



Blockchain in Building Transparent Supply Chain in Fashion Industry

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Abstract

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The thesis aim was to have a deep learning about fashion supply chain. It studied closely how the traditional supply chain and fashion supply chain operates. Supply chain plays a vital role in the effective operation of a company. To achieve an effective supply chain, it is important to have a flow of information among many players in the supply chain.

The theoretical framewok was built through a review from books, journals, articles giving a concept of traditional fashion supply chain, transparent supply chain and blockchain technology application in fashion supply chain.

Qualitative research method was applied in this thesis. Case study of two companies Patagonia and Provenance were conducted to illustrate the difference between companies using blockchain and not using blockchain to build their transparent supply chain.

The findings showed that it is possible to use blockchain to build a transparent supply chain. However, it would take a longer period to apply to fashion business.

Keywords

Traditional supply chain, transparency, blockchain technology, fashion industry

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1 Introduction

This report is a bachelor's thesis for the International Business Bachelor program of Haaga – Helia University of Applied Sciences.

The purpose of this chapter is to illustrate the objectives and aims of the thesis. This chapter describes the research questions, following by work task and the benefits from the thesis. Finally, risk management and key concepts are explained as well.

1.1 Thesis objectives and publication

When the author was working in an international corporation specializing in producing and trading food products, she was a member of supply chain team. During the trainee time, when the problems occurred, the author learnt that information throughout the supply chain is crucial in solving the problem, including fulfilling customer needs and satisfaction. Not only is information required for the proper and smooth flow throughout the supply chain, but the information flow in the team and organization is also essential for the smooth running of an organization. Information throughout the supply chain involves information about the production, the status of the distribution, and the availability of products. In the dynamic world, the role of information is much more essential. However, supply chain process can lack of essential information. To explain, it could be no effective system to control or distribute the information. Therefore, the author aims to research the possibility of using technology to manage information, especially applying the innovative technology of blockchain in managing the information throughout the supply chain.

We are living in an unpredictable world, as we can see during this pandemic time. When the pandemic Covid-19 happened, companies notice that they need to maintain many aspects of their business, and supply chain management was among those. The supply chain plays an essential role in shaping the sustainability of a business. Thanks to an effective supply chain, the company can achieve its competitive advantage (Mckinsey 2013). To persist in the marketplace, SMEs must take into consideration their competitiveness. By reducing the cost or bringing better value to customers than its competitor, small medium enterprises (SMEs) can achieve competitive advantage and exceed its approach. (Porter, 1985.) Many arguments arise when a company can cooperate with other ventures, this could gain competitiveness (Matopoulos, Vlachopoulou, Manthou & Manos, 2007). Supply chain management and efficient supply chain can develop company competitiveness (Tsolakis, Keramydas, Toka, Aidonis & Iakovou, 2013). Many studies show that “organizations nowadays no longer compete as

independent entities, but as supply chains” (Christopher, 1998); (Cox, 1999); (Lambert & Cooper, 2000); (Sezen, 2008). Since the supply chain involves material flow from the company to their end-users, company that could build an efficient supply chain would be the giant in their market.

As mentioned above, an efficient supply chain is one of the keys to unlocking the secret method when a company enters the market, especially in a digital world. Sivula, Shamsuzzoha and Helo (2021) indicate that to practice an effective supply chain, a company needs to obtain the transparency of information due to the involvement of several processes within the movement of the product from the internal company to end-users. However, there is a gap between theory and practicality. Sharing information or tracking the information could be challenging due to its confidentiality or lack of cooperation. This could also mean building a transparent supply chain requires many several factors. This requires ideas, solutions, and empirical experiments to fulfill this request. This is when blockchain technology appears and could be a solution to this request (Sivula et al. 2021).

The objective of this thesis is to find out the opportunities for blockchain to build transparency in the supply chain, especially in the fashion industry. This topic is very topical recently with the increasing attention of blockchain and cryptocurrencies. This increases companies' risk-taking to apply blockchain technology into their business due to its decentralization and integrity, benefiting the financial and healthcare field. This thesis contributes to the authors' professional and learning growth. It allows her to obtain several new skills regarding academic research and specialist knowledge in supply chain management. The author aims to be a supply chain consultant in the background of the digital world that we live in. Writing this thesis helps her to understand the supply chain in the fashion business, the technology of blockchain, and its application.

1.2 Research Question

As mentioned in the above chapter, this thesis aims to research the possibility of blockchain technology to create a transparent supply chain in the fashion industry. In the fashion industry, there are some companies could achieve their transparent supply chain without applying blockchain technology. The thesis includes comparison between using blockchain method and not using blockchain method to build a transparent supply chain.

The research problem is:

How could blockchain technology help to build a transparent fashion supply chain?

The research problems are therefore express under the main research question as follow:

IQ1: How has the fashion supply chain been working recently?

IQ2: How is transparency perceived in fashion supply chain?

IQ3: What is the difference between using blockchain and not using blockchain to build a transparent supply chain?

Table 1 presents the investigative questions, theoretical framework components, research methods, and results from chapters for each investigative question.

Table 1. Overlay matrix

Investigative question	Theoretical Framework	Research Methods	Results (chapter)
IQ1: How has the fashion supply chain been working recently?	Traditional supply chain, fashion supply chain	Desktop study	Chapter 2.1
IQ2: How is transparency perceived in fashion supply chain?	Concept of transparency in supply chain	Desktop study	Chapter 2.2
IQ3: What is the difference between using blockchain and not using blockchain to build a transparent supply chain?	Concept of blockchain, blockchain, blockchain application in fashion supply chain, case study	Qualitative method	Chapter 4

1.3 Demarcation

The topic concentrates on the concept of blockchain in the supply chain and its impact on the traditional supply chain in fashion industry. More specifically, this thesis focuses on researching the theory of blockchain technology, its application in solving the transparency and traceability through study cases. This thesis also focuses on researching the potential technology of blockchain in building a transparent flow of information, from manufacture to end users. Readers from any background can understand the transparency of supply chain management and how blockchain technology is applied in solving the transparency of fashion supply chain. There is no mobile application or application nor the method of launching a successful blockchain application for fashion business discussed in this thesis topic.

1.4 Benefits

This thesis benefits anyone who is curious about blockchain and has little knowledge about blockchain. Blockchain has just become popular lately thanks to its adoption of cryptocurrencies such as Bitcoin and Ethereum. However, it is still a mystery for some on how business can minimize the operational cost by blockchain technology. The thesis provides a successful application of blockchain technology case. Readers can understand a bit more about blockchain technology thanks to the analysis of the study case.

For supply chain students, this thesis brings information about blockchain solutions and the importance of transparency in the supply chain. This thesis supports giving inspires to students who would like to dive into the blockchain field and learn about this powerful tool.

For the author, writing this thesis brings her several benefits. She gains experience on how to research academically. She gains valuable information on blockchain technology, transparency in fashion supply chain. This thesis also benefits the author in the way of potential future careers. This is an opportunity for the author to learn about innovative technology, which is one of the required skills to adapt in the information age.

1.5 Risks and Risk Management

Throughout the implementation of writing this thesis, there are some factors that prevent this thesis from its continuous writing. The biggest of these is the lack of information about blockchain technology, especially in the fashion industry. Since the application of blockchain technology in fashion has been still not well-known yet. The application of blockchain in financial or healthcare has already gotten attention, but application in

fashion industry is still in theory. The second risk is no possible study case of fashion business successful application of blockchain technology.

The two above risks are likely to appear. However, there are still several ways to manage those two risks. For accessing data, the author finds as much data as possible through the internet, articles published, books, the thesis of blockchain application in business. When finding information about blockchain through articles, the author obtains knowledge for effective keyword searches in the library system.

1.6 Key Concepts

As stated by Tang (2006), supply chain management is referred as:

- The management of material, information, and financial flows through a network of organizations (i.e., suppliers, manufacturers, logistics providers, wholesalers/ distributors, retailers) that aims to produce and deliver products or services for the consumers. It includes the coordination and collaboration of processes and activities across different functions such as marketing, sales, production, product design, procurement, logistics, finance, and information technology within the network of organizations.

The fashion supply chain consists of the apparel design, then approaches the phase of raw materials and manufacturing, transporting, and retailing the apparel (Global Fashion Agenda & The Boston Consulting Group 2017).

Blockchain could be understood that “A blockchain is a decentralized database of transactions that enterprises can share without the need for a central authority” (Cottrill & Harris 2017, 18).

One of the iconic characteristics of blockchain is distributed ledger. It is recorded:

- “Distributed ledger is a transaction database shared amongst multiple entities-individuals and institutions-across the world. Every transaction is visible to the whole network. Any update or change becomes immediately available across the network, thus bringing a great amount of transparency and transaction accuracy into the system” (Zycus 2018, 5.)

In blockchain technology, as indicated by GEP (2021),

- “Smart contract can self-verify their conditions and self-execute by releasing payment to the appropriate party. Contracts could be originated to include multiple parties across an entire supply chain with the value and terms fully integrated from end to end and with the execution of the conditions at each stage recorded against the contract and fully visible to the onward chain”

Transparent supply chain processes could be referred to as information available to companies involved in a supply network. This could be related to the raw material origin and provide context to a final product or service (Francisco & Swanson, 2018).

Transparency in the supply chain process can be gained by fast data distribution between different organizations and within different company departments (Sivula et al. 2021).

1.7 Case company

In this thesis, two case studies are introduced: Patagonia and Provenance. Patagonia was founded by people whose passion for surfing and climbing in 1973. In 2006, Patagonia reached 270 million dollars in revenue, one of the greatest players in the green fashion field. Patagonia has been proud of its mission statement: “Build the best product, cause no unnecessary harm, use business to inspire and implement solutions to the environmental crisis” (Patagonia, 2021). When the consumers buy Patagonia’s products, not only do they know about the material of the products but the environmental impact of the products themselves. Being brand transparency gives Patagonia one of its strongest strengths (Deleon, 2018).

Provenance was founded in 2013 in London. The company is proud of being a pioneer in providing blockchain solutions for the production business. The company supports the business in building a transparent supply chain based on supply chain mapping, product traceability. The company provides businesses a solution that combines blockchain, mobile and social media so that company can provide their consumers about the journey of purchased products with verifiable information. There are 200 retailers and manufacturers registration for their platform ranging from food, beverages, and fashion market. CEO of Provenance – Jessie Baker, indicated “We take it for granted that when we buy a product at any point in the supply chain that we’re putting a lot of trust in a brand”, she also mentioned “We try to educate companies about blockchain, but the reason they are coming to us is that they want to be trusted by their customers.” (Brien, 2018.) The company has a decision to suggest the partner shift their focus on trust with their consumers. Thanks to the blockchain solution Provenance provided, the company

can become more transparent so that they can obtain a detailed list of partners and producers in their supply chain (Brien, 2018).

2 Theoretical Framework

In this chapter, the theoretical framework of the thesis is discussed. The framework forms a base on which the research will be built.

The framework (Figure 1) includes traditional supply chain, blockchain technology, fashion supply chain and transparency. Theories for these three categories are presented in detailed ways. Three of this form the theory base for this thesis to reach the conclusion and to answer the research question.

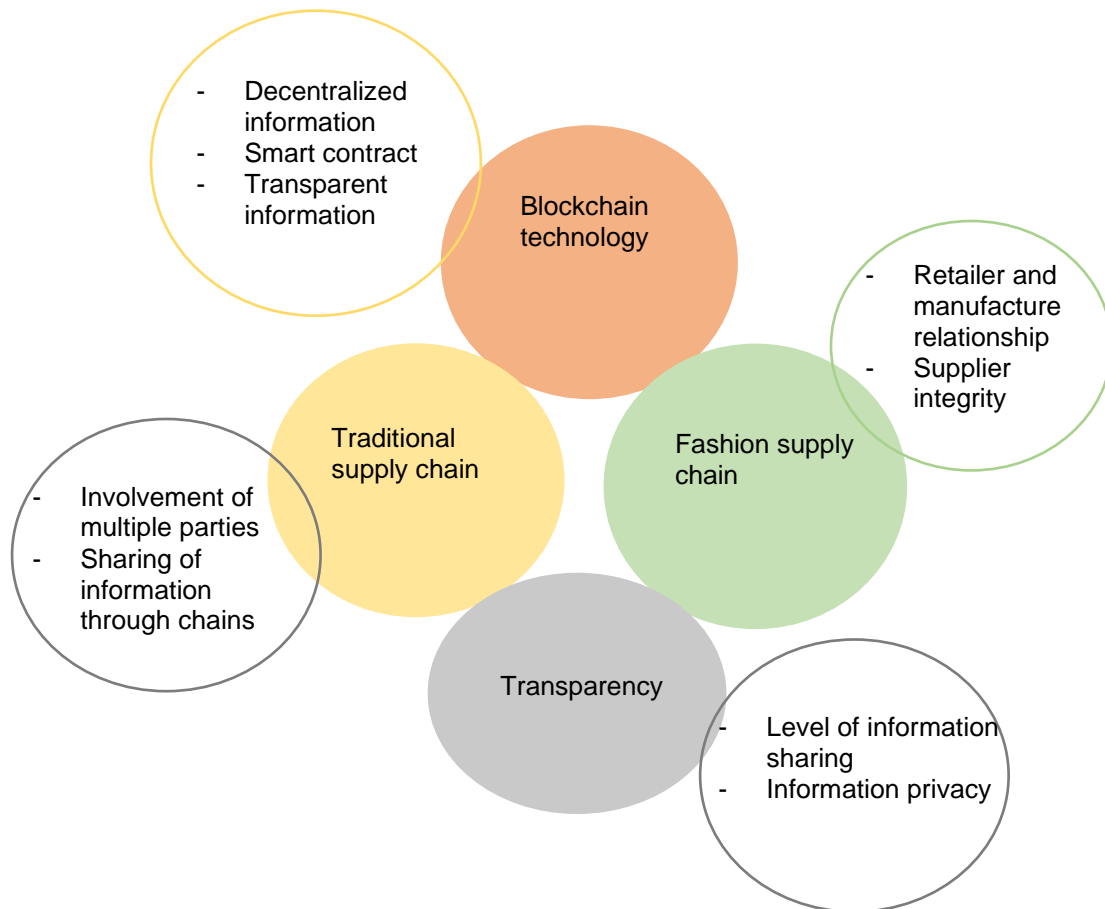


Figure 1. Theoretical framework

2.1 Traditional supply chain

In this chapter, the author answers IQ1 about how the traditional fashion supply chain works. Concept of traditional supply chain management and fashion supply chain management are discussed here.

2.1.1 An overview of traditional supply chain management

There are many definitions for supply chain management or 'SCM' from many sources. Some of them are as below,

- "The planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers' intermediaries, third-party service providers, and customers" (CSCMP, 2021.)

- "The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances, and information from the original producer to the final customer with the benefits of adding value, maximizing, profitability through efficiencies, and achieving customer satisfaction" (Stock & Boyer, 2009.)

As indicated by Cooper, Lampert and Pagh (1997), supply chain is "The integration of business processes from end-user through original suppliers that provides products, services, and information that add value for customers".

The term supply chain origin varied based on various sources. The process starts from an act of procurement of materials, intermediate and finished products then are transformed by those materials and an act of transportation of finished products to customers (Ganesh & Harrison, 1995). The supply chain involves the contribution of manufacturers, suppliers, transporters, warehouses, retailers, and customers. A customer request is performed by these parties collaborating with each other directly or indirectly (Chopra & Meindl, 2003). Supply chain members share the primary goal of meeting the needs of their customers. They cooperate in value-adding processes that affect the proper operation of the supply chain (Noémi, 2012). Each member has a common interest in being part of a successful supply chain as it benefits each individual member (Molnár, Gellynck & Weaver, 2010; Noémi, 2012). Therefore, in today's competitive market, different members of the chain pay attention to the well-performance of the supply chain they involve in.

Five major factors relating to each other in the supply chain are illustrated (Figure 2).

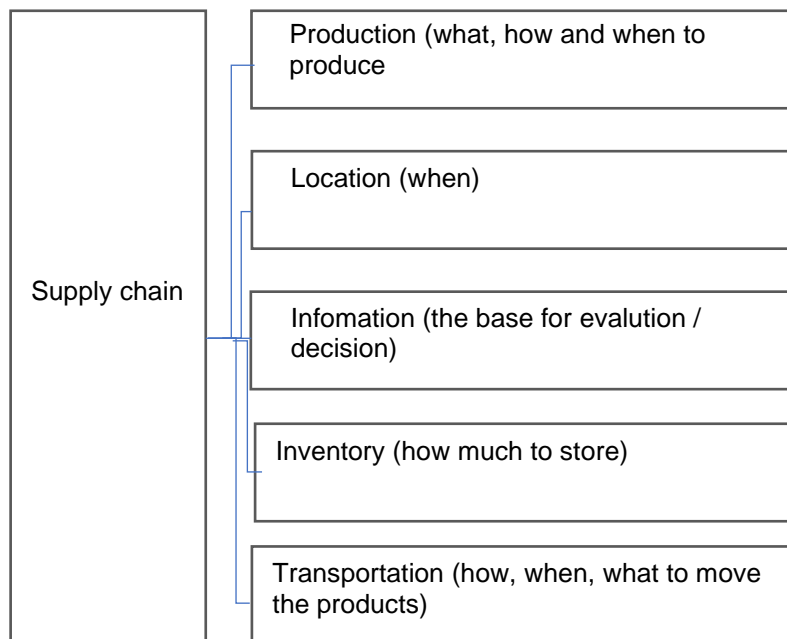


Figure 2. Five major factors in the supply chain (adapted from Ivascu, Larisa, Mocan, Draghici, Turi & Rus, 2015.)

It is shown that throughout the supply chain, information is needed to obtain to achieve the final goal (Figure 2). The information about the production, the production location, information for the production, stock management, method of transportation of produced goods. This several information is obtained to fulfill customer needs.

2.1.2 Concept of traditional fashion supply chain

In 1838, the term 'procurement logistics' was first introduced as supply chain management. In 1905, 'procurement logistics' appeared once more in the US. The Independent newspaper mentioned the wartime period. In wartime supply chain management, the effective production and distribution of goods was no doubt vital. At the beginning of the war, uniforms were custom-made. However, with the increase in demand, several factories were built to produce uniforms rapidly and efficiently for the military. In the Industrial Revolution, with the Ford assembly line, mass production cut costs. With the invention of the sewing machine in 1850, the garment was produced faster, more durable, and more decorative. In 1955, standard shipping containers that could transport several containers affected how the global supply chain worked, more realistic and cost savings. This vast step involved how the fashion product was produced and transported. The fashion industry has gone through several changes from the beginning.

- "Fashion supply chains have been irrevocably changed by the rise of the fast-fashion business model, which harnessed free-trade and technology

developments to revolutionize the supply of fashion products to meet rising consumer demand. The consumer has received the fast-fashion concept so well that it is considered ubiquitous within the fashion industry. Its precise shape and form can, of course, differ from business to business: Zara champions a vertical business model that focuses on in-house control, whereas the Primark model focuses on entry price points on the high street" (Clark, 2015.)

The fashion industry is particular and includes production and sourcing. Sourcing is commonly defined as "the process of finding suppliers of goods or services" (WebFinance, 2016). Production is explained as:

- " The processes and methods used to transform tangible inputs (raw materials, semi-finished goods, subassemblies) and intangible inputs (ideas, information, knowledge) into goods or services. Resources are used in this process to create an output that is suitable for use or has exchange value"

(WebFinance, 2016.)

Londrigan & Jenkins (2018, 33-34) indicates that the worldwide fashion supply chain is built up from the cooperation of vendors whose tasks include sourcing, production, logistics, and distribution of raw and finished goods. How to maximize the revenue is essential in the fashion industry; manufacturers have been shifted to low labor cost locations. Because of the increase of customers' needs, a flexible and short lead-time supply chain transports the suitable product to the right customer in need at the proper time. The more increasing need from the customer, the more customers are looking for socially responsible, safe working conditions, environmentally friendly products. One of the risks fashion supply chains are facing now is fashion products have been produced worldwide, especially in developing countries such as Vietnam, Bangladesh, Laos. This results in brands should take action to minimize excess throughout the supplier network, build up and maintain effective communication throughout the supply chain.

A particular fashion organization includes many different departments (Figure 3).

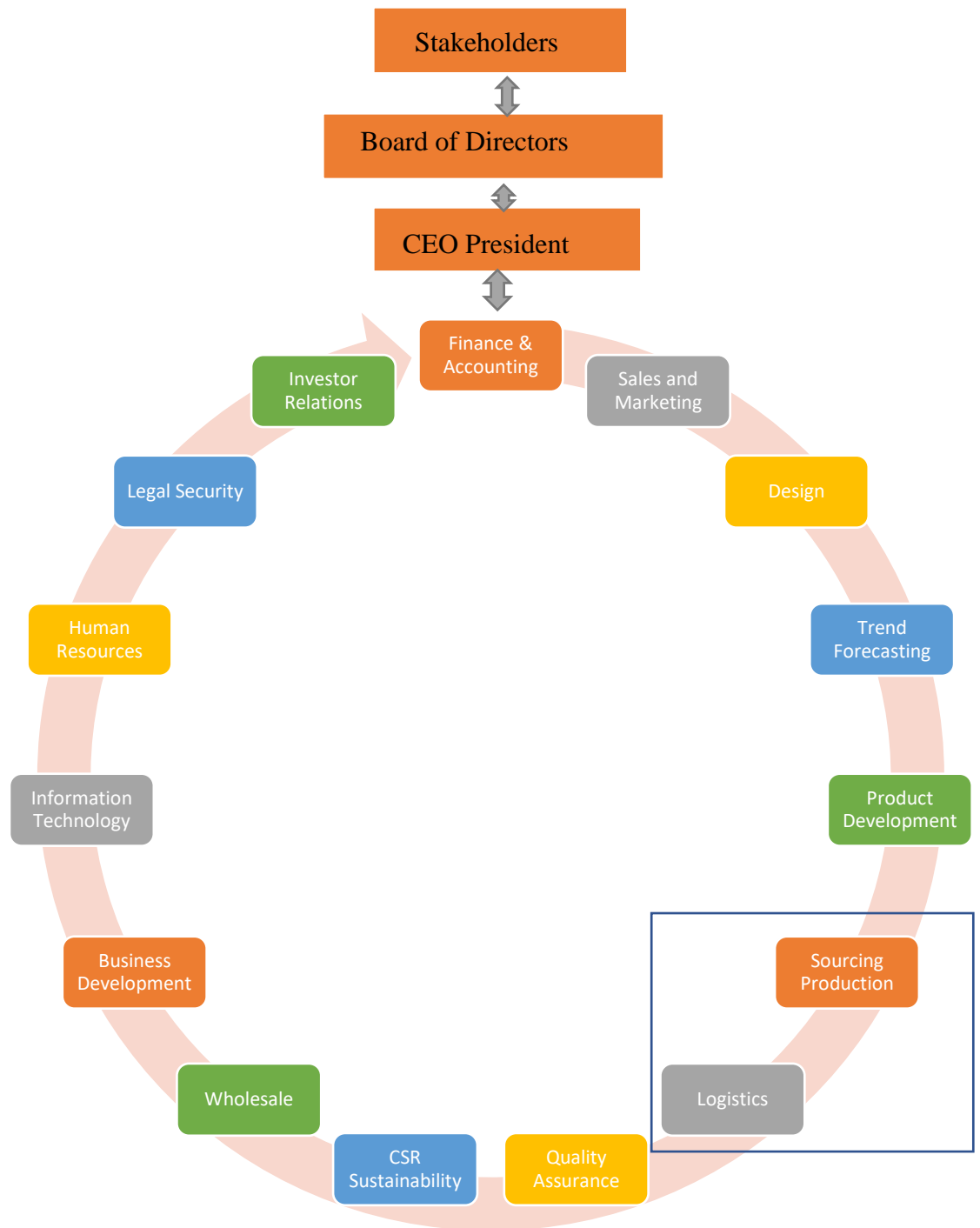


Figure 3. Different departments in a fashion organization (adapted from Londrigan & Jenkins, 2018, p. 63.)

The thesis focuses on supply chain, only sourcing production, and logistics part (Figure 3). When the customer places the order, there is a request for the sourcing and production department to decide which factory will be responsible for producing the products. Once the exact factory has been assigned, logistics departments are responsible for movement arrangement, including choosing the suitable shipping methods based on the order size of

the products and the schedule of the factory producing the products at the right time to fulfill the customer request. Communication plays a vital role since clear communication from sourcing and production is needed for the logistics department to compare the best shipping method to minimize the transportation cost. (Londrigan & Jenkins, 2018, p. 69.)

Throughout the fashion supply chain, the main purpose is to satisfy customer need and requirement of right trend, with increase on environmentally friendly products. This puts the fashion company on how to produce both the product economically and decreases their impact on the environment. To do so, fashion's retailers need to take consideration in textile supply chain flow (Figure 4).

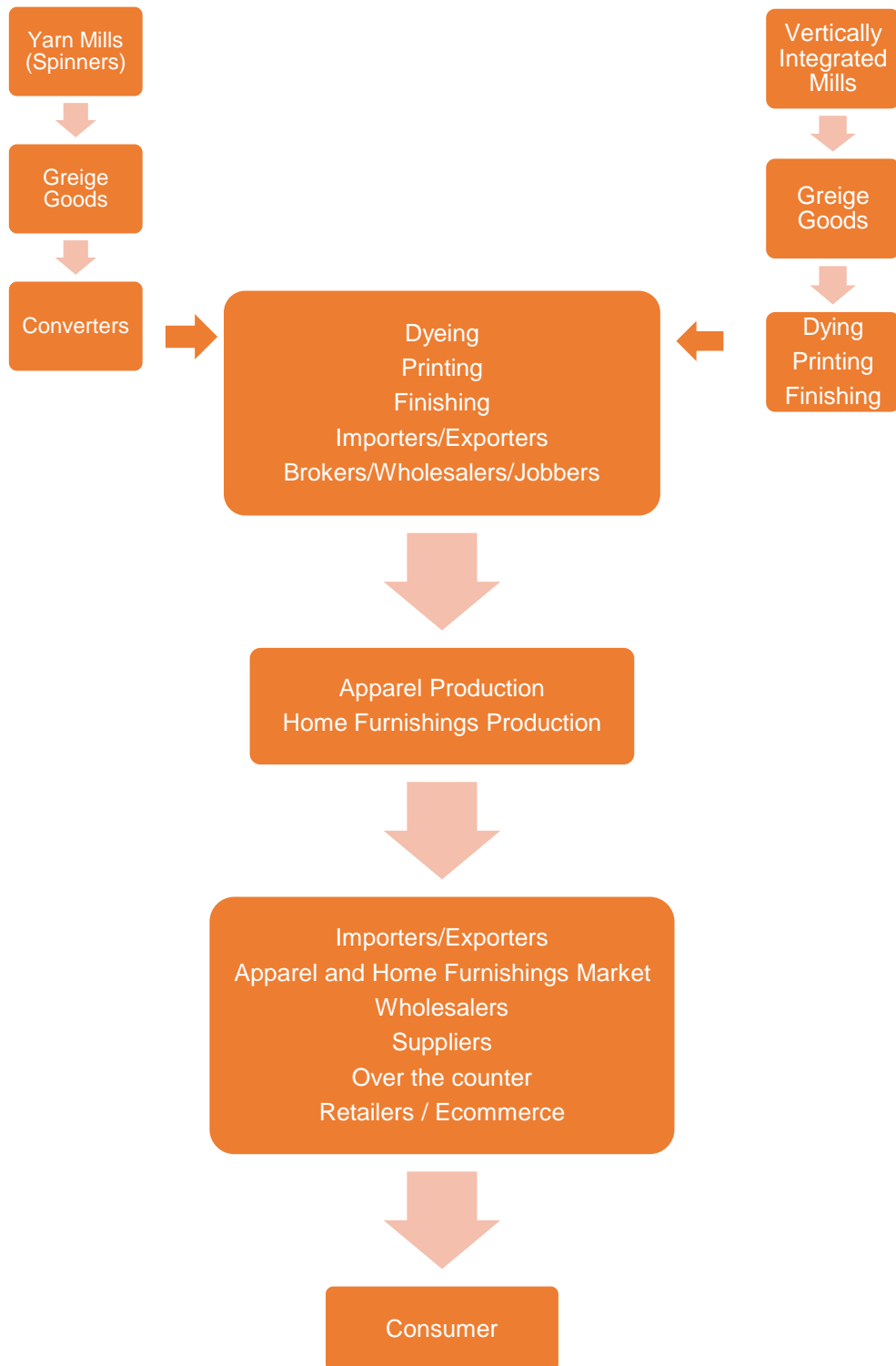


Figure 4. Textile movement throughout supply chain (adapted from Londrigan & Jenkins, 2018, p. 86.)

Target customers' satisfaction is the main factor in choosing required raw materials (Figure 4). Due to the global fashion supply chain, the fashion is now produced in different factories in different countries, this led to the term "country of origin". When purchasing a fashion product, consumers hardly know the exact location of produced one. This situation

puts the retailers in the view of transparency and chooses which information to provide the consumers. There is a regulation from the US government stating that retailers are required to provide the origin of produced fashion products before selling the products to the customers. However, it could be suggested that only a small list of the country of origin of components is provided.

Fernie and Grant (2019) illustrate the common supply chain of a fashion retailer which obtaining foreign factors, as shown in figure 5.

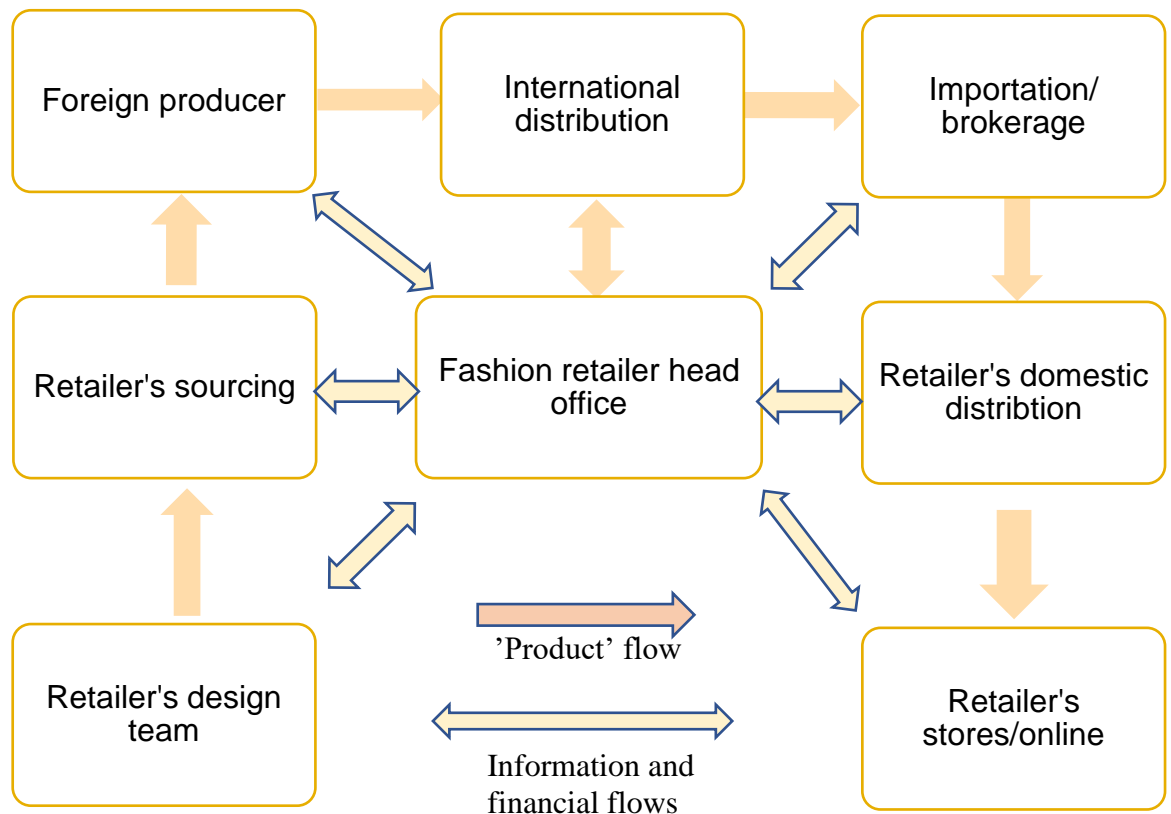


Figure 5. A specific fashion supply chain (adapted from Fernie & Grant, 2019.)

As illustrated in figure 5, retailers choose to outsource and have fashion products produced in foreign markets. Goods are produced partly in a foreign market, but retailers run marketing campaigns and sell those in the domestic market. A common fashion supply chain of a fashion retailer starts from designing a concept for fashion products and specific requirements for products. Then retailers could decide which raw materials and whom to produce the goods. In step three, it involves foreign factories producing the goods in their market. After being produced in a foreign market, products are transported to the domestic market, which requires import activities. When receiving the products in the warehouse, retailers choose distribution channels, either in-stores or online stores.

This is the flow of physical products, while information is needed to be communicated and shared in each step (Figure 5). To be said, information is essential for effective physical product flow; the more information is available and correct, the easier it is for each step to be managed and finished.

Fashion products have many key characteristics which a retailer should take into consideration:

- Trends introduced to consumers must be unique and season-based
- Mass production to minimize the costs, margins would not be sold high
- A variety of colors and sizes customized on customer trends, varied during seasons
- Although produced in a shorter period, fashion products are produced in a complex process
- Produced dependent on timeline and price and economic factors

(Balakrishnan, 2019.)

Balakrishnan (2019) classifies three kinds of fashion brands based on supply chain requirements: target market, consumer need, and internal operational process (Figure 6).

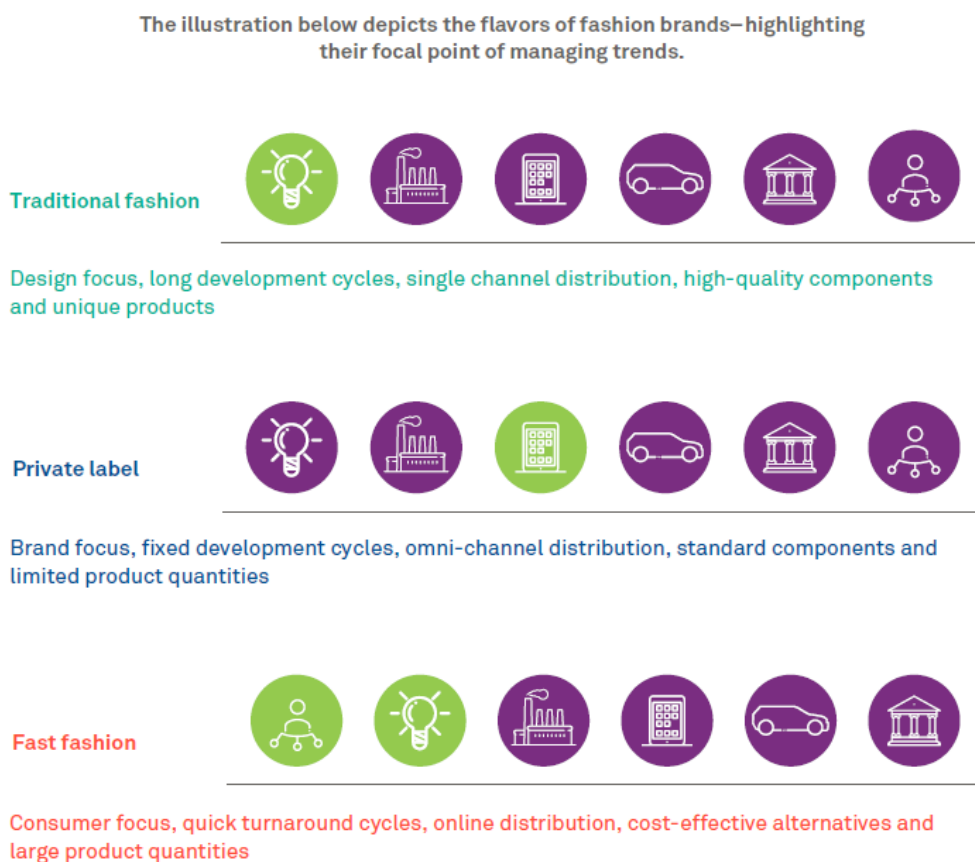


Figure 6. Three different types of fashion brands (Balakrishnan, 2019.)

Traditional fashion retailers rotate around a fashion designer who tries several methods to design new trend for a different season. One of the methods could be occupied from successfully purchased from the previous season. Since an exact factory produces the product, it increases the price and production lead time. Private label retailers choose to outsource the design provided to their loyal consumers with the benefit of lower cost. The last retailers type named fast fashion. Their competitive advantages are to provide customers match fashion products with the latest trends one aired on fashion week. These fashion products are at a reasonable price and quickly released to the market since they are produced in retailers' networks of factories. (Balakrishnan, 2019.)

2.2 Transparency in supply chain

In this chapter, the author discusses concept of transparency of information throughout fashion supply chain. This chapter answers IQ2.

2.2.1 Concept of transparency in fashion supply chain

There is an increasing need from the consumers to acquire the origins and how the purchased products are produced. This results in customer satisfaction if the company can achieve a visible look in their supply chain. Otherwise, punishment from the customers could occur. A transparent supply chain does not mean a business choose which information needs to be published to its consumers, but the business must first clarify its inner supply chains (Kraft & Zheng, 2021).

There are two essential terms in supply chain strategies for an effective and sustainable supply chain which are 'transparency' and 'traceability.' In logistics and supply chain, it is sometimes misused these two terms because these two terms are separate from each other. The UN Global Compact (2014) indicates 'traceability' as:

- "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"

It relates to the ability to show the origin and all activities related to the products throughout the supply chain. This could be done by the act of implementation from the beginning to the end tracking, thanks to the support of some instruments. One of them are stated as, "records and follows the trail as products, parts, and materials come from

suppliers and are processed and ultimately distributed as end products" (United Nations Economic Commission for Europe, 2013).

Egels-Zandén and Sörum (2015, p.5-6) perceive transparency in the supply chain as the ability to track the flow of a product's production process from end to end. There is also another concept of transparency in the supply chain that is related to the level of sustainability of suppliers (Cramer, 2008). Fair Labor Association advises companies need to publish their supplier's information and exact location and offer this available information to end-users and parties involved. Transparency is illustrated in a general and preferable way as:

- "Transparency of a supply chain is the degree of shared understanding of and access to product-related information as requested by a supply chain's stakeholders without loss, noise, delay, or distortion"
(Hofstede, Spaans, Schepers, Trienekens & Beulens, 2004).

Traceability provides a glance of which components of a purchased product are in the progress of the supply chain, while transparency can show a full picture of the whole supply chain network (SGS, 2018).

There are several definitions for transparency in the fashion supply chain. Some of those are listed below:

- "Transparency is when companies know and share publicly #WhoMadeMyClothes—from who stitched them right through to who dyed the fabric and who farmed the cotton—under what conditions, and with what environmental impacts"
(Somers, 2021).
- "Transparency is the public disclosure of information that enables people to hold decision-makers to account. For the fashion industry, it means sharing information about supply chains, business practices, and the impacts of these practices on workers, communities, and the environment. Transparency is crucial for connecting the dots of the problems in the fashion industry and understanding how to fix them. Transparency is vital for holding major brands accountable for their human rights and environmental impacts across their supply chains"
(Fashion Revolution, 2021.)

- "Transparency is an integral aspect of any progressive commercial relationship between a provider and its customers. Transparency is the means of facilitating knowledge, assessment, and opinion on what is happening within an organization and/or service"
(IATA, 2008.)

From a supply chain point of view, transparency happens when the product's information is available and clear from the production phase to the distribution phase to end customers. Customers can know the origin of the purchased products. To fulfil this need from customers, retailers expect to obtain clear and full of information from their retailers, manufacturers, foreign partners within their supply chain organization. When the information is correct and accessible to every party, transparency could be achieved. Transparency is not a goal; it is rather a process of information sharing.

2.2.2 Evaluate transparency level in supply chain

Transparency in the fashion supply chain must be trustworthy, identifiable, traceable, and auditable. This would help the consumer achieve better understanding of retailers' products and their practices. (Chapman, 1995, p.139-142.) Fashion supply chain retailers choose to build their supply chain based on customers' value; this is pushing the retailers to provide their end consumers consistent, customized, and transparent information about their fashion products. If the fashion retailers meet this requirement from consumers, they can understand the consumers and better analyse customer's behaviours for their fashion trend analysis. These put the retailers, parties involved in the supply chain, and consumers all in beneficial positions of the value chain.

The characteristics of fashion products which was mentioned in the previous chapter are produced partly in a foreign market. This leads to the risk for the retailers that their manufactures could do something that harms their brand image. Several scandals in the fashion industry where retailers' suppliers and their manufacturers abused labour workers and did harm to the environment. Collaboration and information sharing are the vital factors that help retailers achieve transparency in their supply chain. In this situation, applying technology is a great choice for a well-function system and to support the system to work effectively and efficiently. Each party involved get up-to-date information with a level of trust and reliable information.

2.3 Blockchain technology in supply chain

2.3.1 Concept of blockchain

There are many definitions of Blockchain from many sources; Welfare (2019) introduces a simple definition as “Trusted and efficient way of sharing data and transactions”.

A detailed definition is as below:

- “Blockchain technology can be viewed as a distributed ledger of information, which maintains a continuously growing list of records, called blocks, secured from tampering and changes. Each block contains a timestamp and a link to a previous block. This means that blockchains are inherently resistant to modification of the data – once recorded, the data in a block cannot be altered retroactively”
(Welfare, 2019.)

A multilayer definition of blockchain-related to technical, business and legal practice is:

- “Technically, the blockchain is a back-end database that maintains a distributed ledger that can be inspected openly. Business-wise, the blockchain is an exchange network for moving transactions, value, assets between peers without the assistance of intermediaries. Legally speaking, the blockchain validates transactions, replacing previously trusted entities”
(Mougayar & Buterin, 2016.)

It is illustrated a model of blockchain which enlarges when adding new blocks (Figure 7).

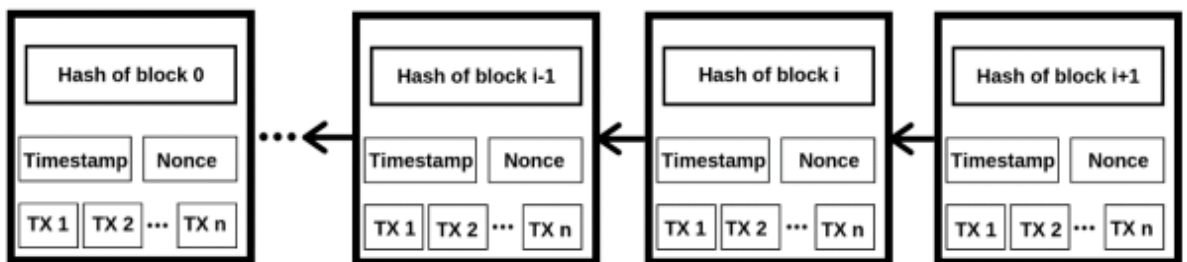


Figure 7. Model of blockchain (Zheng, Xie, Dai, Chen, & Wang, 2018)

Each block has an amount of data and is linked together (Figure 6). Data is contained in several transactions which are contained in each block. The previous block links to the next block throughout the chain based on a mathematical algorithm, Bonneau, Miller, Clark, Narayanan, Kroll & Felten (2015) called “validate the data associated with that block”. After verifying the network's validity and via a distributed and decentralized ledger,

the transactions is added to a blockchain network. The users can “send, receive, and record value or information” (Kakavand, Kost De Sevres, & Chilton, 2017). The blockchain is a chain where the latest data block is hooked to the very current block (Franco, 2014, p.15). Wright & Primavera (2015, p.8-9) introduce the term ‘peer-to-peer economy,’ in which each party involved in the blockchain makes an agreement on ‘state of affairs’ and records a secure and transparent ‘that agreement.’

Blockchain is the value of the internet world, where the user ‘own your data,’ which means a user manages their data, and value is created, transferred, and transacted. The main key in blockchain technology is its transparency due to its shared data and trusted data (Welfare, 2019). One of the main characters of the blockchain database is that the new transaction is included while the data added at the first time cannot be changed. This results in the trustworthiness of added data (Drescher, 2017). Furthermore, based on the concept of running the blockchain, the transaction is confirmed, validated, and linked to each other, allowing members to openly get access to the network and retrieve relevant information for them.

2.3.2 Blockchain application in transparency in fashion supply chain

Since it involves several parties’ cooperation to achieve the final goal throughout the supply chain, one of the factors for improving transparency is how to distribute the data fast and effectively. With blockchain technology, retailers and consumers achieve traceability of goods due to tracking recorded transactions of items. Blockchain also provides security of information due to the immutable technology behind blockchain. Users can have visibility of real-time tracking, which then builds trust based on recorded transactions (Sivula et al., 2021).

Unlike traditional supply chains, each party in a blockchain-based supply chain cooperates, and information flow is more illustrated (Figure 8).

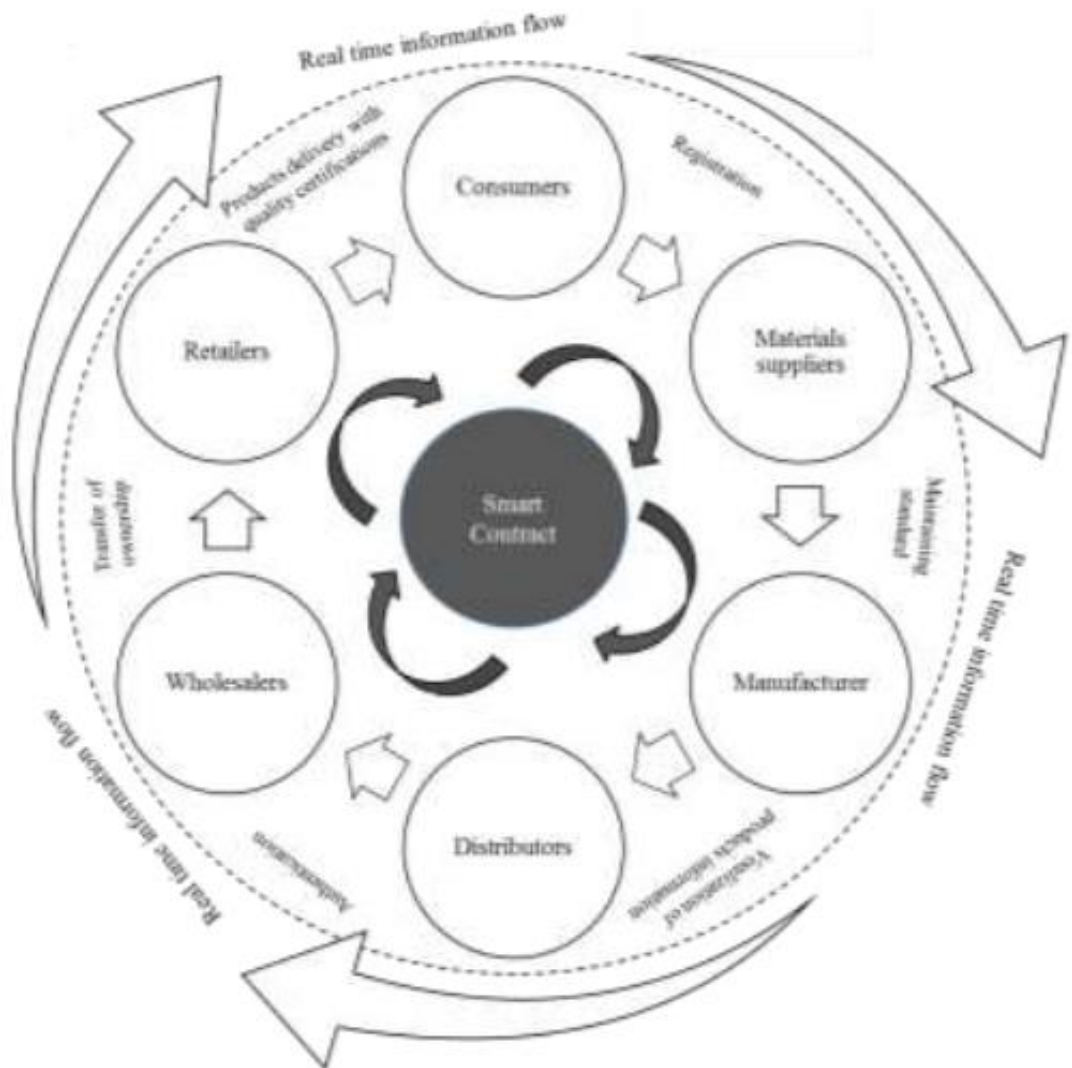


Figure 8. Supply chain based on blockchain technology (Saber, Kouhizadeh, Sarkis, & Shen, 2019)

As illustrated in Figure 8, the blockchain-based supply chain involves registration, maintaining the standard, visualization of product information, authentication, transfer of ownership, and product delivery with quality certification. Each party in the supply chain has an identified registration, and they still maintain the standard of supplied products based on blockchain policies and technical requirements. In this supply chain, retailers, manufacturers, and consumers separately have their possession of products. Since each party has already agreed to standard organizations, the end product with digital identification is provided to end consumers with quality certifications (Sivula et al., 2021; Steiner & Baker, 2015). A physical product obtains a digital key that helps identify the physical identity to virtual identity in the blockchain (Abeyratne & Monfared, 2016). In the

middle of each party in the blockchain, there is an involvement of a smart contract. Smart contracts manage the transfer and selling of products among actors in the supply chain based on a digital sign. When signing the smart contract, agreements are all managed by the network of data, and actors in the supply chain can access this data sharing in the system.

Customers tend to track information background of fashion products they purchased, such as the origins of materials, where those are made of, which countries those were made of, the activities of suppliers or manufactures that produce the fashion products. The more environmentally friendly customers need, the more essential it is for information to be transparent. To be clarified, transparent information throughout the fashion supply chain can give customers insight from the beginning to the end chain of the supply chain. Customers would prefer to pay retailers to check the level of environmentally friendly products. Fashion retailers could order requirements from the manufacturer. The manufacturer follows the full information transparently through a blockchain system to produce products. (Sivula et al. 2021.)

2.3.3 Blockchain and transparency

In the fashion industry, the production occurs in several different locations, which means to finish a product, components are from many places worldwide. Many fashions company has faced a situation where the components of the final products are not sustainable or environmentally friendly produced; this could lead to dissatisfaction for customers' trust and loyalty. Thanks to blockchain, components part of the product come visibly. Customer trust and customer loyalty could be built up from the possibility to understand the origin of components, which means they can reveal raw materials, from where the raw materials were produced to how the final products are brought to their destination. (Welfare, 2019.)

With blockchain technology, a public Blockchain, anyone can get access, and in private or hybrid blockchain, anyone who gets authorization to access can view the data, including the kept data and data usage purpose. The key behind this is the principle of open and shared data. The data is collected purposely based on the agreement and benefit of the parties involved. With blockchain, suppliers and retailers communicate openly and information is transparent between two parties. The data given or shared is trustworthy, safe, and secure. Retailers choose the exact, detailed, and dependable information to make analysis. With the openness and trustworthiness of the first source data, the company can save time investigating the source of the data and take advantage of the time to communicate and negotiate with suppliers. (Welfare, 2019.)

Blockchain is a powerful tool to influence positively at an immense scale. The entire network could get profit from participation in the blockchain by creating value networking. One of the capabilities of decentralized networks is also their transparency. Multiple parties can track and retrieve each transaction on a blockchain. When there is a sign of data to be edited, the entire network will be alerted. This means parties can see who can change them and how. This results in building a reputation for blockchain, a transparent system and referred to as ‘the trust machine’ (Baker, 2021).

Blockchain is a digital ledger where blocks of information are stored; these blocks connect (Guo, Sun, & Lam, 2020) thanks to the traceability characteristics of blockchain-based systems. The fashion industry can benefit from blockchain technology thanks to the ability to increase transparency levers in the supply chain (Figure 9).

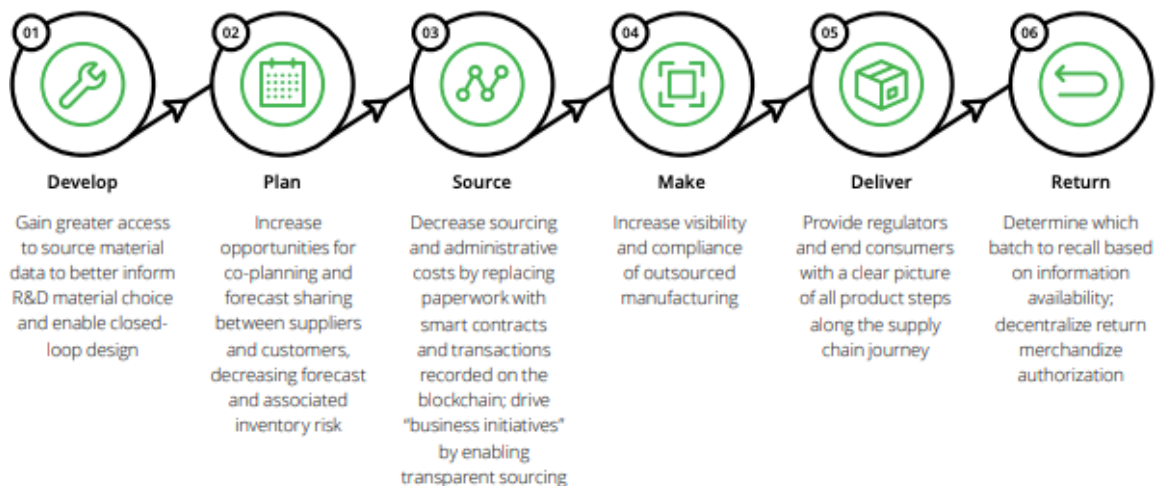


Figure 9. Transparency levers in the supply chain (Deloitte, 2017)

Retailers can trace their raw materials in the supply chain based on sourcing standards based on blockchain technology. Fashion retailers can also provide this information when required, thanks to blockchain technology. Since all the transactions in the supply chain are recorded and monitored through the blockchain network, this can avoid the risk of fake sourcing. Thanks to smart contracts, retailers can have a sharp vision of what is going on in their manufacturers. Every transaction is available on the network, which lowers paperwork and the cost of administration. Retailers can achieve their competitive advantage by providing a transparent supply chain to their end consumers. (Deloitte, 2017.)

3 Research Methods

In this chapter, this thesis presents the research methods. It is better to follow and work on the idea to have a visual research design. The author collects data from book materials, journal articles for theory parts. Since blockchain is a new topic, it could happen that some application of blockchain has not been public, then the use of articles on the internet is an approach for the theory part. It aims that after each theory part for an investigation question, the investigation is answered by the theory conducted.

This information is required to be obtained:

- Core concept of Blockchain technology
- Concept of traditional supply chain
- Concept of fashion supply chain
- Concept of transparency
- The application of blockchain technology in transparent information in the supply chain

However, if the thesis only focuses on the theory part, the view is theoretical and there is no practical information. The aim of the thesis also provides the reader with valuable knowledge about the potential of blockchain technology applications. A researcher could choose many types of qualitative research to conduct their analysis. In this case, the author chooses the case study method to analyze the blockchain application in the fashion supply chain. Creswell (2014) indicates case studies are the method that can provide a thorough analysis of a case. Study cases are Patagonia and Provenance. Patagonia is famous for its long history of developing a transparent supply chain in the apparel industry. However, they are not renowned for applying blockchain in their transparent supply chain. The thesis researcher analyzes the method behind their successful, transparent supply chain. While Provenance is the pioneer in start-up building solutions to solve unsustainable supply chain problems by adopting blockchain technology (Provenance, 2021). By carrying out a study case of successful blockchain application of fashion companies, the author shows a clear insight of how blockchain technology could influence supply chain in the fashion industry. Case studies present two different methods two case companies' approaches in building the transparent supply chain. The data collection for two case studies are conducted through online publication, articles, journals and websites.

The research consists of three phases: data source, data collection method, task outcome (Figure 10). Throughout these three phases, the thesis analyzes the work and the result in the research outcome. These four phases aim to answer the investigation questions and

Task	IQ1: How is the fashion supply chain work recently?	IQ2: How transparency is perceived in fashion supply chain?	IQ3: What is the difference between using blockchain and not using blockchain to build a transparent supply chain?
Data sources	<ul style="list-style-type: none"> - Textbooks - Lectures - Articles - Journals 	<ul style="list-style-type: none"> - Outcome from IQ1 - Textbooks and articles 	<ul style="list-style-type: none"> - Articles - Journals - Websites
Method	<ul style="list-style-type: none"> - Desktop studies 	<ul style="list-style-type: none"> - Desktop studies 	<ul style="list-style-type: none"> - Qualitative research
Task outcome	<ul style="list-style-type: none"> - Concept traditional supply chain - Concept fashion supply chain 	Concept of transparency in fashion supply chain	Comparison between two case company
Research problem	Possibility of adopting blockchain technology in building a transparent fashion supply chain		

Figure 10. Management method

4 Results from the qualitative study

As mentioned in chapter 1, two study case are introduced as following. This chapter examines how two different study case introduced as Patagonia, one of the main players in improving supply chain transparency and the other one is Provenance, a British start-up company which specialization in using blockchain technology in building a transparent supply chain for its clients.

4.1 Patagonia

Sustainability and environmental performance are the core concept of the operations of Patagonia until these days. These two factors outperform their customers' loyalty and brand awareness (Pongratic, 2007). The success of Patagonia is also thanks to its efficient and transparent supply chain. Patagonia has obtained a complex supply chain with enormous information from its suppliers and supply chain partners. In 2015, Patagonia had cooperated with 45 suppliers from Vietnam, Thailand, China, Sri Lanka, India, and Bangladesh and factories. In 2005, Patagonia's operation was heavily paperwork, Excel spreadsheet, and processed rely on manual work. This results in an ineffective way of data management between Patagonia and its 108 suppliers. This led to Patagonia's taking action to solve their inefficient supply chain. One of their movements was to improve their supply chain operation by moving to the cloud platform named GT Nexus. This movement assisted in how documents became visible to Patagonia's supplier. From the same year, GT Nexus had been a unique platform for Patagonia and its suppliers. Patagonia and its partner's collaboration have been transformed based on this cloud which built a transparent supply chain. (GT Nexus, 2015.)

Factories and suppliers could easily go to the cloud to access to the data needed to proceed the order without any delay (Figure 11). This could give visible and smooth flow of information throughout the supply chain. (GT Nexus, 2015).

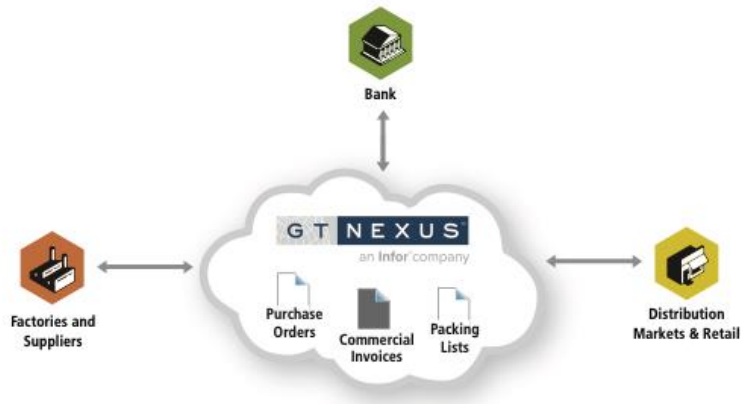


Figure 11. Transactions of Patagonia in the cloud (GT Nexus, 2015)

Patagonia has also applied several campaigns to develop its transparent supply chain. One of them is an Online Tracking system, which provides visibility and trackability of cotton products throughout the supply chain. This validates retailers' trust in believing that the garments obtain organic standards. However, this system has several shortcomings. The service costs non-member 600\$ yearly, which is a factor that makes supply chain actor unwilling to pay more cost. This leadd to a shortage of participation of parties involved, leading to a lack of data collection for Patagonia to trace their supply chain. Since each member has ownership to record their data in the system, which cannot be verified, fraud and cheating can easily appear. (Pongtratic, 2007.) One of the other transparent campaigns named “The Footprint Chronicles” provides Patagonia products information about their factories, farms, and environmental impacts of products (Polley, 2021). Patagonia published their list of factories, farms, and mills available through their website (Figure 12).

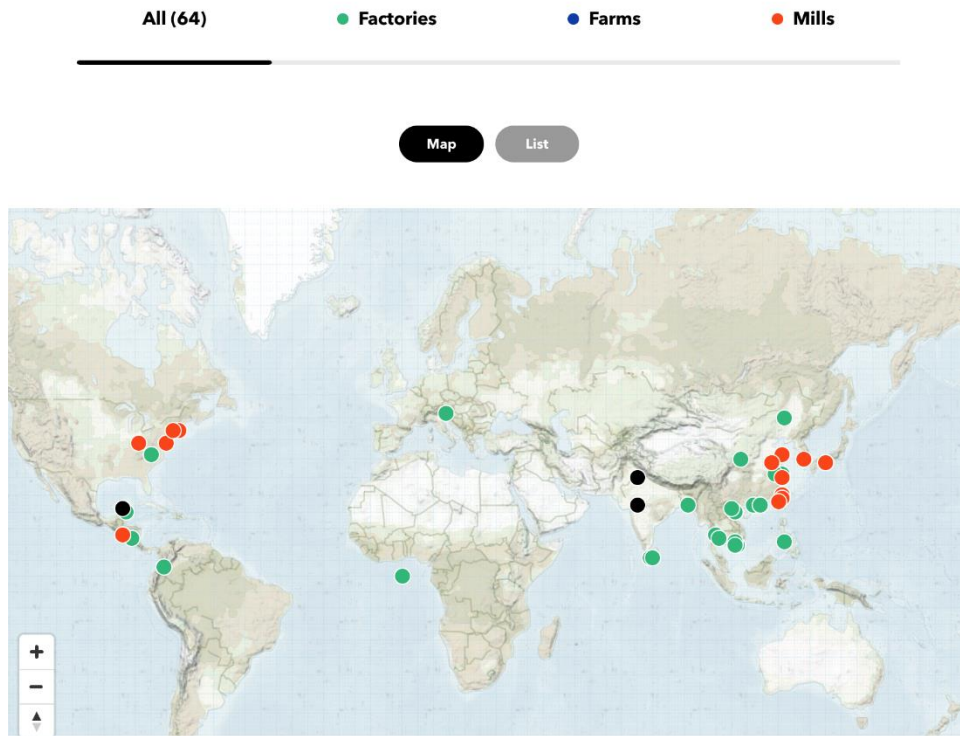


Figure 12. List of factories, farms and mills published by Patagonia (Patagonia, 2021)

Most of Patagonia factories are mainly location in Asia especially Southeast Asia area. This provides consumer the name and contact information of Patagonia’s partners. Patagonia also provides consumer detailed information about the lifeline of their desire products (Figure 13, Figure 14 & Figure 15).



Figure 13. A product named “women’s jackets & vest”

How it's made Where it's made



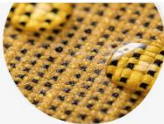

How it's made	Where it's made
 <p>Fair Trade Our first step on the path toward ensuring living wages in our supply chain. Program</p> <p>Learn More</p>	 <p>Recycled Nylon We use recycled nylon made from postindustrial waste fiber and discards from weaving mills and postconsumer... Material</p> <p>Learn More</p>
 <p>Nonfluorinated DWR We're striving to convert to a less-toxic nonfluorinated DWR finish as soon as possible. Material</p> <p>Learn More</p>	 <p>Global Traceable Down Standard All our virgin down is certified to help ensure the birds that supply it are not force-fed or live-plucked. Program</p> <p>Learn More</p>

Figure 14. Information about components of the Patagonia's product (Patagonia, 2021)

How it's made

Where it's made

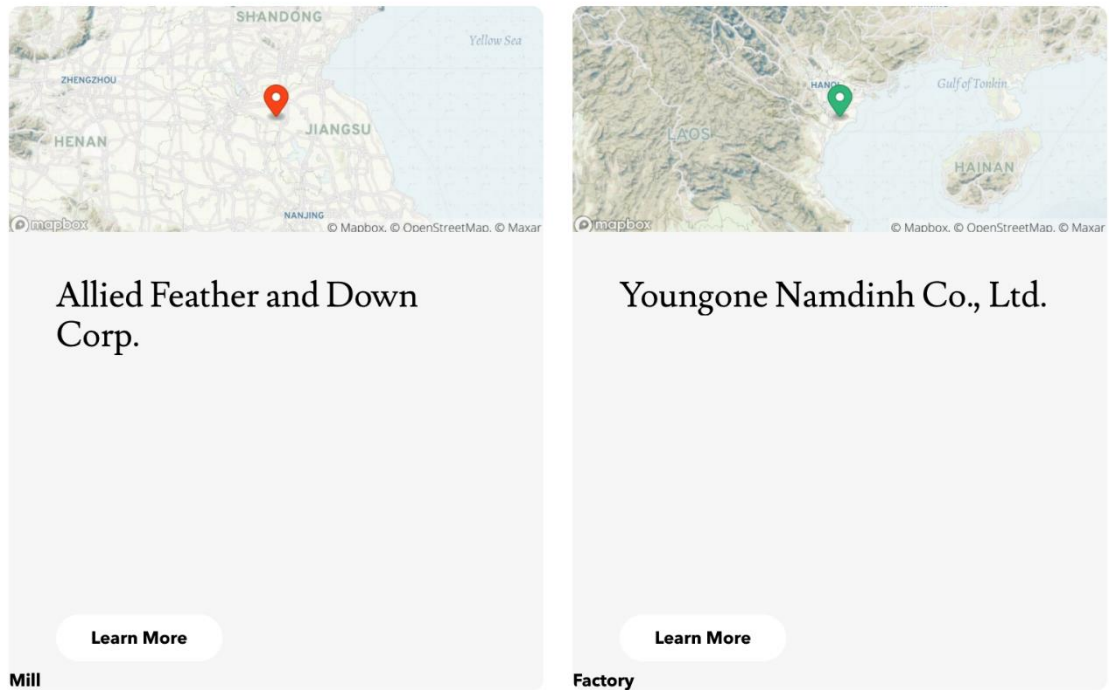


Figure 15. The origin of the Patagonia's product (Patagonia, 2021)

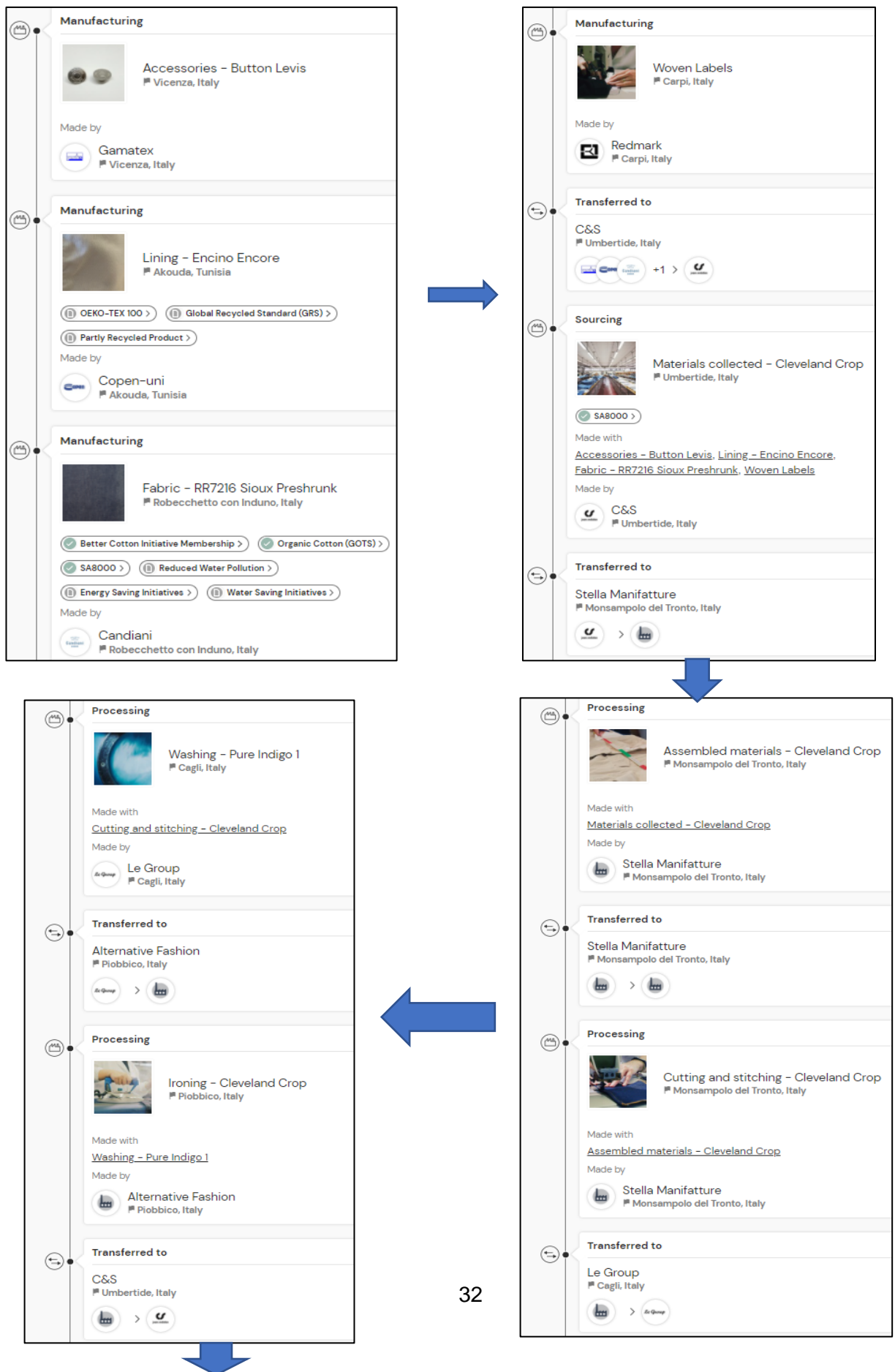
To produce a specific women's jacket, the mill in China and a factory in China get involved in the production. Consumers can acknowledge the list of components of the purchased product and the exact origin of the product. Consumers get in hand this useful information for further research for manufactories.

Though useful information is provided, the trustworthiness of the information could have arisen. Since Patagonia mainly provides this information, questions arise about how Patagonia chooses which information to publish on their website. Therefore, there could be a possibility that this transparency program could mislead the customers in the trustworthiness of the information provided by Patagonia. This put Patagonia and their retailers in building customer trust toward their transparent supply chain (Pongtratic, 2007).

4.2 Provenance

Haikure, founded in 2011 in Italy, had an overview of being open about their supply chain. Therefore, they chose to collaborate with Provenance to help their business enhance sustainability in the supply chain. They aim to give access to information about their

fashion products to their customer. Product Passport was then introduced as the solution to their problem. Provenance provides consumers detailed information about the movement of products from the production phase to end-users (Figure 16).



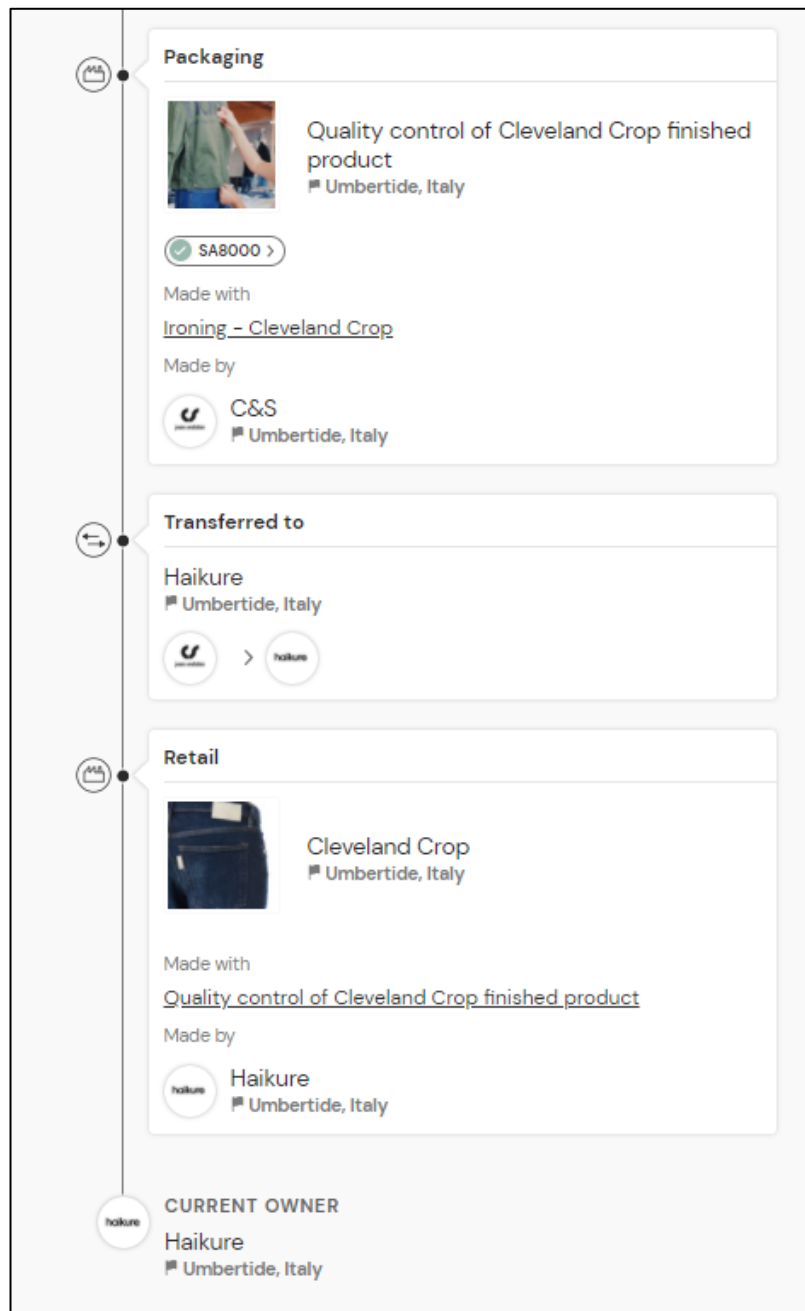


Figure 16. A movement flow of Haikure jeans ((Provenance, Haikure. Our product story, 2021)

It is illustrated that producing jeans involves several steps from manufacturing to the retailer (Figure 16). Consumers could see that exact detailed information from Haikure’s manufacturer in Italy, Tunisia, and the sourcing unit and processing unit in Italy. After

going through the packaging phase in Italy, the products are transferred to a retailer store in Italy. Most production process is done in Italy. The information is provided clearly, easy to track and follow.

4.3 Criteria to compare blockchain solutions and non-blockchain solutions

From the result from two study cases, one could say that Patagonia built its transparent supply chain based on its relationship with its suppliers. This could be due to the ability to choose their suppliers and manufacturers actively. However, as being said, the problems arise as the trustworthy level of information Patagonia provides to their customer. Haikure study case from Provenance seems to be a more transparent supply chain due to the detailed information provided and based on blockchain technology. However, there is only one study case for Haikure in the fashion market on Provenance' website. This could lead to a guess that it takes a big effort to apply blockchain in building a transparent fashion supply chain. Whether using blockchain technology or not, the relationship between retailers and suppliers, retailers and their consumers, requires more attention. These communication and relationships are not achieved mainly based on any system.

4.4 Assessment

Since to keep each transaction secure and trusted on the blockchain, it consumes energy intensively. Blockchains presently have an electricity consumption level of 0.58%. This leads to a discussion between blockchain technology and sustainability; there is a need to harmonize the longer advantages and decrease the use of fossil fuel.

In this situation, 'Proof of Stake' has been introduced as one of the brightest solutions. Last month, Crypto Climate Accord was lately launched with its ambitious goal that the world's blockchain can consume 100% renewable energy by 2025. If proof of stake works and proof of work, it can be used as a tool to support sustainability, and trust will be built. Potential development can be seen, and potential in strengthening the supply chain. (Baker, 2021.)

To collect data, parties must agree on the terms involved in the supply chain; the problem is how to engage and encourage parties involved to share their value and apply the technology. - supplier relationship management.

5 Conclusion

This chapter includes the assessment of the result of main findings throughout the thesis. Furthermore, the author discusses some difficulties facing when doing thesis research and further recommendation. The author's learning is the final part of this chapter.

5.1 Key findings

The thesis has gone through the literature theory to analyze the study case; key findings could be summed up below:

- The fashion supply chain is built up from several players whose participation is essential. There is physical movement from production steps to end-user, and information movement is communicated among each party. The more transparent the information is, the more effective the supply chain could be
- Transparency plays a vital role in the fashion supply chain because the customer increasingly requires the suppliers to provide information for the purchased fashion products.
- Blockchain could effectively build a reliable, trustworthy fashion supply chain based on its verified and decentralized network.

Whether the company would apply blockchain or not to build a supply chain successfully, the problem would be how to develop a strong relationship with different actors in the supply chain.

It should be noted that the system is not a bullet that can solve the problem of building a transparent supply chain. There are several involvements of different players; retailers also should pay attention to building a strong relationship with manufacturers, factories, and suppliers. When relationships with other players in the supply chain are conducted, sharing information could not be a problem anymore. This could lead to possible further research about the relationship among supply chain players.

5.2 Limitation

Many factors are affecting the results of the deep analysis of this thesis. First of all, blockchain technology has just developed in recent years, and there is minimal practical adoption of blockchain technology in the fashion industry. This affects the possibility of the author choosing a potential case company.

Since the author had not got a direct interview from the case company, she used the available information on the companies' websites and journals. Therefore, the analysis of the case companies has limitations. Furthermore, it leads to a challenge that given information was not specific. Thus, the author conducted this research mainly based on the available information on the Internet.

5.3 Suggestions for further research

The author gives some of her recommendations for further research in the future.

A blockchain is a powerful tool for building a transparent supply chain because of its transparency and reliability. However, as said, technology is only a supportive tool. Blockchain is not a bullet point to fix any supply chain system. The company should build, develop, and maintain relations with its suppliers, manufacturers, and partners in the supply chain to have a strong connection within its supply chain. Once there is a strong relationship with suppliers, the company can apply blockchain technology in building its supply chain. A company should consider the possibility of outsourcing IT companies to develop blockchain technology in supply chain management.

5.4 Reflection on learning

The author has many experiences in project management and academic skills with this thesis.

Through the thesis process, time management is a vital skill. Unfortunately, in the beginning, the author had not yet learned how to manage the time for the research. As a result, there were some unclear definitions, and the author moved slowly with the thesis. Finally, however, the author divided the idea into small steps, the support from thesis advisors, the author finally managed to finish the thesis.

Since researching the theoretical framework, the author strengthens her academic knowledge about supply chain concepts, transparency concepts, and blockchain technology. She also gets a chance to practice and maintain her English skills, which is her shortcomings. Several complex sentences are complicated for the reader to understand her points. She tried her best to separate the lengthy sentence into a shorter one and summed up her view to make the conviction clearer. She learned how to write academic English effectively.

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Appendix 1. Gantt chart presenting the thesis activities

No	Task	No.	Subtask	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
1	Introduction	1	Writing the chapter 1	█																		
2	Theretical framework	2.1	Finding soucre literature	█	█	█	█	█	█	█												
		2.2	Reading source literature		█	█	█	█	█	█	█	█										
		2.3	Writing theory traditional supply chain									█	█									
		2.4	Writing theory fashion supply chain											█	█							
		2.5	Writing transparency concept											█	█							
3	Research Phase 1	3.1	Finding soucre literature											█	█	█	█					
		3.2	Reading source literature											█	█	█						
		3.3	Writing concept blockchain technology												█	█						
		3.4	Study case for blockchain application													█	█					
4	Research Phase 2	4.1	Analyze the case study													█	█	█				
		4.2	Final assessment														█	█	█			
5	Evaluation and recommendation	5.1	Analyze the assessment															█	█			
		5.2	Writing conclusions																█	█		
		5.3	Finalize thesis document																	█		