Indeed, with the fashion show in Lecce, neither the French nor the history of Dior were highlighted, but, on the contrary, Italian traditions that are much closer to Dior creative director's values.

Every year, LVMH organizes "*Les journèes Particuluères*", a worldwide event in which LVMH brands open the doors of their factories to show luxury lovers the work of their craftsmen. The event started in 2011 to pay tribute to the European craftsmanship, considered the symbol of the continent's cultural identity. During the visits, people have the opportunity to have a closer look at watchmakers, tailors, experts in the art of *baudruchage*, shoemakers, *chef de cave*, jewelers, trunk makers, *chef remueur*, *première d'atelier* and chefs in their work. The visit generally offers guided tours, demonstrations, lectures and interactive routes, giving people a unique and entertaining experience. In 2018, "*Les journèes Particuluères*" has gathered more than 180,000 people to discover the professions that characterize the most important luxury brands of the world.

As demonstrated by the examples above, for the vast majority of luxury brands, craftsmanship plays a significant role. It is the tool through which the history of the brand, the attention to detail, the high level of quality of the products is communicated to people. Craftsmanship represents a stimulus that the brand evokes in order to establish a strong connection both emotionally and intellectually with the client.

As descripted in the article "*Integration of Arts and Crafts in Artificial Intelligence Environment*" by Jiang Pu (2020), arts and crafts were the key of a society's core production at their origins. In modern society, it becomes more and more a marginal market, most of the time associated with luxury products. One of the main issues that arts and crafts have always faced is the inability of innovation so that to be considered as resources of current production capacity. This step has not yet been taken, but somehow, art and crafts have become a tool of analysis for Artificial Intelligence and vice versa. Giving an example, if on one hand various types of art graphics and images can be converted into data files, on the other hand new kinds of arts and crafts can be created. Virtual Reality can be considered one of them, as well as the 3D environment and language and image recognition. Arts and crafts integrated with AI can be a source of creativity and inspirations. Indeed, AI can easily and quickly generate visual

effects, combining materials, colors, styles and structures. Moreover, AI is characterized by the ability to process large amounts of data, often very complex. Designers and artists can arrive through its use at completely new aesthetic and design forms that have a scientific basis. Thus, an infinite number of combinations of different artistic elements never "created" before are generated. In addition to this, it is important to underline the capacity of AI to come to a final decision or output in a very short time compared to the human mind. The decision-making ability, well described yet in chapter one, allows AI to process a series of inputs (human requests) and to reach the exact result desired by humans being.

The Marketing Research: the effect of the communication of AI on the perception of the luxury of the brand and the product

The research started with an overview about the luxury industry, continuing with the use of Artificial Intelligence in production and distribution processes of garments. After this descriptive section, a luxury definition has been given. In defining a brand as luxury, the literature often mentions craftsmanship. We observed how craftsmanship plays a central role in most of luxury brand and how it is communicated to the external. Indeed, craftsmanship in generally associated with quality, uniqueness and refinement. The aim of this thesis is to understand if the communication of the use of Artificial Intelligence, especially for garments production, will impact consumers' perception toward the luxury of the product and the brand.

The analysis was implemented using a survey which showed the participants a visual stimulus: an image representing two products of a luxury brand, a woman and a man' s knitwear. There were also two different image descriptions, but only one of them was randomly shown to participants. All the questions were aimed at answering the following hypothesis:

- *Hypothesis 1*: the communication by the brand of the presence of AI in their production of luxury products, compared to the communication of crafted production (absence of AI) leads to a lower perception of the luxury of the product by the consumer;
- *Hypothesis 2*: the communication by the brand of the presence of AI in their production of luxury products, compared to the communication of crafted production (absence of AI) leads to a lower perception of the luxury of the brand by the consumer;
- *Hypothesis 3*: in the case of younger consumers (Millennials) the effect is weakened, i.e. the perception is not negatively influenced by the communication of the presence of AI.

To do that, a questionnaire was structured and completed by 243 people, 186 of whom passed the check point and therefore, whose answers were validated and considered for academic research purposes. Participants were subjected to a visual stimulus representing two luxury products accompanied by a short storytelling related to the image. Two different description were formulated, that appeared randomly: the first one was aimed to highlights the craftsmanship and the consequential uniqueness of both products, while the second description informs the participant that the products have not been made by craftsmen but by a sewbot, a robot developed with Artificial Intelligence. Two scales were used in order to define the perceived luxury of the products and the of the brand, respectively the Jonathan S. Vickers and Franck Renand's scale (2003) and the Vigneron and Johnson's scale (1999). From 243 questionnaires have been validated 186 responses: 95 people were subjected to the "Craftsmanship condition", i.e. the vision of the image of luxury products manually sewn by tailors, while 91 people were subjected to the "Artificial Intelligence condition", i.e. the products observed were sewn by a robot developed with Artificial Intelligence.

Data were analyzed through SPSS software by IBM in order to obtain statistical results. Before starting the study of data, a Reliability Test was implemented. Both data gathered for the valuation of the perceived luxury of the product and the perceived luxury of the brand had a positive Cronbach's alpha higher that 0.7, respectively 0.718 and 0.882, verifying the internal consistency of data. The study, then, continued with the calculation of the average values attributed by participants to the product and brand perception scales. In both cases, the mean value given under "Craftsmanship condition" results higher compared to the mean value attributed to the same scale under "Artificial Intelligence condition".

Group Statistics

	Condizione	N	Mean	Std. Deviation	Std. Error Mean
Mean	Craftsmanship	95	5.2421	.70408	.07224
	Artificial Intelligence	91	4.9029	.85529	.08966
Mean2	Craftsmanship	95	4.5767	.86422	.08867
	Artificial Intelligence	91	4.4286	.94838	.09942

Figure 2. SPSS Output: Group Statistics

Although the first comparison gives power to the two hypothesis formulated, it is necessary to check their significance to judge them as verified. For this purpose, the statistical Significance 2-tailed has been implemented trough the Independent Sample Test both scales.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean	Equal variances assumed	4.574	.034	2.958	184	.004	.33917	.11466	.11296	.56539
	Equal variances not assumed			2.946	174.405	.004	.33917	.11514	.11193	.56642
Mean2	Equal variances assumed	.175	.676	1.114	184	.267	.14812	.13295	-.11418	.41042
	Equal variances not assumed			1.112	180.672	.268	.14812	.13321	-.11473	.41097

Figure 3. Output SPSS. The Independent Samples Test for the Sig. (2-tailed)

The statistics analysis accepted the first hypothesis with a Sig. of 0.004 and rejected the second hypothesis with a Sig. of 0.267. Consumers judge negatively the use of Artificial Intelligence in the production processes, so that the perceived luxury of the product lowered. The same reaction did not happen in relation to the perception of the luxury of the brand. This result can be explained by consider that the luxury of the brand is a concept more rooted in consumers' mind and depends on antecedents which are explained by the scholars Nadine Hennigs, Klaus-Peter Wiedmann, Stefan Behrens and Christiane Klarmann in the "*Unleashing the power of luxury: Antecedents of luxury brand perception and effects on luxury brand strength*" (2013). In fact, this work highlights how the perception of the luxury of the brand derives from a set of antecedents, in which the characteristics of the products constitute a part of them. For this reason, the visual and descriptive stimulus shown to the participants of the questionnaire is not powerful enough to negatively influence the perception of luxury of a brand, but only that of the product.

Results obtained show that communicate the use of Artificial Intelligence negatively affects the perception of the luxury of the product, but not that of the brand. In addition, this phenomenon occurs for all socio-demographic groups analyzed, underlining the importance that craftsmanship has in the definition of luxury for consumers as synonym of quality and

rarity. Indeed, the craftsmanship of luxury products represents for brands a value to strongly communicate to the outside world, but which does not reflect the reality of the fashion and luxury industry. Given the high demand for luxury products, companies have long since introduced automated production processes, reserving craftsmanship mainly for the production of *Haute Couture* collections or for special events. However, never as before, modern consumers are increasingly attentive to brands' internal policies and explicitly demand transparency in communication. Moreover, when Artificial Intelligence, as well as other technologies, will become tools to support everyone's everyday life, consumers will be more aware of the capabilities and possibilities of using this kind of technology. So that, luxury brands will then have to adopt strategies to show the role of AI within their business. This paper can help to implement a communication strategy about the evolution of the luxury industry and the use of new technology such as AI, which will not lead to a decrease of the perception of the luxury of the product. In particular, given the results of research, it has been found that for consumers of all ages, craftsmanship is essential in order to define a product as luxury. Brands will, therefore, have to find and implement a storytelling of products that enhance the integration between craftsmanship and Artificial Intelligence, showing what improvements the integration between the two worlds can bring in production processes such as the elimination of production imperfections. Marketing strategies will have to show Artificial Intelligence as a support tool for human activity, which is valued and not destroyed by new technologies, underlining the willingness to maintain alive cultural traditions of arts and crafts.

We have seen how Artificial Intelligence is a powerful support for the production of luxury products and how often leads to product improvement since it lowers the probability of manufacturing defects to zero. However, the questionnaire highlighted how the consumer is poorly informed about this technology and its potential. Therefore, it could be a managerial strategy to start informing and educating consumers about new technologies and how they are integrated with production processes. In fact, as highlighted by the research experiment, consumers are not at all aware of what Artificial Intelligence is and, for this reason, they usually are skeptical when it is used in an industry that has always been based on craftsmanship. A good information campaign that starts to bring the consumer closer to Artificial Intelligence, and more generally to technological innovations, could eliminate the currently negative prejudice about its use.

As all academic research, this study also reveals some limitations that could be overcome in future research. The first issue is the limited socio-demographic distribution of the sample. Firstly, most respondents are between 19 and 30 years old (59.1%), that is a high percentage compared to people between 31-50 years old (19.9%), 51-70 (23.7%) and over 70 years old (1.6%). Future research should stratify more accurately the age of respondents, increasing the sample size, in order to have more precise feedback on the effect of the use of Artificial Intelligence on the perception of luxury products and brands. In this way, it is also possible to analyze in a more accurate way potential differences on perceived luxury of the product and of the brand between one age range and another. In addition, the experiment should also be extended to a geographically point of view, involving diverse populations. The sample selected was exclusively from Italy, and therefore certainly strongly attached and fond of its traditions of art and craftsmanship. Populations of other continents, such as China that has become the country with the highest consumption of luxury goods, could define luxury through different attributes and items. In addition, Chinese consumers may react extremely differently to the use of technology, being also much more accustomed than the European population to an interaction between automation, Artificial Intelligence and humans. The second limitation is related to the distribution of the questionnaire, i.e. through email and social networks (WhatsApp, Instagram and Facebook). In order to have a more precise reaction of consumers, field interviews could be organized in which research participants could observe closely the work in production laboratories, seeing in person the integration of Artificial Intelligence with the work implemented by employees. The visual stimulus of the image and the short storytelling associated with it could lead to misunderstandings or not give a 360° view of the product manufacturing processes.

It is very difficult to understand what is the right balance between craftsmanship and Artificial Intelligence, and above all to understand what is the balance that, once communicated to the consumer, does not have negative effects on the perception of luxury of the product. Of course, Artificial Intelligence is a poorly known technology whose characteristics are not known by most people. Therefore, it is important to educate the consumer about this technology and about the benefits it brings to the business. It is also difficult to understand that also craftsmanship, as well as everything in the world, can evolve without being disfigured by its more traditional features. We must learn to understand the potential that the union of technology and craftsmanship have and, above all, that their interaction does not represent arts' destruction but its evolution. Artificial Intelligence can be a tool for a sustainable promotion of art and

craftsmanship since it succeeds in advancing cultural and aesthetic forms instead of eliminating them. The interaction between humans and computers can be seen as an extension of the traditional form of creation, since AI are interested in human habits and choices and arts and crafts represent the historical evolution of culture. The human-computer collaboration helps in reaching models and styles that users need.