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# How can blockchain impact sustainable supply chain management: A Pedagogical Case Study of the luxury goods industry

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Master in Business Administration

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BUSINESS
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Department of Marketing, Operations and Management

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## Resumo

O presente caso de estudo pedagógico revela o potencial impacto positivo que a tecnologia Blockchain pode trazer à gestão sustentável da cadeia de abastecimento, com particular foco na indústria de luxo francesa. Neste sentido, à medida que a indústria da moda enfrenta uma pressão crescente de novas regulações governamentais e de novas expectativas dos consumidores relativamente à sustentabilidade dos bens, torna-se crítico para as marcas de luxo melhorarem a transparência e aumentarem a visibilidade de toda a cadeia de abastecimento. Por conseguinte, a tecnologia Blockchain oferece soluções viáveis e exequíveis, uma vez que as empresas podem implementá-la para alcançar Objetivos de Desenvolvimento Sustentável.

Ao explorar áreas de sustentabilidade, transparência e satisfação do consumidor, este caso de estudo pedagógico analisa os potenciais benefícios e desafios que podem surgir em torno da implementação da tecnologia Blockchain. Além disso, este artigo sublinha o papel que esta tecnologia pode desempenhar em relação ao seguimento do ciclo de vida dos produtos finais, bem como na melhoria da relação de confiança entre a marca e os consumidores ao assegurar que boas práticas social e ambientalmente sustentáveis são implementadas pelas marcas de luxo. Através dos dados recolhidos na revisão bibliográfica e em entrevistas realizadas posteriormente, este caso pedagógico revela que, apesar dos desafios no seu empreendimento, esta base de dados descentralizada, Blockchain, pode melhorar o desempenho sustentável da cadeia de abastecimento.



Palavras-chave: Luxo; Indústria de bens de luxo; Cadeia de abastecimento; Blockchain; Sustentabilidade; Gestão sustentável da cadeia de abastecimento;

Sistema de classificação JEL:

Q01 – Desenvolvimento Sustentável
O14 –Industrialização; Indústrias Transformadoras e de Serviços; Escolha da Tecnologia
Q56 - Ambiente e Desenvolvimento; Ambiente e Comércio; Sustentabilidade.

## Abstract

This pedagogical case study reveals the potential positive impact that blockchain can bring to sustainable supply chain management, with a strong focus on the French luxury goods industry. In this sense, as the fashion industry faces increasing pressure from new government regulations and new customer expectations regarding sustainability, it becomes critical for luxury brands to improve transparency and increase end-to-end supply chain visibility. Therefore, blockchain offers feasible and attainable solutions as companies can use it to reach sustainable development goals.

Among others, by exploring areas of sustainability, transparency, and customer satisfaction this case study analyzes the potential in-depth benefits and challenges that may emerge around this particular usage of blockchain. In addition, this article underscores the role that blockchain can play concerning the tracking of products' lifecycles, as well as its potential concerning the improvement of consumer trust to ensure social and environmentally sustainable practices are implemented by luxury brands. Through the data collected in the literature review and on interviews, this case study shows that despite the challenges in the implementation, this decentralized database, Blockchain, can ameliorate the supply chain's sustainable performance.



Keywords: Luxury; Luxury goods industry; Supply chain; Blockchain; Sustainability; Sustainable supply chain management.

JEL classification system:

Q01 - Sustainable Development

O14 – Industrialization; Manufacturing and Service Industries; Choice of Technology

Q56 - Environment and Development; Environment and Trade; Sustainability.

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## Glossary of Acronyms

B2B – Business-to-business

B2C – Business-to-consumer

CATSA – California's Transparency in Supply Chains Act

CRM – Customer Relationship Management

CSR – Corporate Social Responsibility

EMS – Environmental Management System

EU – European Union

GDPR – General Data Protection Regulation

REACH – Registration, Evaluation, Authorization and Restriction of Chemicals

SCM – Supply Chain Management

SD – Sustainable Development

SDG – Sustainable Development Goals

SMI - Sustainable Markets Initiative

SSCM – Sustainable Supply Chain Management

TBL – Triple Bottom Line

VIRTUS – Verified, Integrated, Reliable, Trustworthy, Unique, and Secure

# 1. Introduction

As global awareness about sustainable development continues to grow, the need to revolutionize supply chain management practices has never been more urgent. Within this context, the luxury goods industry finds itself uniquely positioned to lead the charge toward a more sustainable future. luxury brands must navigate the complex terrain of sustainable supply chains while preserving their cultural and dream-invoking appeal. Blockchain technology emerges as a transformative innovation and it is seen as a promise for sustainable supply chain management.

In the next chapters, it will be possible to understand the fundamentals of this technology and uncovers its potential impact on supply chain efficiency, transparency, and traceability. Traceability empowers luxury brands to adopt ethical sourcing practices, champion fair labor conditions, and combat counterfeiting, strengthen their reputation for authenticity and responsible luxury. However, the study also acknowledges the hurdles that accompany this journey, as energy consumption concerns and the complexities of implementation require careful consideration.

The aim of this case study will be to analyze how blockchain can impact sustainable supply chain management and how it can help the luxury goods sector trace its resources. In addition, it also aims to contribute to the audience's knowledge and develop their strategic view on this topic. This thesis will follow the structure below:

- Chapter 1 - consists of a brief introduction to the topic discussed in the case study.
- Chapter 2 - includes the contextual presentation of the case study and an introductory overview of the crucial subjects.
- Chapter 3 - explains the methodology used.
- Chapter 4 - introduces the pedagogical note, which is divided into 7 sections. It identifies the target audience, outlines the pedagogical objectives, defines the concepts through a literature review, proposes an animation plan, introduces animated questions, provides their resolutions, and presents the resolution slides.
- Chapter 5 - comprises the concluding remarks to the presented work.

## 2. Case Study Context

### 2.1. Problem presentation

In an era where sustainability is no longer a buzzword, but a serious need for the planet's survival, the luxury fashion industry finds itself at a crossroads. As the harmful impact of traditional supply chain models becomes progressively evident, luxury brands face the challenge of merging their inherent value with the urgent demand for sustainable practices. By embracing innovative technologies and redefining their supply chain management strategies, luxury enterprises can pave the way for a more responsible and conscious industry. However, what should this future road look like? Can this industry find a balance between supply chain efficiency and respectful development?

The luxury industry products and services evoke excellence, exclusivity and has a cultural and dream factor involved which can be hard to associate with environmental concerns or recyclable materials (Karaosman et al., 2020). Therefore, to analyze how luxury companies can implement sustainable practices, it is important to understand how their supply chain works and what new technologies can improve it. Supply Chain Management (SCM) plays an important role when evaluating to which extent the business model of a certain company implements sustainability since it tracks the interactions from end to end of production.

Given the high concentration of luxury brands with headquarters in France (figure 1) and for the country *"art de vivre"* (the art of living)[1] elusive to luxury and France being the birthplace of luxury in haute-couture, perfumery, and gastronomy, for example (Batat & Kerviler, 2020) seems relevant to analyze how the French luxury goods industry keeps up with new environmental challenges. According to the 2022 Deloitte report, eight out of the 100 largest luxury goods companies are French and have contributed over 34% in sales in the financial year of 2021, out of these eight companies, four of them are in the Top 10 sales ranking (Table 1). The group leading is LVMH with more than 54 billion dollars in 2021, followed by Kering SA, L'Oréal Lux, Hermès International SCA and five more others (Deloitte, 2022).

[1] The French art of living (*art de vivre*) is a combination of various aspects that take root in the history and culture of France, and that signify taste, aesthetics, a sense of detail. It is strongly connected to French luxury and can be described as an affirmation of French qualities such as know- how, artisan craftsmanship, refined beauty, and family education and values. (Batat & Kerviler, 2020)


*Figure 1 - Global Powers of Luxury goods 2022 Report*

*Source:Adapted from Deloitte (2022)*

*Table 1 - 10 biggest luxury goods companies by sales*

| Top 10 luxury goods companies by sales, FY2021 | | | | | | |
|---|---|---|---|---|---|---|
| FY2021 Luxury goods sales ranking | Change in ranking from FY2020 | Name of company | Country of origin | FY2021 Luxury goods sales (US$M) | FY2021 Total revenue (US$M) | FY2021 Luxury goods sales growth |
| 1 | ⟷ 0 | LVMH Moet Hennessy-Louis Vuitton | France | 54,938 | 75,92 | 55.9% |
| 2 | ⟷ 0 | Kering SA | France | 20,861 | 20,861 | 34.7% |
| 3 | ⟷ 0 | The Estée Lauder Companies Inc. | United States | 16,215 | 16,215 | 13.4% |
| 4 | ⬆ 2 | Chanel Limited | UK | 15,639 | 15,639 | 54.7% |
| 5 | ⟷ 0 | L'Oréal Luxe | France | 14,597 | 14,597 | 21.3% |
| 6 | ⬇ -2 | Compagnie Financière Richemont SA | Switzerland | 12,862 | 15,314 | -6.9% |
| 7 | ⬆ 2 | Hermès International SCA | France | 10,619 | 10,619 | 40.6% |
| 8 | ⬆ 2 | Chow Tai Fook Jewellery Group Limited | China/Hong KONG SAR | 8,937 | 9,05 | 23.2% |
| 9 | ⬆ 2 | Rolex SA | Switzerland | 8,750 e | 8,750 e | 37.9% |
| 10 | ⬆ 7 | China National Gold Group Gold Jewellery Co., Ltd | China | 7,825 | 7,865 | 50.3% |

*Source: Adapted from Deloitte 2022*

With such financial importance not only in France but also on an international level, these brands have the resources to drive a positive change and influence smaller brands on following the same path, by committing to sustainable practices and increasing brand transparency. As reported by the Fashion Transparency Index 2022 edition, brands still demonstrate a low level of transparency to the public. After analyzing 250 well-known brands and retailers in the fashion industry, the average score for transparency progress stands at 24%, representing only a 1% increase compared to the previous year. The above-mentioned report (Fashion Transparency Index 2022) has several indicators of evolution in five different sectors: Policies and Commitments, Governance, Supply Chain Traceability, Know, Show and Fix, and Spotlight Issues which include matters related to climate change, waste and circularity, sustainable sourcing and materials, social responsibility, among several others (Fashion Revolution, 2022).

Out of the 250 luxury brands, this case focuses on six French luxury brands and by looking at Figures 2 and 3 it can be seen that there is still a long way before achieving a high rate of transparency and accountability in the value chain. Both figures illustrate the brands' performances on their:

- Policies and Commitments: refers to what major brands communicate about their policies, procedures such as the code of conduct or the supplier guidance code and other reports;
- Governance: refers to their accountability in performance and impacts (for instance, does the brand discloses direct contact details for sustainable and social departments);
- Traceability: evaluates whether companies publish their supplier lists in all supply chains and the level of detailed information;
- Know, show, and Fix: refers to the 17 SDS goals, how the company identifies, prevents, and mitigates its impact, what the brands communicate about their actions like audits, investigations, confirmation of facts, etc
- Spotlight issues: evaluates working conditions, equality, sustainability, circularity, natural resources management, environment.

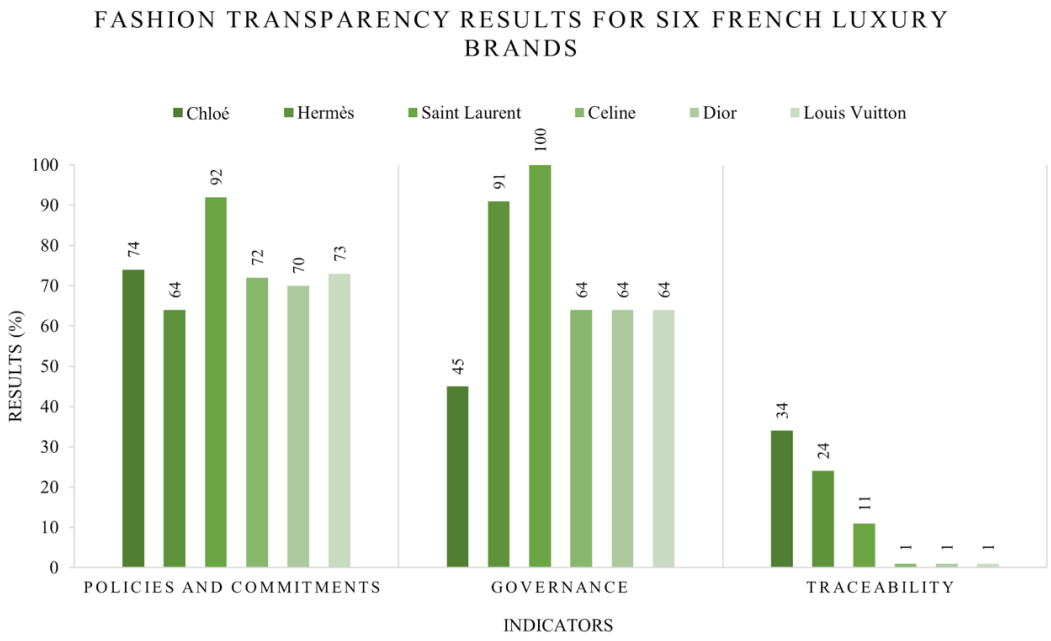


*Figure 2 - Fashion Transparency results for six French luxury brands (part I)*

*Source: Adapted from Fashion Revolution (2022)*

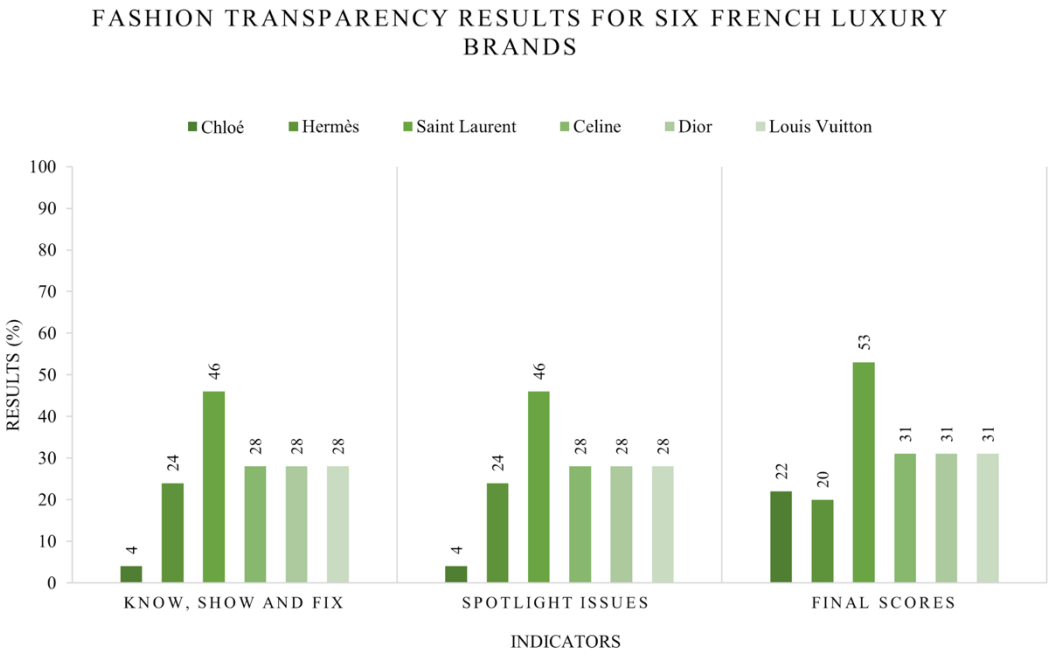


*Figure 3 - Fashion Transparency results for six French luxury brands (part II)*

*Source: Adapted from Fashion Revolution (2022)*

While in the Policies and commitments, the brands show a high percentage, in traceability the values are very low. However, the Fashion Transparency Index 2022 report also states that around 58% of the 250 brands are showing evidence of tracking at least one raw material (like leather or cotton), including blockchain on the list of used technologies for mapping and tracing (Fashion Revolution, 2022). Although the progress is very slow, the luxury industry is reacting positively overall, implementing measures that address simultaneously sustainability and digitalization concerns (Deloitte, 2021). From the selected list of French luxury brands (Celine, Chloé, Dior, Hermès, Louis Vuitton, Saint Laurent) all have started to implement blockchain technology in their business. Blockchain simplifies the track and trace on an upstream and downstream level, it assures that middlemen actors are compliant with the brand's ethical behaviours and obey the rules. In addition, as a secure decentralized record keeping, the latter also reduces operational costs as human errors happen less frequently when combined with AI technologies, and the data is verified by multiple participants and ledgers (Kshetri, 2021).

In today's world, the need for experts in various fields cannot be overstated. In order to gain insight into how can blockchain impact sustainable supply chain management, three professionals that have been successful in this field were interviewed. The first interviewee works for a well-known French luxury brand and is a Customer Service and Logistics Manager with eight years of experience in optimizing supply chain processes, improving collaboration across different departments, and helping the luxury brand maintain a positive customer service experience. The second interviewee is a Client Engagement Manager that also works for a famous luxury brand and is responsible for developing strategies that meet customers' needs and therefore increase customer loyalty and retention. Finally, the third interviewee is a Digital and Operations Consultant for fashion brands and has worked with several luxury brands. The role includes activities related to the analysis and mapping of the industrial production process, defining functional and software development requirements, and training the companies on software use and functionality.

### 2.2. French luxury goods sector

Worldwide, the overall luxury goods market size in 2019 was USD 316.16 billion and is projected to grow from USD 257.26 billion in 2020 to USD 352.84 billion in 2027 (Fortune Business Insights, 2021). The purpose of the firms in this industry is to provide the consumer with intangible benefits in the form of prestige, recognition or achieved social status. Luxury brands represent one of the fastest-growing and profit-making segments in any economy (Hennigs et al., 2015). The luxury industry offers a wide range of goods and is represented by

companies that manufacture and sell vehicles (e.g. yachts, cars, private planes), works of art, wine, perfumery, jewelry, watches, and finally the sector with more relevance to this case study: clothing and clothing accessories (e.g. handbags, shoes, sunglasses, etc.) (Stępień, 2021). In 2021, Louis Vuitton was considered the most valuable luxury brand, with a brand value of 75.7 billion U.S. dollars. The sector of luxury fashion goods is represented mainly by global conglomerates, such as LVMH and Kering, and fashion houses like Chanel, and Hermès which have the biggest market shares, revealing that this is a growing industry, and consumers are attracted to the luxury sector year after year (Statista, 2021).

The French connection can provide a competitive advantage, as France has a long-standing reputation in craftsmanship and is often associated with sophistication and elegance. Foreign brands are opting for French-sounding names for their companies and luxury brands are emphasizing their French touch despite the material made-in label says China or Indonesia. The concept "*Frenchwashing*" (in French *Francolavage*) has been commonly used in recent years to illustrate marketing strategies that use the French language, culture, or imagery to transmit to the customer an idea of luxury and high quality that French products carry but the products do not necessarily have any French connection (Zgadzaj, 2019; Lapierre, 2022). Some of the most famous luxury brands evoke the French heritage *savoir-faire* to promote their products in their global communications. *Le Comité Colbert* plays a significant role in the promotion of luxury culture and contributes to the rekindle of the French way of living in the world. Founded in 1954 by Jean-Jacques Guerlain, the association was originally composed of 15 diverse luxury Maisons and now it counts with almost 100 brands that strive *"to passionately promote, to patiently transmit, and to sustainably develop French savoir-faire and creation in order to inject a new sense of wonder"* (Comité Colbert, n.d, p.1). Throughout its history, the *Comité Colbert* has worked to support its members in several ways, such as helping their members to succeed in the goal of becoming carbon neutral by 2025, by organizing exhibitions or cultural events to promote the work of its members, by preserving historic buildings as well as by lobbying for favorable regulations and legislation (for instance the *Loi Longuet*[2] in France implemented in 1994) (Comité Colbert, n.d).

[2] France increased the criminal penalties for counterfeiting with the *Loi Longuet* in 1994. Entering into force in 2004, this law seeks to protect creators and inventors and was made to take action against counterfeiting and consider it a more serious crime (Sénat, n.d).

### 2.3. Blockchain's impact on sustainable supply chain management

In April 2021, LVMH partnered with its competitors Prada Group and Richemont to *"develop the applications of blockchain technology and raise the standards of luxury"* (Aura Blockchain Consortium, 2022, p.1) and created Aura Blockchain Consortium. In short words, this innovative solution is a nonprofit association of luxury brands that invests in technologies to certify, connect, and empower brands. Their objective is to *"provide consumers with a high level of transparency and traceability throughout the lifecycle of a product"* by sharing knowledge in a safe digital format about sustainability, responsible sourcing, and authenticity (LVMH, 2021; Aura Blockchain Consortium, 2022, p.1). Aura Blockchain Consortium has also partnered with the Sustainable Markets Initiative (SMI), another example of the commitment of the most famous luxury groups to become more sustainable by resorting to this new technology. As previously seen, having a greater awareness of where the materials come from, the way they were sourced and produced, and the working conditions of the human resources are a must in the current days. The main goal of the partnership between Aura Blockchain Consortium and SMI is to provide aid to the members of the Sustainable Markets Initiative Fashion Task Force so they can achieve their sustainability objectives and have an accurate perspective on the entire life cycle of their products.

Several measures have already been taken, for instance, the creation of Digital ID. Launched in 2021 at the G20 in Rome, this new technology uses data to inform their clients about how the products they are buying are designed, manufactured, and distributed as it has associated with it a lifecycle system that provides new circular services like repairing, recycling and reselling services. Moreover, fostering the second-hand market involves manufacturers, retailers, resellers, and recyclers which allows the brand to understand what happens to their product post-sale. Differing from brand to brand, when the client scans the QR code or NFC ship, they can find the product's history, styling suggestions, and contacts of resale partners. With this feature, in case the customers buy a second-hand good, they are able to identify past owners and verify its authenticity.

Kering group created in 2021 a data exchange platform built on blockchain named VIRTUS (Verified, Integrated, Reliable, Trustworthy, Unique, and Secure) to ensure the manufacturing actors involved in the supply chain of Kering Eyewear were compliant with their quality, environmental and social standards. A database was created where the information is added, validated and where transactions are recorded. This sustainability strategy creates a high level of transparency and awareness of the impact each stakeholder has in the end-to-end process. The information uploaded in the ledger indicated the products' cycle, starting from the origin

of raw materials and components, all the way through processing, final assembly, and relevant certifications, the main aim of VIRTUS is to provide a trustworthy account of every step and detail involved in the meticulous craftsmanship of our eyewear (Kering Eyewear, 2021). Kering Houses are all aligned to achieve the group's 2025 goal of 100% traceability, as indicated in their Sustainability Progress Report 2017-2020, they are focused on reducing the environmental impact throughout the supply chain and have the intention to expand blockchain usage by offering their technical support to suppliers. The group has established minimum requirements for raw materials and manufacturing processes, which are all necessary to be fulfilled to be compliant, and additional requirements that the suppliers should aspire to fulfill in the near future. The usage of blockchain belongs to the additional conditions, they should work to ensure complete traceability of all skins for leather (used as raw materials) and provide for instance the following information*: "Species scientific name, source country (...) processing facility, type of source (captive, ranched or wild), location of the different tanning steps"* (Kering, 2018, p.23). This can be done by applying RFID tags, and QR codes to have some physical traceability and good management systems to assure the information is placed online correctly and trace the product's journey precisely.

LVMH in their 2021 social and environmental responsibility report stated their 2030 goal is to have 100% of their strategic supply chains integrated with traceability systems (LVMH, 2022). They have worked towards finding the country of origin of every raw material and in 2021 they knew the country of origin of 76% of the leather purchased and 62% of the wool purchased, for instance. They have also added new clauses in the contracts with suppliers to be certain that the resources were compliant with their social and environmental standards. The fashion *Maisons* belonging to LVMH have started working towards the group's goal. For instance, Patou has added a QR code to their products and the customers can quickly check all the product information like material certifications and traceability details (Figure 4) (LVMH, 2022). Chloé is also trying to give all of its products a digital ID by 2025 so the brand created a project called Chloé Vertical to make products more circular and reduce the environmental impact of the brand's supply chain. The French brand partnered with Eon, a product cloud platform that helps brands turn physical goods into smart assets and reduce the gap between the digital and physical scenario (Figures 5 and 6). In the words of Riccardo Bellini, CEO of Chloé: *"once you buy a product, you know everything about that product. Then you want to resell it, you just click on your digital ID and instantly resell it."* (EON, 2022 p.1).


*Figure 4 - Digital ID Luxury brand Patou*

Source: VestiaireCollective, n.d.


*Figure 5 - Digital ID Luxury brand Chloé*

*Source: EON, 2022*


*Figure 6 - Digital ID Luxury brand Chloé*

Source: Business of Fashion, 2023

According to a specialist (interview A), the easier way to explain the usage of the Digital ID is by stating that each finished product has a digital twin in blockchain, and if every transaction is recorded in the server as it should, one can track the product since the first raw material use. Thus, we can understand if one product is made according to the rules and preferences. It is possible to see the manufacturing place and date, who worked on that specific product, and where the fabric was sourced from being easier to track all the data as it is all concentrated there. The luxury brand tracks and traces on the upstream and downstream levels. On the upstream, they can track information about the origin of the raw materials like leather and also the distribution network. It is easier to guarantee ethical sourcing because blockchain creates smart contracts where both parties need to be compliant in order to create the next link and move to the next step, in case they are compliant with the environmental standards. When customers buy a product and scan the QR code or micro ship, they will be able to have all the information in their hands and check the chronological journey of the product.

The start-up Retraced created a platform to trace on the downstream level of the supply chain until the source of raw materials according to what brands and suppliers need. As they explain "*Transparency is about having the right data at the right time"* and traceability is one important step (Retraced, 2021, p.1). Retrace works on Oracle's Blockchain cloud to ensure all the key supply chain data is saved in a tamper-proof database and is based on the most updated security protocols such as EU regulations, specifically the General Data Protection Regulation (GDPR). Once a manufacturer, supplier, or farmer logs into the platform, the information is run by the Oracle Blockchain Platform, where authenticity certificates of a certain material can be verified or downloaded, and where smart contracts are digitally signed (Retraced, 2021; Fibre2Fashion, 2019). Smart contracts help to address sustainability and improve supply chain efficiency in several ways. In a brief and simple explanation, it is a self-executing contract where terms previously agreed upon between the actors involved are stated. This automated process continues to the next step when the conditions are met (Blockchain and Supply Chain Management, 2021). Moreover, this feature can automate and streamline many of the processes that are currently done manually (reducing waste and human errors). For instance, smart contracts can be used to automatically track the movement of products through the supply chain which makes better use of resources and reduces lead times. A smart contract can be created to release payments once the supplier has proved they met certain sustainability targets imposed by the brand (Figure 7) (Park & Li, 2021).

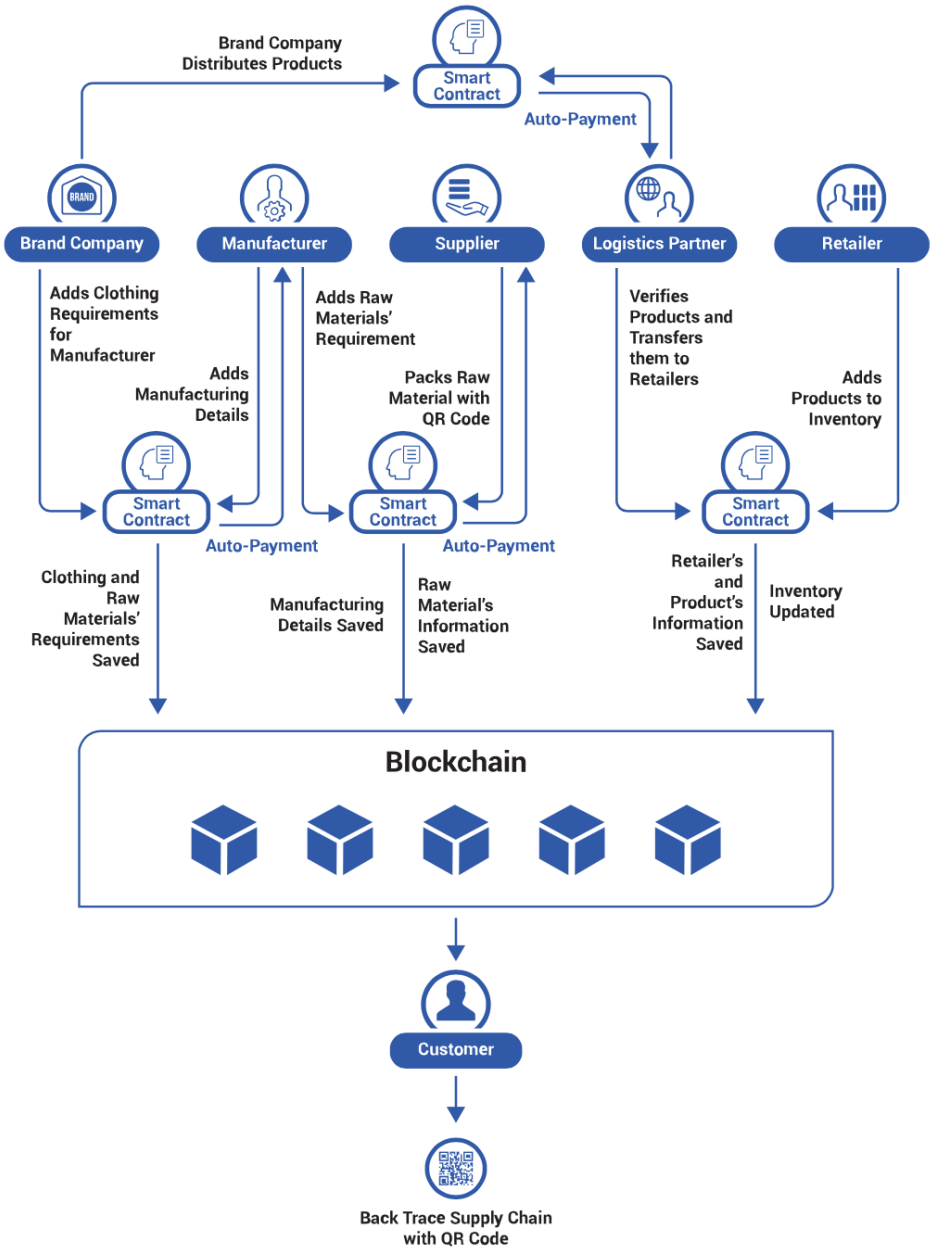


*Figure 7 - Blockchain application in Apparel Supply Chain (infographic)*

*Source: LeewayHertz, n.d.*

The interview findings of interview C emphasized the importance of teamwork once a company implements a blockchain base system, Blockchain technology has great potential but to accomplish the expected results it is necessary to exist a collaborative approach. Luxury brands have complex supply chains as normally their suppliers work with hundreds of other suppliers and trust is a key aspect to ensure the data traceability of the product is accurate. When data is stored in the blockchain, it is possible to see who, when and what data was added, which

is very useful in terms of traceability and control. However, it is hard to control the quality of the data, so all the actors on the downstream level must share real information.

When asked about the transparency characteristic of this technology, specialists had different points to highlight. In one of the companies, some are in destinations they do not visit regularly so blockchain is a vehicle to control that everything is recorded (via pictures, sensors, and data manually inserted) (interview A). In addition, the work done before implementing the technology is very important, with their will to become more sustainable the brand had to change some suppliers and negotiate with others to assure they would act according to their sustainable requirements. In interview B, the specialist has shown concern that nowadays many companies claim they are sustainable, but the proofs of their sustainability are nowhere to be seen by their stakeholders. Blockchain has the information stored and secure, depending on whether it is private or public, it is easy to access and see the facts. Stakeholders are pushing companies and this way they can show their results and their actions as the history of the product is visible and transparent to those who are interested to see it.

In general, blockchain and its features are perceived as promoting supply chain efficiency and effectiveness. When commenting on some key benefits of using this technology, a common aspect among the three interviews was the improvement in information sharing and traceability. Also, the fast exchange of information, automation, better resource usage and a reduction of human errors. Nevertheless, specialists expressed concerns about energy consumption. Blockchain energy consumption depends on whether they are private or public, private Blockchain systems will spend less energy. One of the companies uses a private permission blockchain base, which means only a group of authorized actors can participate and it does not spend much more energy than a Customer Relationship Management (CRM) system companies normally use (interview A). As sustainability is an important pillar for the brand, they chose a server provider that guaranteed to them their will on becoming carbon neutral in the next years.

Another common challenge is the complex implementation that Blockchain requires, as some suppliers and tollers are based in developing countries, and some lack technology expertise. On the industrial side, from the Digital and Operations Consultant experience, companies face a lot of difficulties scaling up the projects and there are still a lot of pilot projects that are never put into practice and sometimes the time and money invested in those pilot projects are a waste, which is also one of the reasons other companies are afraid to invest in this technology (interview C).

### 2.4. Blockchain and the fight against Counterfeiters

According to Kshetri (2021), industries that have a higher risk of having their goods counterfeited are more likely to adopt blockchain technology. Counterfeiting is a major problem in the luxury goods industry and directly affects the economic sector of the company as it can lead to a bad reputation and consequently, a loss in the revenue as the sale of lower-quality goods diminishes the exclusivity and high-end value of the brand. In addition, there is also the social factor that is affected, most of the counterfeited materials are made by forced labor operating illegally (Kshetri, 2021). Nowadays this activity is so developed that it is hard to identify replicas as reported by The Global Brand Counterfeiting Report 2018, one in five items tagged with a luxury brand on Instagram is not authentic. This report also indicates that this problem is growing and is a threat to the welfare of consumers and harms business reputation (Business Wire, 2018; Aura Blockchain Consortium, 2022).

Blockchain provides solutions to help curtail counterfeiting and fight the grey market. By following the product's journey, brands may have more information to verify during the distribution stage if any of the goods were sold to an unauthorized reseller who might sell afterward the good for a considerably lower price. Digital IDs for goods are the easiest way to certify their authenticity and promote safer circularity services like the second-hand market (Deloitte, 2022). As indicated by Aura Blockchain Consortium, one efficient way of fighting this fraudulent practice is via product Authentication by adding tamper-proof digital stamps in the most recently produced materials. However, authenticating old goods can be a challenge as the second-hand market remains to have many products that do not have a digital passport. Customers can authenticate the goods by resorting to an expert or in case they still keep the original receipt, the brand can issue a blockchain-based certificate (Aura Blockchain Consortium, 2022).

For the specialists, blockchain is not the solution to the problem but one big step to protect the brand from this crime. For instance, if one supplier sends to the manufacturer fabric to do ten shirts, and the manufacturer does only seven, they have to justify what happened to the fabric for the other three shirts since the information is stored in blockchain, there is visibility about the quantity produced because every data is inserted there. In the past many companies did not have visibility about their suppliers and did not have access to accurate data and some products could end up in the gray market. Moreover, one of the reasons for a luxury brand to become digital is that it is harder to fake the provenance of a certain product whereas a paper-based certification is easier to falsify. Now the customer can scan the product and receive a digital warranty which can be transmitted digitally to future owners.

### 2.5. Influence of a blockchain base system in the improvement of customer satisfaction

As previously seen, consumers' concerns regarding the source of the materials they buy are increasing. In 2019, Accenture conducted a survey of 6.000 consumers in 11 countries across Europe, North America, and Asia. More than half of the consumers surveyed are willing to pay more for sustainable products, made under fair conditions and that have the recycling idea attached to them (Accenture, 2019). Large conglomerates still face difficulties to gain consumers' trust as there was not much transparency in the past and on another perspective, consumers tend to trust easily small companies as they are perceived to source locally and be ethical and trustworthy (Deutsche Bank Research, 2020).

As pointed out before, blockchain is an important creation for transparency and traceability and has features that empower consumers' satisfaction. Customers appreciate the storytelling Blockchain can give to the product, and it makes them feel involved in the process as well (interview A). One specialist also indicated that the customer journey in the store is more personalized and described as *"the customer enters the store, chooses the product which can be a bag or a clothing piece, and the client advisor at the store authenticates through a phone the material by scanning it, then opens the product specific page and transfers the ownership to the customer. This transfer of ownership is also done in a previous stage from the retailer to the wholesaler and then from the wholesaler to the client for example, and they can see all this chain of custody on that page (...) and it is also a good way to remind the customer that they are paying a premium price for a fair product and giving credit to the people involved in all the work done behind the finished product they have in their hands"* (interview B).

In addition, by analyzing Cartier's after-sales study about their new project of reparation, blockchain is seen as a key technology for customer service and traceability. As Aura Blockchain Consortium states in the case *"since luxury is an industry focused on the long term, Cartier has to ensure that this standard will last"* (Aura Blockchain Consortium, 2022, p.2), this new platform helps increase visibility in the after-sales process and therefore it continues developing the relationship between the customer and the brand. Once the client sends the good for repair, the timepiece is registered, and pictures are sent to the client upon Cartier's reception (Figure 8) and to the Aura SaaS platform to create the transaction number. Afterward, the client receives an email with the pre-cost estimate (Figure 9) and if accepted the goods will be repaired; if not accepted the goods will be returned to the client. With this new procedure, when comparing the year 2019 to the year 2020, Cartier increased 15% its cost-estimate approval rate as the customer's feedback was positive, having a satisfaction rate of 4.8 out of 5 (Aura Blockchain Consortium, 2022).


*Figure 8 - Cartier Case study (after-sales service) I*

*Source: Aura Blockchain Consortium, 2022*


*Figure 9 - Cartier Case study (after-sales service) II*

*Source: Aura Blockchain Consortium, 2022*

From a different perspective, adopting Blockchain in the supply chain is more useful in a B2B strategy rather than a B2C strategy so the company can work internally with their suppliers with higher efficiency. It can improve customer satisfaction since it improves the customer experience with the proof of Authenticity and the access to the history of the product with the digital ID, but what the customer accesses with the ID is an intermediary between the client and the supply chain. If the customer wants to verify if the information is viable on the blockchain platform, it depends if the company has a public or private blockchain and usually it is not very user-friendly (interview C).

# 3. Methodology

In this chapter, it will be presented which methods were used to gather information and enable the discussion of the theme.

A pedagogical case study is an educational approach that involves analyzing and exploring real-world situations or scenarios. This method presents a specific context for analysis and allows students to apply their theoretical knowledge and develop their critical thinking skills. Furthermore, by presenting relatable scenarios it fosters a deeper understanding of the subject as there is a more engaging experience (Barney & Hesterly, 2014; Davis & Wilcock, 2003). According to Remenyi et al. (2002) case studies stimulate classroom discussion and are widely recognized as an *"effective approach to learning, as it tends to be more generally enlightening and also has a longer lasting effect on behavior"* (Remenyi et al., 2002, p. 4).

Regarding the data collection methods used in this pedagogical case study, semi-structured interviews (Table 2) with professionals working in supply chains in luxury brands are a primary source of data. The names of the firms interviewed, and the interviewee's names are anonymous to protect the source and provide the opportunity to obtain a closer understanding. The interviewees provided a broader perspective into the practices implemented by luxury brands and valuable expertise to successfully respond to the case study's question. As a secondary source, data was collected from published reports on the luxury firms' websites, scientific papers, certified journals, and books which allowed me to expand in-depth the knowledge about the luxury industry in France, sustainability, sustainable supply chain management, and Blockchain to obtain a concrete overview regarding the topic of interest.

Interview guide:

1. What are the key benefits and challenges of blockchain integration in sustainable supply chain management?
2. How can blockchain bring a bigger overview of the traceability and the life cycle of a product?
3. Can this disruptive technology (Blockchain) reinforce brand transparency?
4. In your view, Blockchain is an effective way to help curtail Counterfeiters?
5. Can a blockchain base system improve customer satisfaction?

*Table 2 – Specialists interviewed*

| Interview reference | Position | Years of Experience |
|---|---|---|
| A | Customer Service and Logistics Manager (worker in a Famous Luxury brand) | 8 |
| B | Client Engagement Manager (worker in a Famous Luxury brand) | 3 |
| C | Digital and Operations Consultant (Consultant for fashion brands) | 4 |

## 4. Pedagogical note

### 4.1.Target audience

Undergraduate and master students in Business Administration and Management who have a strong interest in the luxury sector and want to broaden their knowledge about blockchain and sustainability are the main target of the case study. The case can be used in courses related to CSR and Ethics, Sustainability, Luxury management, Logistics and supply chain, for instance.

In addition, entrepreneurs and supply chain professionals can make use of this case to expand their horizons and learn about how blockchain can be applied to sustainable supply chains.

### 4.2.Pedagogical objectives

The present pedagogical case study aims to provide insight into the new disruptive technology, Blockchain, and how it supports luxury companies to improve their socially and environmentally sustainable performance on the supply chain level.

Through the resolution of this case study, it is expected that the audience will gain a wider and broader perspective on the importance of the implementation of sustainable practices across the supply chain. In order to achieve this goal, the audience should strive for the objectives stated below:

1. Understand the concepts used in this pedagogical case.
2. Recognize the importance of traceability in the assessment of the product's life cycle.
3. Identify the benefits and challenges of the implementation of blockchain in sustainable supply chain management.
4. Understand how blockchain can improve brand transparency.
5. Develop the audience's problem-solving skills and analytical thinking.

## 4.3. Literature Review

This section presents the literature on Luxury and Sustainability, the Luxury Goods sector, Sustainable Supply Chain Management (SSCM), and Blockchain. It will also demonstrate how these concepts are connected and analyze possible contradictions between them.

### 4.3.1. Luxury: Concept and characteristics

The word luxury comes from the Latin term *Luxus*, which means indulgence, opulence and extravagant living (Oxford Latin Dictionary, 2012). The French philosopher Yves Michaud in his book *Le nouveau Luxe* explains that luxury implies rarity, expenditure, distinction, and pleasure (Mcneil & Riello, 2016). It can be seen as a powerful social force as it is associated with wealth, sophistication, desirability, and influence. Considered a subjective concept that has evolved through the years, some authors commonly mention the desire to purchase and experience that brings self-confidence and highlights a high social status, bringing to the customer a sense of exclusiveness and uniqueness (Stępień, 2021; Dubois et al., 2001).

In order to better understand what can be considered a luxury, Ko et. al (2019) analyzed various definitions of the concept and proposed the following definition: *"A luxury brand is a branded product or service that consumers perceive to have high quality, to offer authentic value through desired benefits, which can be emotional or functional, to have a prestigious image built on qualities such as artisanship, craftsmanship, or service quality, to be worthy of commanding a premium price and finally to be capable of inspiring a deep connection with the consumer"* (Ko et al., 2019, p.2).

Kapferer in 1997 shows an economical perspective of the term in analysis and refers that luxury goods are those whose price and quality relationship are the highest in the market. In addition, the author also suggests that the importance is not on the absolute price, but rather on the price differential between luxury goods and goods with comparable functions. With a similar view, McKinsey's report on luxury brands refers to them as brands that have constantly been able to justify a high price, significantly higher than the prices of average goods with comparable characteristics (McKinsey, 1990 as cited in Kapferer 1997). However, luxury is not only a collection of goods or services with certain characteristics. It plays a big role in the world economy, but it is neither an economic sector, nor a single industry, but a group of companies involved in the design, production, distribution, and sale of goods and services which has its focus groups high-end customers (Stępień, 2021).

### 4.3.2. Sustainable development, Triple Bottom Line and Corporate Social Responsibility

While a variety of definitions of the term Sustainable Development (SD) have been suggested, this thesis will use the definition first suggested by the World Commission on Environment and Development (WCED) which states that SD is the *development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (World Commission on Environment and Development, 1987, p. 43). Since the Rio de Janeiro Earth Summit in 1992, this concept has become more used and has been incorporated into international treaties, and national constitutions of many countries around the world (Ruggerio, 2021). Climate change, the overexploitation of natural recourses, and social imbalances have prompted scholars to focus in more detail on Corporate Social Responsibility (CSR) and sustainability.

The term Triple Bottom Line was first introduced by Elkington in the 90s and since then has been influencing organization's strategies in their transition to sustainability in three equally important dimensions: social equity (People), environmental quality (Planet) and economic benefits (Profit) (Elkington, 1997) also described in figure 10.


*Figure 10 - The three dimensions of TBL*

*Source: Dalibozhko & Krakovetskaya, 2018*

The social dimension refers to the impact the company has on society, in other words, in the community the company operates, in its employees and its customers. Companies should ensure their actions are aligned with the values they defend and with the interests of their stakeholders. Some indicators that might help them understand if the company is socially performing well are, for instance, customer and employee satisfaction, engagement with the community, human rights, and ethical concerns across the supply chain (Dalibozhko & Krakovetskaya, 2018). Regarding the environmental dimension in TBL, it covers the impact an enterprise has on the planet, including on the one hand its attempts to reduce the generation of waste and greenhouse gas emissions, the exploitation of natural resources, the energy consumption, among other indicators that might contribute to a larger ecological footprint. On the hand, it includes how the company proactively takes actions to protect the planet like reforestation, end using toxic materials, searching for renewable energy sources and being compliant with environmental certifications (Dalibozhko & Krakovetskaya, 2018). Finally, the economic dimension refers to the traditional financial bottom-line companies are familiar with, to its profits/earnings, and returns on investments and describes how well the company is managing its spending and its operational costs. This dimension has particular importance and as it has concentrated in it the ability to create value for both stakeholders and shareholders. It also secures continuous growth for the company and the investment in long-term strategies that allow the implementation of sustainable practices and new services that meet the needs of the social-environmental dimensions, if the company is not economically sustainable the other two dimensions will demonstrate a poor performance too (Correia, 2019; Elkington, 1997; Elkington, 1998).

In 2001, the European Commission showed its commitment to achieving sustainable economic growth with greater social cohesion and with better jobs not only for European Union's (EU) citizens but to inspire other economies in the world to follow its steps. In this direction, the European Commission stressed the importance of the concept of CSR, by explaining that it *"is essentially a concept whereby companies decide voluntarily to contribute to a better society and a cleaner environment"* (European Commission, 2001, p. 4). Companies are increasingly aware that implementing CSR practices increases their economic value, either through their management instruments and their operations or as a strategic investment. In addition, the European Commission stated that implementing sustainable practices should be seen as an investment, similar to quality management, and not a cost (European Commission, 2001). With a similar vision, The UN Industrial Development Organization (UNIDO) defines CSR as a way of integrating social and environmental concerns in business operations and

interactions both with stakeholders and shareholders with the ambition of balancing the expectations of the latter and the companies' social, environmental, and economic imperatives. UNIDO also exemplifies some key issues that CSR usually addresses, for instance: responsible sourcing, labor standards, and working conditions, environmental management, good governance, and human rights (UNIDO, 2022).

Bansal and Song (2017) explain that over time the difference between the terms Corporate Responsibility and Sustainability has become unclear and left areas of research unexplored. The concepts of corporate responsibility and sustainability emerged from distinct paradigms and should be treated differently, although, in the past two decades their definition began to converge. While Corporate Responsibility began with a focus on ethics and societal well-being, examining the impact of businesses during an industrial era, Sustainability research emerged as a response to the negative effects of economic development on natural resources (Bansal and Song, 2017). This view is supported by Sipilä et al. (2021), CSR and sustainability despite being associated should not be seen as synonyms. Sustainability is the target, the goal of implementing CSR practices in business operations. Although these are terms that only gained relevance in the 21st century, in recent years it is a field of study for many researchers and as they are interpreted in various ways it is difficult to explain them in one singular definition.

### 4.3.3. Association of Luxury and Sustainability, Sustainable Luxury

Sustainable Development has become a key issue for all industries and businesses. However, the increasing importance of sustainability principles can be seen as incompatible with some of the luxury requirements and its sense of uniqueness made with valuable rare materials (Karaosman et al., 2020). By comparing these two broad concepts, it is possible to identify some elements of contradiction.

Firstly, the ostentation, consumption, and superficiality that luxury entails can oppose some characteristics of sustainable development, particularly, fairness, moderation, and social harmony (Kapferer, 2015). *"Luxury brands deliver a dream, they do not want to contaminate with information that could harm it"* when buying a luxury good, consumers do not want to think about less positive things concerning the misbehavior of some actors of the luxury sector (Kapferer, 2015 p.6). Academics suggest that one explanatory factor of incompatibility is the trouble of bringing world problems to a luxury purchase that is seen as a dreamy experience (Kapferer and Bastien, 2012 as cited in Kapfer, 2015). Similarly, Cervellon and Shammas (2013) in their exploratory research on the value of sustainable luxury across four mature

markets - France, Italy, the UK, and Canada advocate that sustainable luxury products lessen the consumers' feeling of pleasure in the moment of purchase (Cervellon & Shammas, 2013).

Secondly, findings from an empirical study provide evidence that there is a weak association between recycling and luxury (Achabou & Dekhili, 2013). For instance, the idea of buying an Hermès product made with recycled cotton was negatively seen by customers as they interpret there is a loss of uniqueness and do not perceive the damage caused to the planet by the mass production of cotton (Achabou & Dekhili, 2013; Kapferer, 2015). Despite the effort made to choose distinctive sustainable materials with superior quality, the application of such materials seems to undermine the perceived quality of luxury goods (Dekhili et al., 2019).

In contrast, Adigüzel and Donato (2021) explain *"that luxury brands producing upcycled goods might lead to higher consumer willingness to buy compared to luxury brands producing recycled goods"*. Based on findings from three experiments, the authors concluded that consumers attribute greater novelty to an upcycled good rather than a recycled good. (Adıgüzel & Donato, 2021) Although sustainability is not the most important criteria when acquiring luxury goods, there is an implicit belief that luxury brands have the duty of being sustainable and providing quality (Kapferer, 2010; Bendell & Kleanthous, 2007). In addition, unlike fast fashion, for example, the luxury sector has a strong focus on quality and timeless duration, meaning it has some points of agreement with sustainability, for instance, the preservation of handmade traditions or the transmission of products from generation to generation (Kapferer, 2015). Literature findings reveal that ninety percent of all Porsches ever manufactured can still be found working in good condition, which means that the core of luxury (durability and timeless heritage) lies within the conception of Sustainable Development (Kapferer, 2010; Bendell & Kleanthous, 2007).

### 4.3.4. Sustainable Supply Chain Management (SSCM)

Lambert et al. (1998) define SCM as *"the integration of key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders"* (Lambert et al., 1998, p.1). A good and functional SCM coordinates communication within and between companies and helps companies to increase their revenues, cut costs and achieve faster production cycles (Investopedia, 2021). With the creation of the Green Deal by the European Commission and the Sustainable Development Goals (SDG) by the United Nations, there is increased pressure to improve environmental performance.

The Sustainable Supply Chain Foundation (SSCF) provides a new definition of SSCM: integration of "*environmentally and financially viable practices into the complete supply chain lifecycle, from product design and development to material selection, (including raw material extraction or agricultural production), manufacturing, packaging, transportation, warehousing, distribution, consumption, return and disposal"* (SSCF, 2010, p.1). This integration can involve different concerns, including the reduction of carbon footprint, natural resources conservation, and social responsibility (SSCF, 2010). The definition of SCM has been broadened to include the management of materials, information, and capital flows and the cooperation between actors throughout supply chains, whilst considering all three dimensions of sustainable development: environmental, social, and economic dimension (Karaosman et. al, 2020). It has been suggested that an efficient SSCM includes the implementation of practices such as investments in pollution control and prevention, the adoption of environmental management systems, and the achievement of environmental certifications (e.g. ISO14001) and codes of conduct (Koberg & Longoni , 2019). Companies that start implementing sustainable practices will benefit not only from improved environmental performance but also from better economic performance. SSCM combines economic, social and environmental factors to develop better performance by maximizing productivity and social welfare while solving environmental issues (Narimissa et al., 2020).

Karaosman et al. (2020) devoted some attention to the influence of the company size on SSCM and referred that the industry sector, the company location, and mainly the company size influence the adoption of green practices, bigger companies will inevitably have a more complex SC. When analyzing Italian luxury firms, the bigger ones mostly outsource their products and are not 100% aware of the raw material processing. The production manager of one of the companies stated *"sixty years ago we had the entire production of silk internally (…) years have passed and globalization created complexities, it was too costly to produce everything (…)"* (Karaosman, et al., 2020, p.6), so they started outsourcing it in Asia for a lower cost. Karaosman et al. (2020) also concluded that the main motivation for luxury fashion firms to implement sustainable practices is reducing negative impacts generated by their operations, but the lack of end-to-end visibility is a limitation in their SC traceability.

### 4.3.5. Importance of Traceability in SSCM

Aviram (2021) brings an interesting perspective: *"the linear production known from the industrial revolution must change"* (Aviram, 2021, p.1). Since the industrial revolution fashion industries from all kinds of markets have caused major environmental effects from the

overconsumption of natural resources to the wrong disposal of industrial residues and waste. Although the concept of luxury has not gone through a drastic change the process of production of luxury goods has, for instance, nowadays it is uncommon to find the product's origin *made in* France, Switzerland, or Italy. Luxury brands should benefit their customers with a continuation of ethical values, hardly shown when they resort to manufacturing their products in underdeveloped countries and therefore reducing transparency in their supply chain. (Aviram, 2021). Gelderman et al. (2021) in their study about the impact of buying power on corporate sustainability concluded that there is a positive correlation between sharing traceability data and company performance on all three dimensions of CSR (economic, environmental, and social).

In this case study, the term that will be used to describe traceability is *"the ability to identify and trace the history, distribution, location, and application of products, parts, and materials, to ensure the reliability of sustainability claims, in the areas of human rights, labor (including health and safety), the environment and anti-corruption"* (Business for Social Responsibility, 2014, p. 6). Companies have shown increasing concern about tracking all the processes in the supply chain and implementing traceability measures to comply with regulations and gather information from their supply chain actors. Data traceability brings positive inputs about quality control, product safety also about materials used and produced by suppliers, and the source of location or how materials were extracted. Luxury brands are known all over the world and they do not want to ruin their reputation with scandals, that is why traceability data should be a major concern. The lack of proper information about the origin, distribution, production, and working conditions, may lead to scandals related, for instance, to greenwashing. This kind of data needs to be carefully analyzed to avoid unfortunate incidents and the exposure of unethical practices (Gardetti & Muthu, 2020).

Nowadays, traceability is almost imperative to create reliable relationships with stakeholders, whether they are suppliers, employees, customers, or investors. Stakeholders and governments are also incentivizing and somehow pressuring companies to report on their websites their actions, there are two recent Acts important to highlight: in the United States of America, the CATSA (California Transparency Supply Chain Act) *which requires retailers to trace their supply chain and to publish on their website measures they use to eradicate human abuse in the production process* (Jestratijevic et al., 2020) and in the EU, there is also REACH Act (Registration, Evaluation, Authorization, and Restriction of Chemicals) which impacts almost all companies across the EU and was created to improve the protection of the environment and human health from the risks that chemicals may cause (ECHA, n.d.).

Luxury firms' supply chains are mostly spread in a great number of countries and continents and checking whether different tier suppliers are compliant with sustainability measures remains a big challenge (Gelderman et al., 2021). Blockchain technology may assure the reliability of the entire chain in all three CSR dimensions as enables companies to maintain secure information due to its immutable information features (Park & Li, 2021).

### 4.3.6. The role of Blockchain in the improvement of traceability

According to Forbes, Satoshi Nakamoto, whose true identity is still not identified, published in 2008 the whitepaper *"Bitcoin: A Peer-to-Peer Electronic Cash System".* Satoshi Nakamoto announced the creation of Bitcoin as *a "purely peer-to-peer version of electronic cash",* this was when blockchain technology made its first public debut (Marr, 2018, p.1). Over the last decade, Blockchain became the biggest ground-breaking technology in history and although blockchain is frequently associated with Bitcoin, several innovations in the system afterward made it be used in all kinds of industries and their supply chains. (Marr, 2018). Defining the concept is complex, Bernard Marr tried to simplify it by explaining that blockchain is *"an open, decentralized ledger that records transactions between two parties in a permanent way without needing third-party authentication"* (Marr, 2018). In other words, Blockchain *"is a secure database shared across a network of participants, where up-to-date information is available to all participants at the same time" (*McKinsey & Company, 2023).

Considered a disruptive technology for the design, operation, and management of supply chains, Blockchain allows companies to validate and carry out safe transactions in a faster environment. The immutability feature of this technology arises advantages for supply chains as its usage increases transparency (reduces the risk of fraud as it is visible to all the actors) and traceability (it is ideal for tracking items in complex supply chains). Blockchain also plays a major role in SSCM, it not only fosters real-time tracking as it registers every transaction but also reduces rework which consequently decreases resource consumption. However, it is also worth noting the energy consumption of blockchain, which can be very significant depending on its purpose. Sedlmeir et al., (2020) concluded that the levels of energy consumption are different according to their design choices but in general blockchain technology consumes more energy than non-blockchain solutions. Nonetheless, enterprises' blockchain usage is normally hybrid, meaning it is usually combined with other conventional IT. Literature also shows that the amount of energy smart contracts consume largely relies on the underlying blockchain consensus mechanism responsible for validating and adding transactions to the blockchain. Depending on its consensus mechanisms it can contribute significantly to carbon emissions,

Proof-of-work (PoW) based smart contracts demand more energy, whereas Proof-of-Stake (PoS) based smart contracts are more energy efficient. In addition, the generation of e-waste can also be considered a disadvantage as there is a growing demand for hardware that quickly becomes outdated and can be hard to find ways of recycling. To address these concerns, researchers are actively working on sustainable designs (Groschopf et al., 2021). Some authors also state on the other side of the balance, there should be considerations of the cost savings that can be achieved by the enterprise, including reductions in paperwork and transportation expenses (for instance airfreight), among the creation of other opportunities also mentioned along this case study (Sedlmeir et al., 2020).

Furthermore, one notable advantage of blockchain is its ability to facilitate easy verification of the materials supplied in an early stage in the chain, regarding their compliance with the codes of conduct of the company (Saberi et al., 2019). Companies can increase consumers' trust in their products, one good example are the groups DeBeers and Alrosa with the blockchain platform Tracr. Accounting for about half of the world's diamond supply, these two large mining firms adopted some blockchain programs in their supply chain. The objective was to improve transparency across the diamond value chain from the mining phase to the retail phase. De Beers created records of GPS locations for each diamond found, when found, the diamonds are added in a tamperproof bag that has a QR code that includes information about the diamond's carat weight, clarity, or color for example (Figure 11).

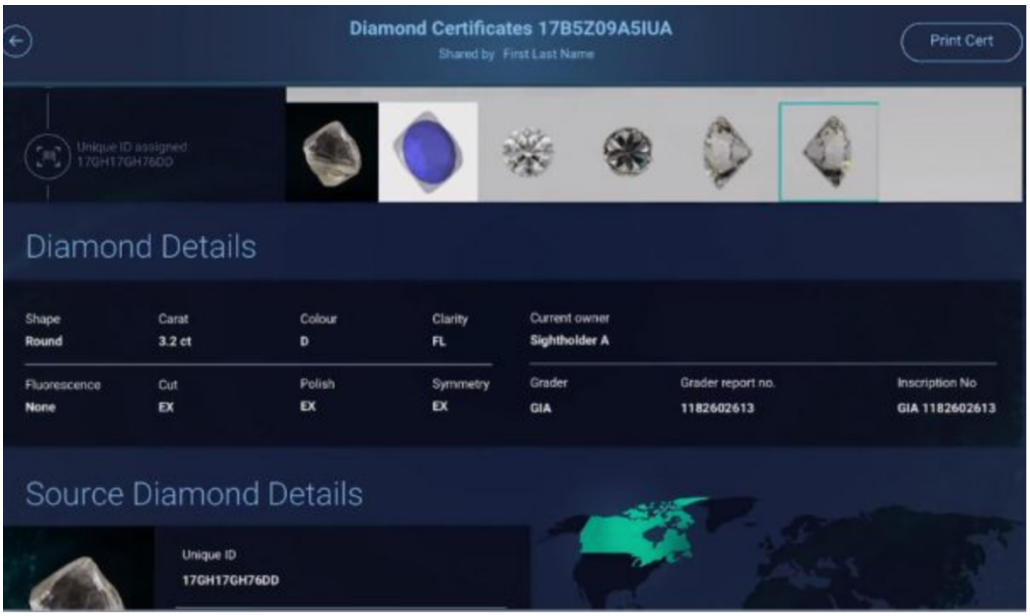


*Figure 11 - De Beers Blockchain diamond tracking platform TRACR*

*Source: Akilo, 2018*

They track a piece of diamond each time they change phase, from the moment they are mined from the ground until they are sold to the customer. The company created a digital certificate for each diamond, the data is stored immutably on the blockchain allowing the buyer to verify if the diamond is conflict-free. This revolutionary technology helps firms demonstrate their products are sustainable (Kshetri, 2021).

One more problematic Blockchain can aid Luxury firms is in the fight against counterfeit business. Large companies that opt to outsource manufacturing find it hard to control the exact quantities of items produced by their suppliers. Sometimes, in the manufacturing phase, the extra raw materials or finished products are sold to the counterfeit market. By following the materials life cycle and authenticating the "made in" label, firms prevent financial losses as the luxury goods industry is one of the most affected by counterfeiting and gray markets (Boissieu et al., 2020).

### 4.4. Animation Plan

The case study presentation and the literature review were carried out to provide mainly a wide range of purposes and to be interesting not only for the professor presenting it but also for the students resolving the case. The professor can choose to evaluate the class individually or in a small group work (around 3 to 4 people to assure there is active participation of all the elements). It is suggested that the students read the full case study individually prior to the class to have time to research some unknown concepts and be able to clarify doubts in class, allowing the discussion of the theme before starting to resolve it.

As teamwork is an important skill in the professional world, below you can find the class plan for a group work approach.

- Pre-class plan - individual preparation of the student:

*Table 3 - Action plan 1*

| Phases | Action Plan – detailed steps | Time |
|---|---|---|
| 1 (pre-class) | 1. Individual case reading<br>2. Check LVMH, Kering, Aura Blockchain Consortium websites, review luxury industry data<br>3. Note down any doubts | 60 minutes |

| | | |
|---|---|---|
| | 4. Define 2 or 3 key points for each question for further group discussion. | |

- First class plan (total 90 minutes):

*Table 4 - Action plan 2*

| Phases | Action Plan – detailed steps | Time |
|---|---|---|
| 1 | 1. Organization of the groups<br>2. General presentation of the case for all the class, doubts clarification | 10 minutes |
| 2 | 1. Question 1 resolution in group<br>2. Identify the concept of Blockchain<br>3. Characterize Blockchain value | 20 minutes |
| 3 | 1. Question 2 resolution in group<br>2. Understand the pros and cons of Blockchain implementation | 25 minutes |
| 4 | 1. Divide the groups to present their answers, for instance:<br>- groups 1, 2 and 3: question 1<br>- groups 4, 5 and 6: question 2<br>2. Group discussion on the answers presented. | 35 minutes |

- Second class plan (total 90 minutes):

*Table 5 - Action plan 3*

| Phases | Action Plan – detailed steps | Time |
|---|---|---|
| 1 | 1. Organize in the groups from the last class<br>2. Brief case review; | 15 minutes |
| 2 | 1. Question 3 resolution in group | 20 minutes |

| | | |
|---|---|---|
| | 2. Identify the concept of Triple bottom line<br>3. Understand how different concepts are connected | |
| 3 | 1. Question 4 resolution in group<br>2. Understand the concept of sustainable supply chain management<br>3. Identify how Blockchain can improve sustainable supply chain management | 25 minutes |
| 4 | 1. The professor can ask for 3 volunteer groups (or the rest of the missing groups) to present their answers<br>2. Sharing opinions about the case in general<br>3. Presentation of the resolution slides by the Professor<br>4. The professor can ask for a document where the groups report their answers, to be delivered when the Professor considers it is appropriate. | 30 inutes |

### 4.5. Animation Questions

1. What value can Blockchain add to a luxury brand? Please exemplify.
2. Develop a SWOT analysis for the application of blockchain in sustainable supply chain management.
3. French luxury brands have changed their approach to Sustainability through Blockchain. Analyze their approach using the triple bottom line concept.
4. Based on all the findings of this case study, how can blockchain improve sustainable supply chain efficiency? Please explore.

### 4.6. Case study resolution

1. What value can Blockchain add to a luxury brand? Please exemplify.

Blockchain can add significant value to any brand, and luxury brands, in particular, are renowned for leading the way in anticipating and setting trends, one example of this is the implementation of blockchain in SSCM. There are three keyways in which blockchain can add value to a luxury brand: the promotion of sustainable and ethical practices, verified record of product provenance of their products and finally the enhanced customer experience.

Firstly, this technology tracks back to the origin of the raw materials and products which allows brands to ensure they are compliant with ethical and sustainability standards and consequently reinforces the brand's commitment to the SDGs. This allows the luxury brand to show they are implementing responsible business practices and appeal not only to consumers but also to new workers. The workforce is a major engine in every company, they are responsible to turn goals into reality, without skilled and motivated workers, brands may find more obstacles in the way of achieving their objectives. Companies rely on the quality of their employees to develop new ideas and stay ahead of the competition, they are critical components in any brand's success. In addition, creating a good internal culture can enhance the company's reputation and lead to higher employee retention rates, lower turnover costs, and a more motivated workforce. Sustainably speaking, environmentally friendly practices help luxury brands to differentiate from their competitors, blockchain can play a crucial role in promoting sustainability by creating a secure and transparent record of a product's supply chain, from sourcing to disposal which enhances their reputation as transparent and trustworthy. Moreover, the technology helps avoid green scandals as it can assure companies are compliant with regulations like REACH and CATSA.

Secondly, Blockchain can help establish provenance, by creating a tamper-proof ledger of product information, it provides a transparent record of a finished product journey, from its origin to the point of sale. Luxury brands place high attention on authenticity and consumers are willing to pay a premium price for luxury goods. Nevertheless, as the literature shows, luxury consumers expect products to be manufactured with the highest standards of craftsmanship, meaning their provenance is a critical component of the brand's reputation and value. This technology is particularly useful in guaranteeing the provenance and providing assurance of the authenticity and quality of the product, the interviews state it is harder to falsify authenticity with a digital warranty.

Finally, Blockchain is a valuable asset to the brand as it enhances customer satisfaction. By incorporating blockchain into supply chain management, the customer service of a luxury brand has access to the purchase history of the customer and their requests, they can create a more personalized experience, from the initial contact to the after-sales support (the latter can be illustrated briefly by the Cartier case study mentioned earlier, with the new after-sales reparation service using blockchain technology the satisfaction rate is 4.8 out of 5), and find new customer's needs to fulfill. If the customer is satisfied not only with their bought but also with the whole experience, higher are the chances they will recommend the brand and remain loyal if their expectations are met or transcended.

Ultimately, by leveraging the benefits of blockchain technology, luxury brands can differentiate themselves from competitors, enhance their reputation as transparent and trustworthy, and ultimately increase customer loyalty and satisfaction.

2. Develop a SWOT analysis for the application of blockchain in sustainable supply chain management.

SWOT analysis is a strategic tool used to identify potential internal and external factors that may affect positively or negatively the business in a certain domain. Based on the information collected in the presentation of the case, the literature review and the interviews, it is possible to analyze the strengths (S), and weaknesses (W) as well as the opportunities (O) and threats (T) a luxury brand can face when implementing blockchain technology in SSCM (Table 6).

*Table 6 - SWOT Analysis of blockchain implementation in SSCM*

| **S - Strengths** | **W – Weaknesses** |
|---|---|
| • Increases suppliers' compliance<br>• Accountability (the brand can identify more easily if suppliers are not performing adequately)<br>• High security (immutable features) Transparency<br>• Traceability (information sharing)<br>• Cost-efficient<br>• Automation (smart contracts). | • Energy consumption<br>• Complex implementation<br>• Low degree of digitization in some countries<br>• Parties need to comply with diverse laws, regulations, and institutions<br>• High level of compromise<br>• Big investment. |
| **O – Opportunities** | **T – Threats** |
| • Improve customer relationship<br>• Increase competitive advantage<br>• Protect intellectual property<br>• Strengthen brand reputation<br>• Expand to a digital market (metaverse)<br>• Enhance transparency and trust in the resale market. | • Regulatory uncertainty<br>• EU's general data protection (Regulation and blockchain)<br>• Data Manipulation (before inserted in the server) |

Most of the strengths identified show that Blockchain improves supply chain efficiency and consequently sustainability as there is a higher control in the supply chain. Among all the benefits this technology can bring to luxury companies, traceability is one of the main strengths as it is the first step for a company to identify its footprint and make changes towards its sustainability KPIs. In the list of weaknesses, it is important to note its complex implementation not only because some suppliers are based in countries with a low degree of digitalization but also because it depends on a high level of compromise from every actor on an upstream and downstream level.

Regarding the opportunities and threats, the opportunities are in advantage. Besides all the sustainable advantages it can bring to luxury brands, blockchain technology presents several opportunities for luxury brands. Firstly, it can enhance competitive advantage by providing unique features and capabilities. Secondly, it offers a means to protect intellectual property, ensuring a safer second-hand market and combating counterfeiting. Thirdly, blockchain can strengthen brand reputation by promoting transparency and traceability, enabling consumers to verify the authenticity and ethical sourcing of luxury products. Lastly, it facilitates expansion into the digital market, including emerging platforms like the metaverse, enabling luxury brands to engage with their customers in an innovative way. However, due to its short existence and recent implementation, it is possible to identify some threats, mainly external as it does not depend on the company's competence, for instance, its uncertain legal status, there is still no regulation directed to blockchain only. Although blockchain's long-term effects have not been seen yet, new regulations are highly likely to be created in the near future.

3. French luxury brands have changed their approach to Sustainability through Blockchain. Analyze their approach using the triple bottom line concept.

The triple bottom line concept is a business framework used by enterprises to implement sustainability in their business strategy, it is based on three dimensions: People, Planet and Profit. As seen along this case study, blockchain is a promising tool applied in luxury brands' supply chains to improve their performance and reach their sustainable goals. This technology influences all three dimensions (figure 10), which will be further explained in the next paragraphs.

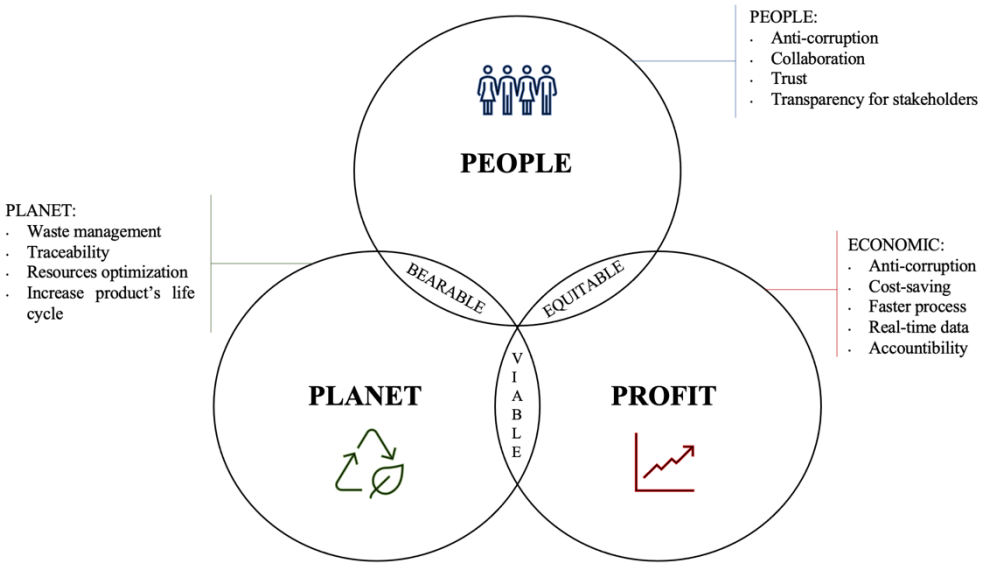


*Figure 12 - Blockchain Triple bottom line adaptation*

*Source: Adapted from Dalibozhko & Krakovetskaya (2018)*

- People: On the social level, blockchain features play a big role in combating the counterfeiting and grey market, where human resources are often working under illegal conditions. The visibility and transparency that blockchain gives to luxury enterprises allow them to identify corrupt practices along their complex supply chain and avoid fraud. In addition, as stated in the interview, blockchain requires a collaborative approach and a high level of trust, which means teamwork is involved and a good ethical environment is needed. Stakeholders also benefit from the visibility transmitted, for instance, with the digital ID customers know they are buying a luxury item with raw materials sourced and manufactured under fair conditions. Another example is related to luxury investors, they will be more pleased knowing they are doing a clean investment and their funds impact positively society.
- Planet: This disruptive technology can support environmentally friendly business practices by improving transparency along the supply chain at a downstream and

upstream level, it becomes easier to identify the product's provenance and their transactions to assess the environmental impact of the extraction of a certain raw material, tracks carbon emissions, also optimizes resources usage (for example fewer human errors occur, paperless transactions). Although Blockchain's energy consumption is a concern, tracking the finished products back to their initial point of start may reduce re-work by digitalizing all the processes and creating secure algorithms, which may lead to fewer greenhouse emissions and create a real-time notion of the carbon footprint of each product. Furthermore, it enables as well the verification if the green standards and rules of the luxury brand are being followed by their suppliers and subsequently their suppliers' supply chain actors. From another perspective, by fighting counterfeiting and creating a safer secondhand market, it also increases the continuity of the life cycle of some luxury items, as stated earlier in the case study, some digital IDs even provide safer solutions in case clients want to resell that item.

- Profit: The economic dimension is equally important as the social and environmental dimensions since it is what assures business continuity. Blockchain redesigns supply chain flows for companies who implement it, the technology allows real-time information about location and status across all the steps, turning the processes faster. Transactions are simplified, not only some intermediaries can be removed from the process but also there is a mitigation of performance risks that saves future costs. As indicated in the case study, payments can be performed faster without any intermediary creating a smoother procedure. Moreover, smart contracts are a key feature in Blockchain as it automates some steps and minimizes lead times, reduces paperwork between actors, speed up the processes and decrease transaction costs. Overall, although implementing blockchain is a big initial investment, in the long term can decrease costs considering its efficaciousness.

4. Based on all the findings of this case study, how can blockchain improve sustainable supply chain efficiency? Please explore.

This pedagogical case study presents several improvements for sustainable supply chain efficiency. Blockchain has the potential to boost a company's performance and remain aligned with its sustainable goals. The four general improvements frequently referred along the case study are increased traceability, better resources management, advanced data safety and supply chain digitalization**,** each of these mentioned improvements has several details which will be further explained in the next paragraphs.

Traceability is one of the improvements frequently addressed that Blockchain brings to SSCM and can be considered one of the key advantages, every step can be tracked and verified by the technology, providing greater transparency and accountability. As mentioned in the interviews, blockchain can verify transactions in real-time and ensure the data is accurate and updated and as it provides greater visibility into the social and environmental impact of suppliers and the products manufactured/services provided by luxury brands. It allows enterprises not only to make more informed decisions about their sourcing and production practices but also to identify areas that need improvement or some problems' origin. Kshetri (2021) mentions the group De Beers as an example of a good blockchain implementation, the group has created a platform to ensure that diamonds are ethically sourced and not involved in any conflict. This transparency provides a new level of accountability for diamond producers and retailers.

The second improvement is resources management, which is a crucial element for success, the optimization of resources and waste reduction is directly related to sustainability. Blockchain tracks the movements of goods and combines inventory availability with manufacturing processes and creates an accurate calculation of what should be the result. In addition, it records the carbon footprint of every product, by collecting data from all the parties involved (sourcing, production, transportation, etc), the data can be waste generated, energy consumption and transportation emissions and can as well estimate the greenhouse emissions that the product emits during all its life cycle. Blockchain is seen to be a reliable tool for brands to calculate their environmental impact and communicate it to consumers so they can also make an informed decision.

The last two improvements, data safety and digitalization are interconnected, as the former relies on the latter for its existence. With the big amount of data generated by supply chains every day, digitalization became essential for effective data management. According to the literature, resorting to digital platforms and blockchain-based solutions, supply chain processes are more automated and reduces lead time as it requires fewer manual processes, reducing costs (for instance less human errors) and increasing efficiency. Digitalization is also a tool of risk mitigation, physical records can easily be lost in case of natural disasters, and geopolitical crises and prevents fraud. One specific example of an improvement and also connected to data safety, are the creation of smart contracts. Park & Li (2021) point out that smart contracts automate supply chain processes and verifies if all the actors are being compliant with the brand's standards and rules. Blockchain can also provide enhanced data safety, due to its complex algorithms to encrypt data, the technology prevents data breaches and blocks unauthorized

access. Moreover, according to the interview, as blockchain is a decentralized network, the data added is stored in multiple nodes, if one of the nodes has a problem and goes offline, the data remains accessible by its authorized users. Another key point is that the data records are immutable, once the data is recorded in the network, in case an alteration is needed, all the network users need to authorize, preventing fraud and keeping the data accurate and transparent to all the users.

In summary, the implementation of blockchain technology in supply chain management has the potential to help companies achieve their sustainable goals, increase efficiency and transparency, and build greater trust with their customers.

### 4.7. Resolution slides:


*Figure 13 - Resolution slides, cover*

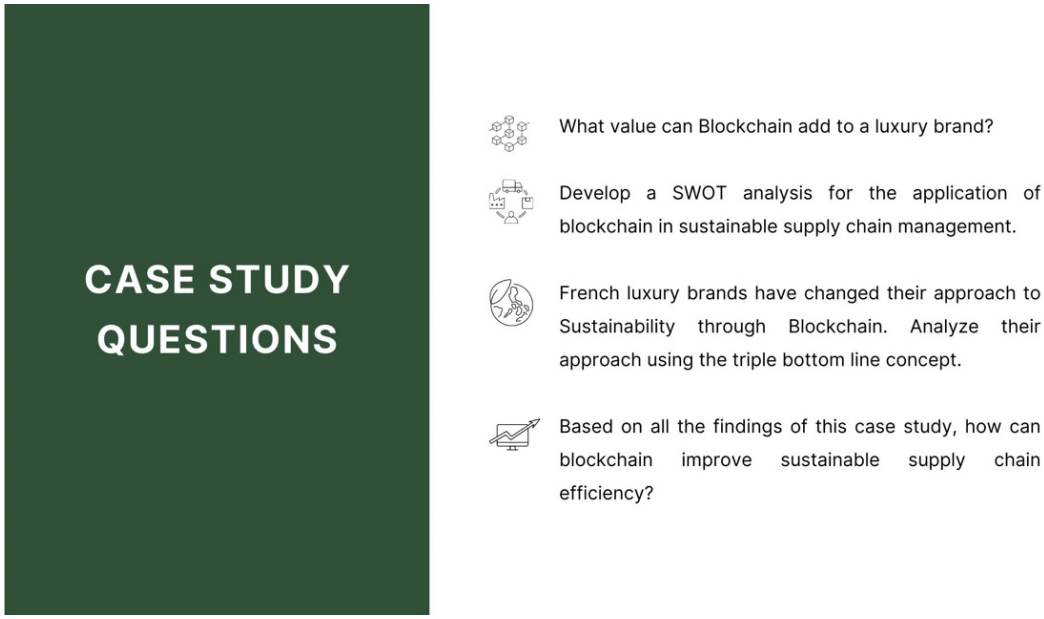


*Figure 14: Resolution slides, case study questions*

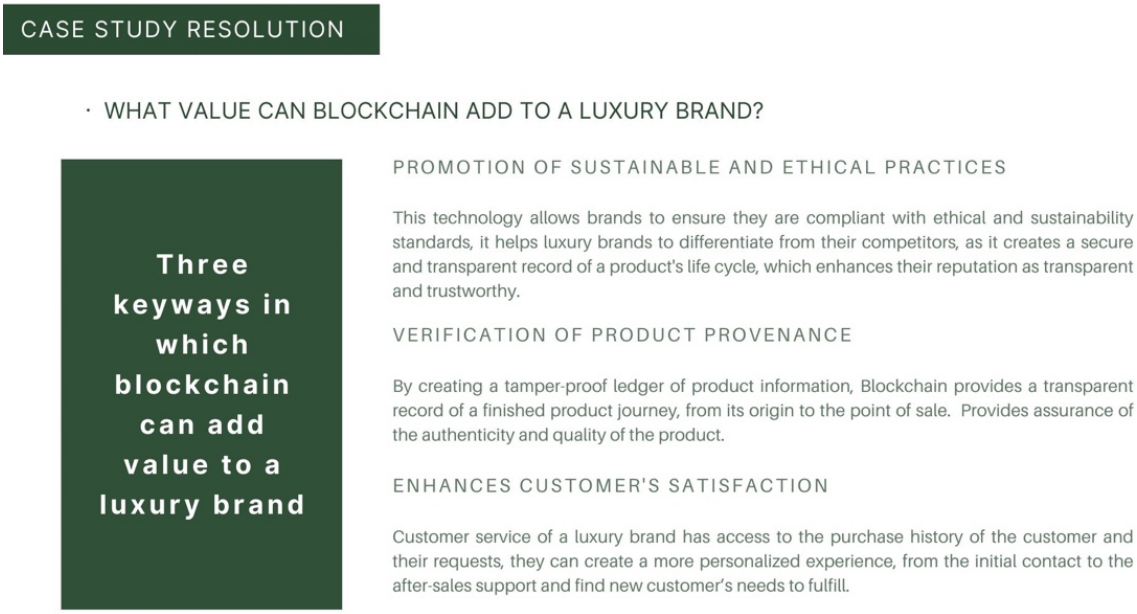


*Figure 15 - Resolution slides, question 1*

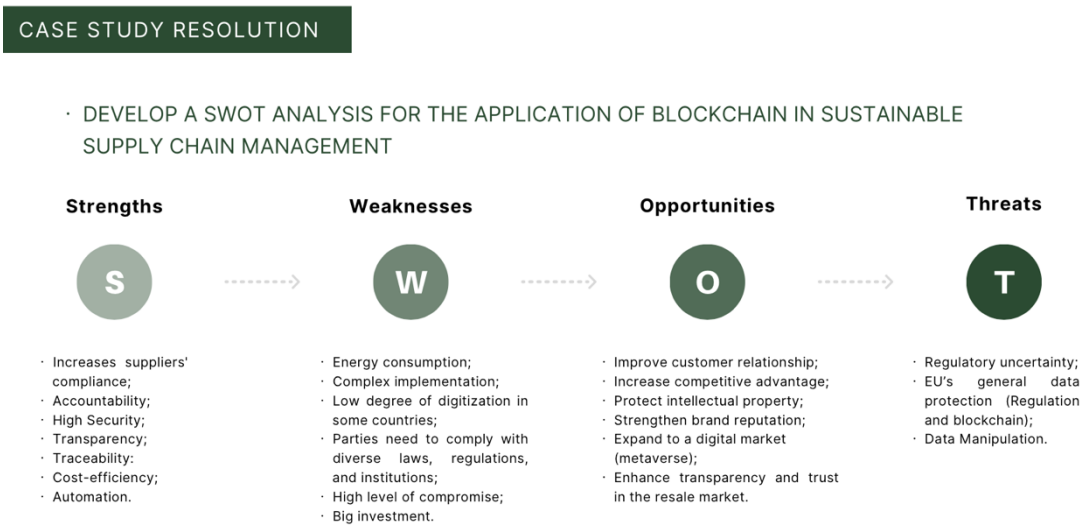


*Figure 16 - Resolution slides, question 2*

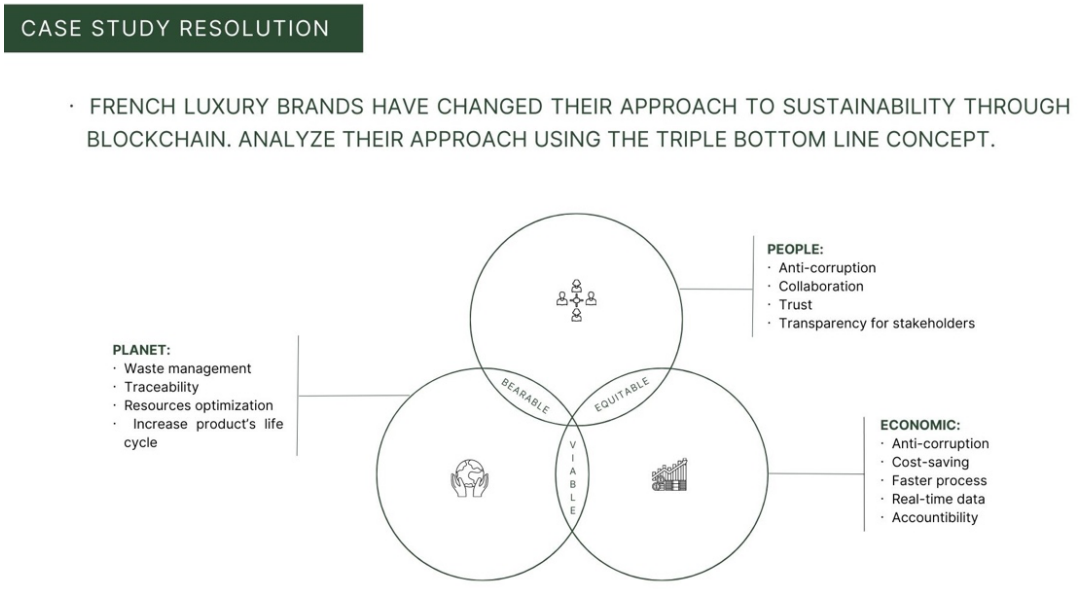


*Figure 17 - Resolution slides, question 3*

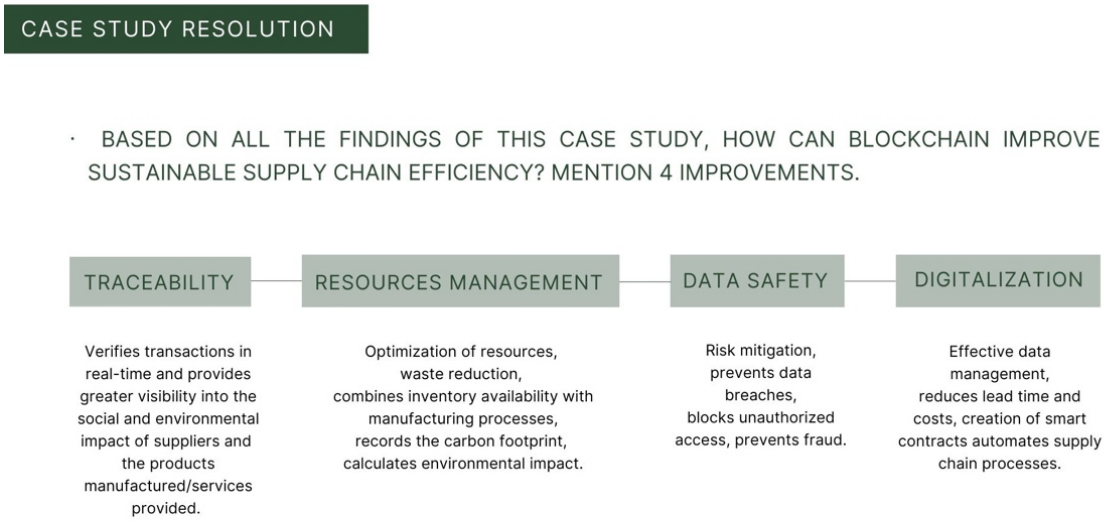


*Figure 18 - Resolution slides, question 4*

## 5. Conclusion

This pedagogical case study aimed to expand the reader's knowledge about Blockchain technology and provide a better understanding of how it can be applied in luxury brands' sustainable supply chain management. Considering these are two areas still in development, we can conclude companies need to carefully evaluate the pros and cons of Blockchain implementation and verify if the brand has the necessary resources and structure to do it. On one side, bigger enterprises have more resources to implement it but on the other side, their supply chain is more complex, and more difficulties arise. While smaller companies may not have so many economic resources to implement it, but the process of implementation has fewer barriers.

Nevertheless, although currently, the challenges are many, the bigger benefits this technology can bring are yet to be seen due to its recent existence. Bitcoin and the metaverse world were the first demonstrations of blockchain potential, and companies understood this potential when they noticed it could improve their supply chain efficacy and simultaneously reach faster their sustainable goals. By providing greater transparency and accountability, blockchain technology can help companies make more informed decisions about their sourcing and production practices, identify areas for improvement, and report their environmental impact to consumers, the Aura Blockchain Consortium is a notable example, by providing consumers with information on the lifecycle of a product in a safe digital format. From the above-mentioned benefits, implementing blockchain technology in supply chain management can offer significant advantages compared to conventional strategies, the two key differences are decentralization and transparency, whereas, in a traditional supply chain, the flow of information and goods are controlled by a centralized entity such as a company, with this disruptive technology, the data is distributed across a network with several nodes, making it more secure and resistant to fraud. Blockchain records each transaction on an immutable ledger that can be accessed by all parties involved, enabling better transparency in the supply chain and the traceability feature makes it ideal for tracking products in complex supply chains, increasing consumer trust and preventing counterfeiting.

In conclusion, the luxury industry is embracing blockchain as a means of enhancing sustainability, authenticity, and transparency in its products and supply chains. This case study highlights the potential benefits of blockchain technology for sustainable supply chain management, certainly, Blockchain is not the solution for all the sustainable challenges luxury companies face nowadays but should be considered as a tool to achieve environmentally

friendly results, overall, this technology empowers sustainability, and more pros may arise in the foreseeable future.

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