The role of blockchain technology for transparency in the fashion supply chain

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Abstract

The fashion industry is one of the most challenging sectors for sustainable development, comprising numerous social and environmental challenges. The industry is based on a complex network of global and fragmented supply chains leading to a lack of transparency. Therefore, transparency and supply chain traceability are core priorities in order to increase the fashion supply chain visibility and enable accountability. A potential solution to this issue is the application of new technologies. Blockchain is an emerging technology that has a potential to address the current issues and make supply chain processes more transparent.

The combination of the emerging blockchain technology with the concept of transparency in fashion supply chains constitutes the novelty of the research and the contribution to the current body of knowledge. The environmental and social challenges regarding transparency in fashion supply chains are analysed using the theories for Green Supply Chain Management and supply chain power structures. The study relies on interviews with blockchain professionals and industry experts in supply chains and sustainable fashion.

The study finds that blockchain has the potential to become the single source of truth for the fashion supply chain and provide transparency across the supply chain. However, this advancement of transparency can only occur in a less complex fashion supply chain with a balanced power structure and more collaboration than the current standard.

**Key words:** Blockchain; Supply chain; Transparency; Sustainable fashion; Power structures; Green Supply Chain Management; Sustainability
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Abbreviations

BCT – Blockchain Technology
SC – Supply Chain
SCM – Supply Chain Management
GSC – Green Supply Chain
GSCM – Green Supply Chain Management
1 Introduction

This chapter commences with a brief introduction of the background for the topic of the thesis. It then provides a deeper understanding of the existing conditions in the chosen industry and the specific aspects relevant for the research. The chapter ends with a presentation of the identified research gap followed by the research purpose and research question.

1.1 Background

Fashion is one of the world’s largest consumer industries, generating a projected €290,000m in 2018 (statista.com, 2018) and accounting for 4% of worldwide exports (Morgan, 2015). The industry accounts for 9.3% of world’s employees with 60 million people along its value chain (Fashion United, 2018; Global Fashion Agenda & The Boston Consulting Group, 2017; Morgan, 2015).

In their annual report, Global Fashion Agenda and The Boston Consulting Group (2017) project that the overall apparel consumption will rise by 63%, from 62 million tons today to 102 million tons in 2030—an equivalent of more than 500 billion T-shirts. At that scale, it is not surprising that the market for textiles is critical to the world economy (Giljum, Dittrich, Lieber, & Lutter, 2014).

1.2 Fashion supply chains

The production of fashion apparel relies on complex and opaque SCs that are often linked to unsustainable practices including both environmental and social dimensions (de Brito, Carbone, & Blanquart, 2008). The environmental impact comes primarily from the intense use of chemicals and natural resources (Park & Dickson, 2008) which leads to local pollution in production countries with short-term and long-term consequences (de Brito, Carbone, & Blanquart, 2008; Fletcher, 2010; Joy, Sherry, Venkatesh, Wang, & Chan, 2015). The social impact includes harmful working environments and unfair labour practices, and the raw material production often takes place in socially vulnerable communities using unsafe and unstable working conditions that differ greatly from those acceptable in the retailing countries (de Brito, Carbone, & Blanquart, 2008). These impacts make the fashion SC both environmentally and socially unsustainable and therefore makes the fashion industry unsustainable (De Brito, Carbone, & Blanquart, 2008).

However, the effort to resolve these issues is potentially obstructed by the need for financial sustainability. The fashion industry is driven by cutting and externalising costs (Čiarnienė & Vienažindienė, 2014). These cost effective approaches have negative impacts on both social and environmental sustainability (Macchion et al., 2018). Therefore, attempting to become more socially and environmentally sustainable can conflict with the financial ambitions, making sustainability less feasible and, in some cases, less desired (Nagurney & Yu, 2012).
The fashion SC consists of several steps from raw material to finalised apparel. These steps start with the design of the apparel, go through the textile phase of raw materials and processing to manufacturing, transporting and retailing the apparel. These steps are presented in Figure 1 and based on the definition and depiction of the process by Global Fashion Agenda & The Boston Consulting Group (2017).

1.3 Transparency issues in fashion supply chains

SCM encompasses the internal company processes of employees and managers as well as external processes in the network of suppliers, intermediaries and retailers. Implementing sustainability into a SC includes rethinking the governance model but also requires rethinking of the product design phase, procurement processes, manufacturing, distribution, sales and sometimes product return (Macchion et al., 2018; Zhu & Sarkis, 2004). In addition, the influence of societal stakeholder must be considered due to the indirect influence on this governance.

A key aspect of fashion SCs is the lack of transparency caused by having multiple intermediary steps between the production of raw materials to the purchase of a finished product (Fashion Revolution, 2017). This transparency is crucial to the overall quality management of both process and product as it allows identifying, verifying and tracking sources of non-compliance (Macchion et al., 2018). Moreover, it allows to improve the current practices towards sustainability, as the challenges are identified, and companies are enabled to act upon the issues.

Low transparency also limits the knowledge and information on the industry’s social and environmental impact (Fashion Revolution, 2017). This is particularly important because in the apparel sector the most critical issues occur upstream in the SC while the entities downstream are held responsible for the environmental and social outcomes of their SCs (M. Tachizawa & Yew Wong, 2014; Seuring & Müller, 2008).

Unauthorized subcontracting is a frequent problem (Fashion Revolution, 2017; Global Fashion Agenda & The Boston Consulting Group, 2017) and some of the worst labour abuses occur in unauthorized subcontracted sites, farthest from any kind of scrutiny or accountability (Kashyap, 2017). Sub-contracting occurs, where factories contracted by apparel companies meet production demands by contracting out some of the work to smaller, less regulated factories, where labour rights abuses are common (Fashion Revolution, 2017). Regarding these pressing issues, SC transparency is seen as a way of avoiding unsustainable practices and unauthorised subcontracting.

An increasing number of fashion brands and retailers are publicly listing their suppliers (Fashion Revolution, 2017). By publishing SC information, the companies aim to build the trust of workers, consumers, labour advocates, and investors, and it sends the message that the apparel company does not fear being held accountable when labour rights abuses are
found in its SC (Kashyap et al., 2017). A lot of effort has been put into the development of transparency indexes as standard SC measurement tools. The leading tool recently developed in the industry is the Sustainable Apparel Coalition’s (SAC) Higg Index that is already in use by many companies. It makes it possible for all industry participants to understand the environmental and social impacts of their production processes (Global Fashion Agenda & The Boston Consulting Group, 2017).

One of the areas with the lowest transparency throughout the value chain is particularly the use of chemicals in processing. That hinders the compliance and leads the workers to the exposure of hazardous chemicals (Global Fashion Agenda & The Boston Consulting Group, 2017). Due to the low transparency in the primary stages of the SC, the water and chemical usage has been significantly difficult to address for fashion brands. However, the increased media and corporate attention influences the brands to engage with suppliers and set targets (Global Fashion Agenda & The Boston Consulting Group, 2017).

Even though an increasing number of brands share their policies and commitments, much of the information about the fashion SCs’ is not revealed to the customers. Particularly, when referring to the brands’ impact on the lives of workers in the fashion SC and a measurable impact on the environment. Furthermore, the great challenge lays in the fact that even the brands with the highest levels of transparency, are not fully transparent when it comes to disclosing information about their suppliers, business practices and their management of SCs. (Fashion Revolution, 2017).

1.4 Social aspects of transparency in supply chains

Fashion supply chains will often comprise companies in many countries with different institutional approaches to working conditions. These differences often entail labour practices like hazardous chemicals, workers’ compensation, working hours, worker treatment, worker rights, gender equality, child labour and human rights protections (de Brito, Carbone, & Blanquart, 2008; Global & Boston, 2017; Karaosman, Morales-Alonso, & Brun, 2017).

Unethical behaviour is becoming an increasingly common problem in many industries and most often occurs with suppliers (J.-Y. Chen & Baddam, 2015). Consequently, supplier ethics is becoming a key factor to consider and supplier selection is one of the most important decisions in strategic procurement planning (J.-Y. Chen & Baddam, 2015). Examples of unsafe working conditions on cotton farms, in garment factories and in dyeing facilities are abundant and the statistics for social issues in the fashion industry is becoming a topic of intense debate and scrutiny (Bajaj, 2012; J.-Y. Chen & Baddam, 2015; de Brito, Carbone, Blanquart, & Blanquart, 2008; Karaosman et al., 2017; Manik & Yardley, 2013). In the recent years, the unethical practices led to a horrendous human disaster. On April 24, 2013, an eight-story clothing factory called Rana Plaza, near Dhaka, Bangladesh, collapsed killing 1,127 people (Huynh, 2015). The disaster, has been widely commented all over the world and is considered a “wake-up call” for the industry (Sancho, Gimenez, & Sierra, 2016)

The fashion industry has an average of 5.6 injuries per 100 workers per year (Global Fashion Agenda & The Boston Consulting Group, 2017). The minimum wages in the industry are half of what is considered a living wage (Global Fashion Agenda & The Boston Consulting Group, 2017) and less than half in many Asian nations (Clean Clothes Campaign, 2014). The resulting poverty primarily affects women as they often constitute the majority of the
apparel, footwear, and textile workforce—as much as 74% to 81% in Cambodia, Vietnam, and Thailand (Huynh, 2015).

Although many solutions have been suggested, the issues are expected to persist. The significant gap between minimum wages and living wages require extreme compliance to minimum wages by paying 120% of the legal minimum wage. 14 million workers are currently being paid below this 120% threshold and if wages are not increased this number is projected to exceed 21 million by 2030 (Cowgill & Huynh, 2016; Global Fashion Agenda & The Boston Consulting Group, 2017).

1.5 Environmental aspects of transparency in supply chains

In the fashion industry each step of the clothing production process carries the potential for an environmental impact. Fashion leaves a pollution footprint as each step of the clothing life cycle generates potential environmental and occupational hazards (Claudio, 2007). Textile manufacturing pollutes approximately 200 tons of water per ton of fabric (Nagurney & Yu, 2012), approximately 8000 synthetic chemicals are used to turn raw materials into textiles (Curwen, Park, & Sarkar, 2013), and it creates an estimated 10-20% of fabric waste (Briggs-Goode & Townsend, 2011, p. 315).

Textile production requires an extensive usage of chemicals when creating and treating garments. Polyester, the most widely used manufactured fibre, is made from petroleum. The rising demand for fashion apparel has resulted in a high demand for man-made fibres, especially polyester, and the production has nearly doubled over the last 15 years (Claudio, 2007). The production of polyester and other synthetic fabrics is an energy-intensive process requiring large amounts of crude oil and emitting volatile organic compounds, particulate matter, and acid gases, all of which can cause or aggravate respiratory disease (Claudio, 2007). Environmental health and safety issue also apply to the production of fabrics that are not man-made. Cotton, one of the most popular and versatile fibres used in clothing production, carries a significant environmental footprint. The crop accounts for a quarter of all the pesticides used in the United States which is the largest exporter of cotton in the world (Claudio, 2007).

Furthermore, to produce the textiles on a sizable scale, the apparel production has been acquiring more and more land for growing new crops. The area of forested land that has been cleared for crop cultivation and related uses has exceeded the safe operating space by 17%, as defined by boundaries of human resource usage (Rockström et al., 2009; Steffen et al., 2015). By 2030, it is predicted that the fashion industry will use 35% more land for cotton, forest for cellulosic fibres, and grassland for livestock—altogether over 115 million hectares that could be used to grow crops for an increasing and more demanding population or to preserve forest (Global Fashion Agenda & The Boston Consulting Group, 2017).

The fashion SC also faces critical issues downstream at its very end. After use, less than 1 percent of material used to produce clothing is recycled into new clothing. This continuous production is currently responsible for a projected emission of 1.2 billion tonnes of greenhouse gas annually which is more than those of all international flights and maritime shipping combined.” (McKinsey, 2017). Also, by 2050 fashion production will have released over 20 million tonnes of plastic microfibers into the ocean (McKinsey, 2017).
1.6 Blockchain as an emergent technology

Sustainability considerations serve as a principal source of organizational and technological innovations (Ganesan, George, Jap, Palmatier, & Weitz, 2009; Nidumolu, Prahalad, & Rangaswami, 2009). Thus, when referring to GSCs, the technological innovations in information sciences and engineering are increasingly valuable in the vertical integration and coordination of SCs. This can be done in multiple ways with application of hardware and software for measurements, data capture, analysis, storage and transmission (Opara, 2003). Furthermore, often the technology advances enable the entities in the SC to collect new information about their products journey, as well as information about consumers, which combined with SC partners’ capabilities can lead to radical innovations. (Ganesan et al., 2009)

Blockchain – an emerging technology

One of such technologies with a great potential to change the SC set-up towards sustainability is BCT (Evans, Aré, Forth, Harlé, & Portincaso, 2016; Microsoft, 2018; Tapscott, Tapscott, & World Economic Forum, 2017).

BCT emerged as a convergence of the developments of the Internet, strong encryption, the open source movement, peer-to-peer file-sharing technology, and the activism of the Cypherpunk movement. Since the late 1980s, an active movement called Cypherpunks (not to be confused with cyberpunk), has worked towards defending personal privacy and the idea of an open society. On October 31, 2008, a paper for a decentralized money system was published on a Cypherpunk email forum at metzdowd.com by a user called Satoshi Nakamoto. The paper was named “Bitcoin: A Peer-to-Peer Electronic Cash System” (Bauman, Lindblom, & Olsson, 2016).

The emerging BCT has received a tremendous interest around the world form business leaders and policy makers and across sectors (Bauman et al., 2016; Ko & Verity, 2016). It is considered as a leading technology to lay the foundation for the Fourth Industrial Revolution by the World Economic Forum (2017) and is viewed as a technology that can disrupt business models and transform industries even beyond how internet influenced the world.

Blockchain is a type of distributed database hosted across a network of multiple participants. It provides a way to share information and transfer digital assets in a fast, tracked and secure way (Ko & Verity, 2016). The World Economic Forum (2017) defines BCT as “distributed, not centralized (unlike the internet); open, not hidden; inclusive, not exclusive; immutable, not alterable; and secure.” What is more, the information or assets on the blockchain are accountable and tamper-proof. Information that is stored on blockchain can be any token of value or shared data value and it means it can be anything from monetary payments to intellectual property and personal data (Ko & Verity, 2016).

As visible from the definitions, there are several characteristics inherent to the blockchain. In order to grasp the full potential of the technology it is important to understand the main mechanisms behind it.
Distributed, decentralized ledger

First of all, blockchain is a distributed, decentralized ledger. The technology allows a network of entities to interact via blockchain, enabled by a global network of consensus, which eliminates the need for trusted middlemen between parties exchanging information or value. Hence, the infrastructure enables these interactions point-to-point over a network, where trust is ensured by the BCT mechanisms (different consensus algorithms) and is not essential among the interacting actors (Bauman et al., 2016). It runs on computers provided by volunteers around the world, thus it has no central database that could be hacked or shut down (Tapscott et al., 2017). That means the users do not have to rely on centralized platforms and institutions storing their data and providing service solely based on connecting people and sending information or any value between them. Instead, BCT challenges the current centralized intermediaries such as banks, credit-card companies, social networks (e.g. Facebook), as it allows the actors on blockchain to send money, information and soon any form of digitalized value, directly and safely between the actors on blockchain (Tapscott et al., 2017).

Figure 2 illustrates the differences between centralized, decentralized and distributed networks (Rasic, 2018). The model is modified from the study by Baran (1962) titled: “On distributed communications networks” that originates the research on different types of data networks. Blockchain is a decentralized, distributed ledger, thus these networks combined illustrate the underlying technology of blockchain.

Immutability & Trust

Furthermore, blockchain is a distributed system, which provides an immutable registry. That is one of the most important features of the technology that makes it inherently different from any other technological solutions. This is how World Economic Forum (2017) defines blockchain’s immutability: “Within minutes or even seconds, all the transactions conducted are verified, cleared and stored in a block that is linked to the preceding block, thereby creating a chain. Each block must refer to the preceding block to be valid. This
structure permanently timestamps and stores exchanges of value, preventing anyone from altering the ledger.” (Tapscott et al., 2017)

What is more, trust is an important aspect of the technology. The interaction via blockchain is enabled by a global network of consensus – it protects a common database from failure or attack; eliminate duplicate record keeping and associated delays and errors and convey trust across the network (Bauman et al., 2016; Evans et al., 2016). The distributed data sharing is enabled by the consensus algorithms. According to Tapscott, Tapscott and World Economic Forum (2017) “the purpose of consensus algorithms is to distribute the authority to decide on the state of the blockchain to a decentralized set of users”. Thus it eliminates the need for trusted middlemen between parties exchanging value or information, with infrastructure enabling these interactions point-to-point and where the locus of trust moves to periphery (Bauman et al., 2016; Evans et al., 2016).

**Private vs Public Blockchains**

Blockchain has also been implemented for internal solutions in so-called private blockchains. Such blockchains are implemented to leverage BCT for a controlled environment, for example, for government services or in regulated financial markets (Bauman et al., 2016). Private blockchains are essentially blockchain systems with controlled access (Ko & Verity, 2016). Participants are limited by the network to those who are known and trusted an agree on pre-specified rules allowing them to exchange assets between each other (Ko & Verity, 2016). However, the private blockchains deviate substantially from the open-blockchain paradigm, since they are restricting the access to a club of participants and hence the information (Evans et al., 2016). Thus, the private blockchain has been questioned and challenged, if it should be considered as blockchain, given the applied restrictions mechanisms oppose the main idea of blockchain being open-sourced (Bauman et al., 2016).

Finally, the introduction to BCT and understanding the mechanisms behind this technology, leads to exploring the potential application of the technology for transparency in supply chain. The following paragraph reviews such plausible implementation of BCT.

**1.6.1 Blockchain for supply chain transparency**

The distributed ledger technology has a great potential to transform many sectors, specifically the ones that supply or rely upon a third-party assurance by providing cost savings, traceability of information flows and reducing transaction times (Ko & Verity, 2016; Tapscott et al., 2017). It could prove to be a broader force for transparency and integrity in the society, could enable a fight against bribery, corruption and lack of sufficient information with more effective technology. Notably, the possibilities extend far beyond financial services. Blockchain could also effectively influence SCs (Evans et al., 2016) by removing unnecessary paper work and the issue of trust among the SC entities (Evans et al., 2016; Microsoft, 2018; Tapscott et al., 2017).

It is recognised that stakeholders in the value chain and those affected by the transaction are demanding more sustainable production and greater transparency around SCs (Bauman et al., 2016). More secure traceability of goods and more notable information in production and SC could be enabled by BCT (Provenance, 2015). This can be achieved by tagging different inputs, such as minerals, materials, chemicals and assigning them with digital certificates on blockchain. Furthermore, it can be done at all levels of SC. Referring to the fashion SC –
information can be provided even from the level of tracking the source of cotton, the person who picked cotton, the harvest date and other relevant data (Andrew, 2018). As seen in Figure 3, each entity in the fashion SC can add data blocks to the BCT registry, visualised as blocks built on top of the previous blocks. This allows all the stakeholders to follow in a step-by-step, transparent way and enable the intermediaries, retailers and consumers to make more informed decisions and purchases along the whole SC (Bauman et al., 2016; Provenance, 2015).

Figure 3: Blockchain applied to the fashion supply chain

Furthermore, BCT offers a competitive advantage for the companies being early adopters (Andrew, 2018) It can be achieved through the enhanced trust in the eyes of consumers, since the companies are able to show where the products are sourced from and prove their sustainable sourcing from an unbiased, decentralized ledger (Andrew, 2018). What is particularly relevant regarding increasing transparency in SC and BCT is the fact that the users can discover the state of the system, not from a single, centralized authority but by applying common rules and having an access to an open-data (Provenance, 2015). Interestingly, blockchain implementation questions trust to the centralized authority when there is no sufficient reason for such trust. Furthermore, bestowing all of the power to one entity can lead to an unfair competitive advantage. Blockchain allows to redistribute the power across the whole SC and democratize trust (Briggs, Foutty, & Hodgetts, 2016).

Finally, by design, BCT enforces the transparency, security, authenticity, and auditability necessary to make tracing the chain of custody and attributes of products possible. That in turn allows customers to derive the high-quality information needed to make more informed choices. Therefore, its applicability to transparency in SC will be further explored in the research.
Figure 4 illustrates the potential applicability of blockchain for transparent SCs. Blockchains allow to store the data in a shared database (Provenance, 2015). Hence blockchain can break the data silos and create transparent access to the information for all entities across the SC. The figure has been adapted from a diagram, firstly presented by Grossman (2015), however it has been specifically altered for the application of blockchain for transparent SCs.
2 Purpose and Problem formulation

The fashion industry has received less attention on the topic of sustainability compared to other similarly polluting industries (Carter & Liane Easton, 2011), even though its global social and environmental impact serves as a tremendous challenge. Furthermore, the major negative impact comes from the production of fashion apparel that relies on complex and opaque SCs which are often linked to unsustainable practices with both environmental and social dimensions (de Brito, Carbone, & Blanquart, 2008).

As sustainable considerations in SCM becomes more common, there is a need to explore ways in which fashion SCs can be influenced by sustainable practices. Furthermore, the emergent technologies such as blockchain create opportunities for the industry to facilitate the implementation of practices related to sustainability in their SCs (Microsoft, 2018). BCT has the potential to disrupt the current global and complex SC set-ups towards more transparency, accountability and trust among all SC entities (Evans et al., 2016; Microsoft, 2018; Tapscott et al., 2017).

The aim of the research is to contribute to the understanding of BCT and transparency in the fashion SC. The combination of these three concepts, *blockchain technology, transparency* and *fashion supply chains* constitutes the novelty of this research due to the originality of the research and the emergent nature of blockchain. The study provides in-depth insights of applying BCT for transparency in fashion SC and seeks to provide a scope of blockchain application and explore the aspects of its impending possibilities. The resulting research is relevant for both fashion SC professionals seeking to understand the opportunities and implications of blockchain as well as researchers seeking to connect the niche topic of emerging BCT with the well-developed area of fashion SC and transparency in the fashion SC.

Therefore, from a research perspective, this study investigates the role of BCT for transparency and - in a broader perspective - its linkage to sustainability. This topic is explored within the area of the fashion industry and specifically the current global fashion SC set-ups.

The research question is formulated as follows:

**What is the role of blockchain technology for transparency in the fashion supply chain?**

The issues of environmental and social sustainability in the fashion SCs are explored through the theories of GSC and SC power structures. The role of BCT for transparency is applied to the selected model since the technology has been recognised to have a great potential in facilitating more transparent business practices and processes.
2.1 Research mapping

The visualised research mapping provides a better understanding of the logic behind the research and the interconnectedness of the investigated concepts and issues.

The research explores the transparency in a fashion SC through the lens of sustainability. Investigating this area of research serves as a mapping of the current environment in the fashion industry regarding transparency. Furthermore, the research examines the potential influence of BCT upon transparency.

![Figure 5: Research mapping](image)

2.2 Delimitations

This research includes entities operating in the fashion supply from between the raw material production and the retail phase of the finished apparel product. The research does not include the consumer or the distribution since they do not present issues of transparency that are readily comparable to those of the retailer and upstream SC entities. Furthermore, since the issues pertaining to social and environmental sustainability are more prevalent in the upstream supply chain it was considered more relevant to focus on these entities, especially considering the time constraint on the thesis work. Circular fashion or return processes are also omitted unless the process includes returned material that is upcycled. Only apparel is included, excluding other fashion goods. The research looks especially, although not exclusively, at fashion produced in the developing world regions and focuses on consumption in the American and European markets. Furthermore, the research focuses on usage of BCT rather than the specific mechanisms of the technology or different possible ways of implementing it. Several aspects of BCT are not examined in this research as the focus is only on aspects relevant for transparency in SCs. Different types of BCT, consensus algorithms and the distinction between permissioned and permission-less is not included in the research.
3 Theoretical background and analytical framework

This chapter commences with an introduction to the existing and recognised theories developed by researchers in the field of social power structures in fashion and GSCM. These theories form the basis for answering the research question, with social power structures illuminating the aspects of social sustainability in fashion and GSCM illuminating the aspects of environmental sustainability in fashion. The chapter ends with a model that combines power structures and GSCM to visualise how each model applies to the other. This combined model also shows the potential influence of BCT.

3.1 Power structures in fashion supply chains

To understand the different dynamics within the fashion SC and the current lack of transparency, it is important to look not only at the environmental but also the social aspects. Overall, the research within SCM has been neglected in the fashion industry (Bruce et al., 2004) and early sustainability initiatives tended to focus on environmental issues, but with time the triple bottom line (environmental, social and economic) approach has been adopted (Mangla, Kumar, & Barua, 2014). Therefore, the environmental sustainability (greening) issues are not the only concern, the expanding issues related to social sustainability have also been gaining in importance (Sarkis, Helms, & Hervani, 2010; Seuring & Müller, 2008).

The sustainability and transparency issue in the fashion industry is highly related to an important issue in the fashion SC, namely the power structure of the SC (Niu, Chen, & Zhang, 2017). Many stakeholders are involved in the fashion SC. Thus, collaboration is crucial to implement sustainable practices along the fashion SC and the power relationship between SC partners makes the coordination of a sustainable SC even more complicated (X. Chen, Wang, & Chan, 2017). It is therefore crucial to understand the existing power structures in the fashion SC when implementing sustainable practices.

To understand the power structure in the fashion SC, firstly we need to investigate what defines power. In substance, power is relative, and no one firm has power in all contexts. Furthermore, the buyer-supplier exchange is never solely about power, because there is always some mutual interest between the contracting parties (Cox, Ireland, Lonsdale, Sanderson, & Watson, 2002). Nevertheless, the power refers to the resources, thus the power also depends on the availability of alternatives for sourcing the same resource and on the criticality of the commercial and operational resources (X. Chen et al., 2017; Cox et al., 2002).

The power structure in fashion is very industry specific. First of all, the current set-up of the SCs is global, since retailers globally source their products to acquire the cost benefits in time to meet their fast moving and demanding consumer needs. (Bruce et al., 2004) The major retailers in the fashion industry have such a buying power that are able to “make or break” the success of particularly smaller suppliers (Bruce et al., 2004). This clearly shows that the major retailers have the biggest power in the fashion SC. Furthermore, another important factor of the current global SC set-up is the offshoring practice. The practice has led to an employment decline and has heavily and negatively influenced local suppliers (Bruce et al., 2004). Finally, in order to manage the logistics the suppliers and retailers need to be well synchronized to follow the dynamic patterns of demand (Bruce et al., 2004). Such conditions create a fast-pacing environment, where communication is crucial, and the lack of transparency is more prompted to emerge.
For the purpose of this study, a framework or model should be applicable to the specific power structures in the fashion industry, as social sustainability and transparency can be different across industries. Therefore, power structures in the fashion industry are examined using the model of roles in the apparel SC as defined by Guercini and Runfola (2007). See Figure 6. The model is based on research of sourcing strategies and the influence of power between SC entities specifically in the fashion industry. It highlights the central role of the retailer in the SC with retailers configuring their supplier networks. This central role has a significant effect on the relationship with upstream suppliers (Guercini & Runfola, 2007) which in turn is highly relevant for the research of transparency in this study.

![Figure 6: The central role of retailer in the textile and apparel supply chain](image)

The central role of the retailer results in a power imbalance among SCs entities, where one becomes a dominant one and turns into the leader of the SC (Niu et al., 2017). Such power structure results in significantly affecting the SC members’ decisions and the channel dynamics (Niu et al., 2017). That can potentially influence or surpass transparency and the free flow of information through the SC.

Furthermore, what is important to consider is that fashion SC most often also consists of intermediaries. As stated by Popp (2000): “that intermediation is a potential barrier to greater transparency in SCs because it acts as a source of information asymmetry and impactedness.” What is more, Popp (2000) highlights the fact that intermediation raises costs and frequently aggregates as an activity with no value.

**Power structures and sustainability**

When it comes to power structures in SC and sustainability, according to Shi, Qian, & Dong (2017) the manufacturer and retailers often utilize high power to gain economic benefit with less sustainable investment, even though it is beneficial for both to invest in sustainable practices. Furthermore, the optimal sustainable investment is higher for the manufacturer than for the retailer in most scenarios.
Interestingly, Shi et al. (2017) state that the more power retailer in SC has over their SC partner, the more economic benefit can it gain. However, often the power is utilized to charge a higher retail or wholesale price, than to make more sustainable effort.

What is important to mention, is that a firm less powerful in the SC is more incentivized to make sustainable investment. That is due to the fact that the manufacturer, who has less power can see immediate benefits from these practices, such as environmental tax reduction (Shi et al., 2017).

Finally, Niu et al. (2017) show that the buy-back contract reduces the sustainability of the SC, regardless of the SC power structures. Moreover, they find that the sustainability index can increase with the alternative power structure - supplier as a leader and with the buy-back price below a unique threshold.

3.2 Green supply chain management

GSCM is a strategic organizational practice originally based on the combination of SCM and Environmental Management (Fahimnia, Sarkis, & Davarzani, 2015). The purpose of traditional SCM is to coordinate the efficient flow of raw materials from various suppliers to manufacturing companies (Chin, Tat, & Sulaiman, 2015) and includes varying levels of cooperation between the SC parties (Banchuen, Sadler, & Shee, 2017; L. Chen et al., 2017). GSCM however adds the implementation of environmental management to become more environmentally sustainable (Ahi & Searcy, 2013).

The theories behind GSCM can be traced back to environmental management movement of the late 1960s (Sarkis, Zhu, & Lai, 2011) although the concept was not fully formalised until the mid-1990s when individual organisations entered into larger integrated SC networks and began incorporating environmental management into on-going operations (Seuring & Müller, 2008; Srivastava, 2007). Since then the research in the field has rapidly increased and in recent years many comprehensive reviews of the green and sustainable SCM have been completed (Benjaafar, Li, & Daskin, 2013; Brandenburg, Govindan, Sarkis, & Seuring, 2014; Fahimnia et al., 2015; Laari, Oyli, & Ojala, 2017; Rajeev, Pati, Padhi, & Govindan, 2017; Seuring, 2013; Seuring & Müller, 2008; Srivastava, 2007; Tang & Zhou, 2012; Varsei, Soosay, Fahimnia, & Sarkis, 2014).

Despite this increase in focus there is no consensus definition for the term GSC. A study by Ahi and Searcy (2013) focused on this definition and found a total of 22 definitions for green supply chains (and 12 definitions for sustainable supply chains). One reason for the different definitions is that SCM can encompass many different business aspects and that the beginning and end of the chain is not always clearly defined (Sarkis et al., 2011)

A key consideration regarding GSCM is that is focuses solely on the improvement of environmental characteristics and does not encompass the social impacts of SCs (Mangla et al., 2014)

Environmental sustainability often pertains to the raw material provenance and production (e.g. organic, certified, locally produced or eco-friendly materials), material wastage (e.g. textile reuse and waste reduction), material treatment (waste-water management, restrictions to or elimination of toxic substances), end-product usage (life-cycle assessment, cradle-to-cradle design and product recycling) and transportation (transport optimization, full-load capacity, reverse logistics) (de Brito, Carbone, & Blanquart, 2008; Fletcher, 2010; Joy et al., 2015; Karaosman, Morales-Alonso, & Brun, 2017; Park & Dickson, 2008).
For the purpose of this study, the model for environmental sustainability had to present a comprehensive approach to SCM, as transparency is an issue across multiple entities. Several frameworks and models were considered, including some that looked exclusively at sourcing or other aspects of SCM. However, the choice of GSCM is highly suitable when looking at the material flow through entities while also being aware of waste issues and options for reuse and recycling of material.

Therefore, this study examines GSC in the fashion industry by using the Extended Supply Chain model introduced by Beamon (1999). See Figure 7. The model is based on the traditional supply chain which includes Supply, Manufacturing, Distribution, Retail and Consumer entities, adding the environmental aspect to all entities. The extended model is the result of extensive research of the environmental effects of traditional SCM (including waste, resource use, water and air pollution) as well as changes in environmental legislation, management standards and public opinion.

However, to align with the purpose of this study, certain aspects of the model are considered while others are not:

- **Supply** (product design, material selection and sourcing), **Manufacturing** and **Retail** processes are considered as part of the research
- **Distribution** processes and **Consumer** aspects are not considered
- **Return logistics** (collection, remanufacturing, reuse and recycling) are only included if it relates to material refurbishment or reuse

The entities considered in the study are visually emphasised in Figure 7.

![Figure 7: The Extended Supply Chain model](image-url)
The increasing interest in GSCM can be partially attributed to the global increase in environmental issues and the related increase in environmental awareness (Srivastava, 2007) but also to the fact that it makes good business sense and can increase profits as a business value driver (Laari et al., 2017). Organisations are realising the importance of their SC partners in managing the environment (Bai & Sarkis, 2009; Vachon & Klassen, 2008) and scientific literature shows that organisations are increasingly being held accountable for the environmental performance of suppliers and partners (Koplin, 2005).

Some fashion industry manufacturers have approached sustainability by employing so-called eco-fashion initiatives which the International Standards Organization (ISO) has defined as “identifying the general environmental performance of a product within a product group based on its whole life-cycle in order to contribute to improvements in key environmental measures and to support sustainable consumption patterns” (Claudio, 2007).

3.3 Merged model of Power structures and Green Supply Chain with Blockchain influence

By using the models for power structures and GSC the study ensures an encompassing and balanced focus on both social and environmental aspects. Social related transparency issues are presented regarding the SC entities through the theory of power structure. Furthermore, the environmental challenges related to SC transparency are enclosed with GSC theory. However, an important understanding is how each model applies to the other in the fashion SC. For this purpose, the GSC model and the Power structures model are merged to show the interrelations of GSC characteristics and power structure.

In Figure 8 the power structures between SC entities are shown as arrows identifying the power relation. The direction of the arrows specifies which entity asserts the power, and the relative power of the retailer is indicated by its larger size. The combined model also shows the potential influence of BCT onto both the SC entities and the power relation between them. BCT is depicted as a shared database accessible to all SC entities in correlation with the BCT visualisation in Figure 4.

As a result, the model visualises how the research examines transparency as an aspect in the individual entities as well as in the relation between them. Since the research does not include the consumer or distribution as SC entities, these have been excluded from the combined model.

![Figure 8: Combination of Power structures and GSC in fashion – with BCT influence](image-url)
4 Method

This chapter starts with providing an understanding of the research approach of using an inductive approach and qualitative research method. It then presents the research structure of using literature and interviews for data collection and elaborates on the many considerations that played into the selection of interviewees, the preparation, conducting of interviews and coding of interviewee data. Finally, it presents the ethical considerations and assesses the quality criteria of the research.

4.1 Inductive approach

The study aims to explore a niche area that has not yet been developed in the academic research. It investigates the role of BCT in improving transparency in the fashion SC and its relation to sustainability. Thus, this study will be based on an inductive approach to build on existing research. This will be done using what Jupp (2006) defines as enumerative induction where reasoning from statements and observations form the basis for generalisations and inference. This is suitable as this study examines an emergent technology by combining knowledge from different areas of expertise to create meaning and understanding.

The body of knowledge on transparency and sustainability in the fashion industry is well-developed and broadly covered in the academic studies (Carter & Liane Easton, 2011; Gold, Seuring, & Beske, 2010; Pagell, Wu, & Wasserman, 2010). However, the role of BCT and its applicability for such purpose is yet to be analysed within the academic studies. Therefore, this paper does not apply any hypothesis, in order to leave the room for interpretation and discussion on BCT based on the primary data collected for the purpose of this study.

Such an approach allows the authors to look at the blockchain implementation for transparency in the fashion industry more broadly and understand the benefits, challenges as well as nuances and limitations of BCT for such purpose. Moreover, it allows us to alter the direction of the study based on the research findings and thus, be more flexible and accurate. Finally, following the inductive approach, the paper begins with identifying the preliminary relationships between transparency, sustainability and BCT in fashion SC. Further on it draws on the data set collection and generates meaning in order to identify patterns and reach the conclusions.

4.2 Qualitative research

To fully understand the role of BCT in fashion SC transparency the study is based on a qualitative data collection with an exploratory purpose. The interpretive, situational and reflexive nature of qualitative research has emergent flexibility (Schreier, 2012) that allows this study to interpret the social realities (Bauer & Gaskell, 2000, p. 7) of BCT and SC transparency in fashion. Furthermore, qualitative research offers an inductive approach, allowing for an iterative and ongoing pursuit of meaning. (Galletta, 2013) Such approach due to the nature of this research is vital for achieving the holistic understanding of BCT and its role in fashion SC transparency, as it leaves much room for interpretation.

Furthermore, according to Silverman (2011) qualitative studies requires the researcher to evaluate and reconsider initial ideas as more knowledge and understanding is obtained. As previously argued, when discussing the inductive approach, this study needs to allow such
flexibility due to investigating a niche topic of BCT and its role for transparency and sustainability.

Finally, the topics of transparency, sustainability and BCT, as well as SC in the fashion industry are very complex due to their global, widely-spread nature. Thus applying qualitative research support a flexible structure of the study, honours an inductive style, and puts focus on individual meaning, and the importance of rendering the complexity of a situation (Creswell, 2013).

4.3 Research structure

The research structure aims to organize both the primary interview data and secondary literature data collected for this study and provide an understandable mapping of the whole study.

Firstly, the relationship between SC transparency and sustainability in the fashion industry is analysed to investigate the purpose of the research and explain the background and environment of the issue introduced in the research question. This is mostly researched as a secondary data, as the issues of transparency and sustainability in the fashion SC are widely covered by the academic body of knowledge studies (Caniato, Caridi, Crippa, & Moretto, 2011; Karaosman et al., 2017; W.-Y. Li, Choi, & Chow, 2015; W.-Y. Li, Chow, Choi, & Chan, 2016; Macchion et al., 2018). Thus, secondary data from academic research will explore the theoretical knowledge on SC transparency, as well as cross-sectoral collaboration and knowledge sharing. The data includes relevant academic research, as well as industry reports and government publications.

Secondly, the analysis also relies on the primary data. The data is collected with the qualitative methods that include personal semi-structured interviews using open-ended questions. The structured aspects will ensure comparability and rationality and unstructured aspects will allow for flexibility and depth of responses (Tracy, 2012, p. 139). Interviewees consist of 12 industry experts representing each of the main areas of research: a) sustainable fashion practices in all aspects of production, b) SC transparency across all contributors, c) BCT focusing on SC transparency. Thus, all aspects of the research question are covered by the primary data. Significantly, the focus of the interviews is put on investigating BCT and its role for SC transparency in fashion as the technology and its role for transparency has not been sufficiently researched in the academic studies. This research aims to address this gap and thus, the majority of the interviews focus on BCT in relation to the research question.

4.4 Collection of data

To achieve this, we have chosen qualitative interviews as our primary empirical data for our research of the relation between Blockchain and SC transparency. Furthermore, we will rely on interviews and research literature to explore the relation between SC transparency and sustainability. The qualitative interview is applicable to research, as it provides the basic data for the understanding of the relations between social entities and their situation. The objective is a fine-textured understanding of beliefs, attitudes, values, and motivations in relation to the behaviours of people in specific social contexts (Bauer and Gasker, 2000).
4.4.1 Literature search

The literature search for the study sought to find literature within the topics of (1) Supply chain transparency, (2) Supply Chain Management, (3) Sustainability in the fashion industry and (4) Blockchain in supply chains. Literature on (5) Green Supply Chain Management and (6) Power structures in supply chains were also found as were (7) Supply chain collaboration, (8) Supply chain inequality, (9) Sustainable Supply Chain Management and (10) Sustainable Sourcing. These and related search terms were used to find relevant literature through the Malmö University Libsearch database as well as in Google Scholar and Google Books. Industry reports from the fashion industry were found online from relevant industry organisations.

4.4.2 Literature as secondary data

The study firstly explores the transparency issues in the fashion SC through the lens of sustainability. The area of sustainability in fashion is a growing body of knowledge with many publications already covering this area (Choi & Li, 2015; Guercini & Ranfagni, 2013; Hu, Li, Chen, & Wang, 2014; Johannon & Hanna, 2013; W.-Y. Li et al., 2015; Nagurney & Yu, 2012; Shen, Zheng, Chow, & Chow, 2014; Yang, Han, & Lee, 2017). Furthermore, it has been argued that the fashion industry has been neglected in terms of SCM research (Bruce et al., 2004), however in the recent years a number of publications arise to fill in this gap and explore the SC in the textile industry, as well as the sustainable perspective in the fashion SC (de Brito, Carbone, & Blanquart, 2008; Johannon & Hanna, 2013; W.-Y. Li et al., 2016; Y. Li, Zhao, Shi, & Li, 2014; Shi et al., 2017; Turker & Altuntas, 2014; Winter & Lasch, 2016). What is more, the need for greater transparency in the fashion SC has been investigated and confirmed (Pagell et al., 2010; Quarshie, Salmi, & Leuschner, 2016). Therefore, the area of sustainable fashion and transparency in fashion SC has been mostly investigated with the secondary research.

4.4.3 Interviews as primary data

Since blockchain is a relatively new concept there is little research on blockchain and even less on the relation between blockchain and SC transparency. However, as blockchain becomes more widespread there is a growing group of experts with knowledge of the different usages of the technology. The role of transparency in fashion SCs has been previously researched, but for this thesis it was necessary to further explore this role while reflecting on the roles of power structures, GSC and sustainable development. Therefore, interviewees were found that could illuminate these specific aspects of transparency. It was fitting to explore these topics through interviews with experts as this provided the opportunity for “mutual discovery, understanding, reflection, and explanation” (Tracy, 2012, p. 132).

Interviewees were selected using a sampling plan based on the three areas of expertise (blockchain, sustainable fashion and supply chain) to ensure sufficient investigation in to each. With 11 interviews conducted in the study, each area of expertise is represented by at least 3 interviewees. An effort was made to include experts within each topic who presented a specific knowledge area as they could then illuminate the topic in ways that other interviewees could not.
The interviews were conducted as semi-structured interviews as this aligned with the inductive research approach of exploring relationships (Galletta, 2013, p. 150) and made it possible to gather qualitative data. All interviews were both recorded and transcribed and the interview data was subjected to three cycles of coding with thematic coding, category lumping and finally analytic coding.

Table 1: Interviewees across expertise areas

<table>
<thead>
<tr>
<th>Specific expertise</th>
<th>Interview type</th>
<th>Duration</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blockchain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC1 Supply chain and sustainability</td>
<td>In person</td>
<td>60 mins</td>
<td>Strategy Nordic Blockchain Association</td>
</tr>
<tr>
<td>BC2 Blockchain and organisational innovation</td>
<td></td>
<td></td>
<td>Innovator Nordic Blockchain Association</td>
</tr>
<tr>
<td>BC3 Supply chain and Business application</td>
<td>In person</td>
<td>1h 15mins</td>
<td>Blockchain in business processes Carlsberg Business Services</td>
</tr>
<tr>
<td>BC4 Blockchain security</td>
<td>Online</td>
<td>60 mins</td>
<td>Co-founder CryptoWomen</td>
</tr>
<tr>
<td>BC5 Blockchain technology in logistics operations</td>
<td>Online</td>
<td>60 mins</td>
<td>Logistics &amp; Technology BlockLab</td>
</tr>
<tr>
<td><strong>Supply chain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC1 Green Supply Chain</td>
<td>Online</td>
<td>30 mins</td>
<td>Corporate partnerships Environmental Defense Fund</td>
</tr>
<tr>
<td>SC2 Sustainable sourcing</td>
<td>Online</td>
<td>55 mins</td>
<td>Strategic Sourcing PANDORA</td>
</tr>
<tr>
<td>SC3 SCM, procurement and outsourcing</td>
<td>Online</td>
<td>55 mins</td>
<td>Supply and sourcing Novo Nordisk</td>
</tr>
<tr>
<td><strong>Sustainable fashion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1 Socially responsible fashion</td>
<td>Online</td>
<td>35 mins</td>
<td>Ethical Trade Carcel</td>
</tr>
<tr>
<td>F2 Fashion upcycling</td>
<td>Online</td>
<td>55 mins</td>
<td>Business development Better World Fashion</td>
</tr>
<tr>
<td>F3 Fashion activism</td>
<td>Online</td>
<td>30 mins</td>
<td>CEO and co-founder Slow Factory &amp; The Library</td>
</tr>
<tr>
<td>F4 Non-toxic &amp; Closing the loop fashion</td>
<td>Online</td>
<td>45 mins</td>
<td>Sustainability Nudie Jeans</td>
</tr>
</tbody>
</table>

4.4.4 Semi-structured interviews

As part of the qualitative approach, semi-structured interviews were chosen as the primary research method. The structured aspects ensured comparability and rationality while the unstructured aspects allowed for flexibility and depth of responses (Tracy, 2012, p. 139).Aligned with the purpose of exploring the overlap between fashion SC transparency, sustainability and BCT, semi-structured interviews permit exploration and conversation on relationships and (institutional) structures (Galletta, 2013, p. 94). Furthermore, the semi-structured approach is designed to be “cumulative and iterative” (Galletta, 2013, p. 72) and allowed the interviewer to acquire answers to specific questions while also venturing into unplanned but related topics based on the answers from and experiences of the interviewees’ (Galletta, 2013, pp. 94-95). Both these aspects support the purpose of exploring relationships and power dynamics between entities in SCs.

Preparations for the interviews were based on the framework for the development of a qualitative semi-structured interview guide by Kallio, Pietilä, Johnson, & Kangasniemi
(2016). The three central phases of the framework include (phase 2) Retrieving and using previous knowledge, (phase 3) Formulating the preliminary semi-structured interview guide, and (phase 4) Pilot testing of the interview guide.

When retrieving and using previous knowledge the interview topics were thoroughly researched beforehand. The research resulted in a comprehensive understanding of the topics and created a conceptual basis for the interviews, which ensured the correct focus the interview and adequate information from them. When formulating the preliminary semi-structured interview guide the interview questions were formulated based on the topic and adapted to each interviewee. The questions directed the interview towards the research topic while also allowing interviewees to elaborate on related aspects or viewpoints. Pilot testing the interview guide consisted of one interview for each of the three topics and were conducted with people with sufficient professional knowledge of the topic area to correctly assess the quality of the questions (Galletta, 2013, p. 49). Pilot interviewees participated in the interview and then provided feedback on the topic coverage and relevance of questions, the formulation and the flow of the conversation.

Conducting the interviews

The process of conducting the semi-structured interviews differed depending on the interview topic, but all interviews were attended by both authors and followed the same overall structure with an opening segment, a middle segment and a concluding segment, as recommended by Galletta (2013, pp. 46-50). The opening segment contained questions that built trust, established basic facts about the interviewee and gave the interviewee the opportunity to create their own narrative on the topic. The middle segment relied on this trust to secure comprehensive and in-depth answers while also allowing the interviewee to veer into relevant topics. Follow-up questions and a discussion-based approach were used to ensure comprehensive interview data. Finally, the concluding segment revisited any topics that had been mentioned but not connected to other topics that were discussed and asked the interviewee to elaborate on any aspects they saw fit to add to. As part of concluding segment some interviewees were asked questions meant to make them critically reflect on their answers. This was done as part of reciprocity between the interviewer and interviewee and was done to further explore the interviewees views and make coding of the interview more comprehensive, as the interviewee could foray into aspects not covered by other interviewees (Galletta, 2013, pp. 94-95). Much care was taken to both avoid leading the interviewee and asking questions that could risk making the interviewee defensive. To avoid breaking the trust of the interviewee potentially critical questions were only asked if the atmosphere was fitting (Galletta, 2013, p. 99). The interview contained open-ended questions that were both factual and opinion-based, to ensure comprehensive answers from the interviewees and to allow interviewees to answer freely based on their interpretation and experience (May, 2011, p. 111).

Most interviews were conducted using online video software. This made it possible to interview experts regardless of their location and ensured a broader range of the thesis work. Furthermore, as the purpose of the thesis is linked to global challenges and global SCs, a more global approach was fitting. As the topic and the interview questions were not sensitive or emotional in nature it was less important to meet face-to-face (Johnson, 2014). Using video technology, such as Skype or Google Hangouts, offers a synchronous conversation and emulates an in-person setting as it provides non-verbal cues and facial expressions (Hanna, 2012). This aspect was considered important, as having a rapport with the interviewee makes for more effective interviews and more truthful answers (Cassell &
Miller, 2007). Furthermore, the interviewer also encouraged discussion and open conversation to aid interviewee responsiveness, as this is an indicator of quality of a qualitative interview (Heerwegh & Loosveldt, 2008).

After each interview the two interviewers debriefed and captured immediate thoughts and impressions of the answers given, the possible agreements or disagreements compared to other interviewees and any possible data sources that the interviewee had mentioned.

4.4.5 Selection process

To ensure a sufficiently purposeful sample of interviewees, a sampling plan was designed. The plan combined the approaches of securing a variation sample with a convenience and opportunistic approach (Tracy, 2012, p. 134) due to the limited timespan of the study. The combination of these approaches ensured that different expertise within each topic was covered within the required timeframe.

As the study is based on three main knowledge areas (blockchain, supply chain management and sustainability in fashion) the interview data should contain expertise knowledge in these areas from people who could also elaborate on the role of transparency in their field. Furthermore, due to the emergent nature of blockchain a high variety of interviewees was needed to cover different aspects of the technology. Interviewees were found by researching people and organisations that work with one or more of these knowledge areas or who have relevant recent experience. Also, some interviewees were contacted by attending industry events and reaching out to experts appearing in panel discussions.

Different facets of each field were covered by finding interviewees with specific areas of expertise in their work or experience. As the purpose of the study is to explore global SCs, interviewees also had to represent different countries and continents, and SC professionals represent different roles in the SC. The number of interviews and interviewees reflect the level of knowledge available in peer-reviewed literature with more interview data necessary for Blockchain, some for sustainable fashion and fewer for SCM. Introductions to the background and expertise of all interviewees is available in Appendix 1.

4.5 Coding and organizing of data

The purpose of this study necessitates meticulous reflection upon the different approaches and viewpoints expressed by interviewees. Within each of the three areas of expertise it was necessary to go beyond just describing the answers and instead pursue comparisons to expose both agreements and discrepancies in opinions, experiences and viewpoints.

To accurately establish these comparisons from the interview, the transcription data was subjected to two cycles of coding. First, thematic coding was applied to the transcription data by annotating codes onto post-it notes based on interviewee answers. These codes were adapted and revisited throughout the coding process to ensure a continuously relevant and accurate list of thematic codes. The coding then went through a second cycle where they were lumped into categories by grouping post-its into themes. The five sections in the analysis reflect the five themes that were identified in the coding process. It is worth mentioning that more than five themes were identified, however only those most relevant to the research question were included in the analysis. The revisiting of codes served two
purposes: Firstly, different interpretations of the same qualitative material can be equally valid and each interpretation can emphasise a different aspect of the data (Schreier, 2012). Revisiting the codes made it possible to re-evaluate these interpretations and ensured a more accurate result, as all interview data was systematically considered (Schreier, 2012, p. 187). Secondly, similar concepts can appear when coding and replication can be prevented by revisiting the codes throughout the process. Coding, categorising and revisiting throughout made it possible to gather all relevant data from the transcripts (Silverman, 2011, p. 260).

Qualitative research often requires interpretation (Schreier, 2012, p. 87) and the interviews explored topics that can, to a certain extent, depend on the subjective opinion of the interviewee. Therefore, aspects of analytic coding were applied to extract meaning and identify the data most relevant to the research purpose and research question. Memos for each code and category were written into a spreadsheet which made it possible to compare and synthesize the information (Richards & Morse, 2013, p. 158). An example of how quotes were coded, grouped and interpreted is available in Table 2. This approach was suitable because the interviewees represented different knowledge areas and their information therefore had to be interpreted and compared for appropriate analysis. Using analytic coding memos made it possible to question the data and summarise findings (Richards & Morse, 2013, p. 158).

Table 2: Example from the coding process

<table>
<thead>
<tr>
<th>Quote</th>
<th>Code(s)</th>
<th>Theme(s)</th>
<th>Context/Interpretation</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>“…finding the right place in the supply chain to pull the lever. And it's usually at the end of the supply chain.”</td>
<td>Power in downstream SC - retailer</td>
<td>The influence of transparency on supply chain entities’ power structure</td>
<td>The retailer is the most powerful and has the highest impact of sustainable change.</td>
<td>Power structures</td>
</tr>
</tbody>
</table>

4.6 Research validity and reliability

The validity of this research depends on the reliability of interview data and therefore, any matters that influence the data quality or data collection must be contemplated. To ensure reliable research, the interviewees are experts in their field, either through their current company and responsibilities or through their years of experience in the field. However, due to the emergent nature of BCT the interviewees were all early adopters, which presents a unique consideration, as early adopters may be more prone to sharing positive impressions of their expertise (Bauman et al., 2016). This potential concern was managed by creating a space for honest discussion during the interview and triangulating the information from all interviews as part of the subsequent analysis.

Schreier (2012, p. 22) states that “Qualitative research is situational” as it depends on context. This is relevant to the communication prior to the interviews and the method of conducting interviews. Specific steps were taken to ensure validity and reliability of the interviews:

Firstly, in the communication prior to the interviews, all interviewees were informed about the aim of the research and that it would involve matters of transparency in SCs. Although
this was a necessity to find willing interviewees it set the frame for the interview and could potentially influence their mindset and steer their answers towards this topic.

Secondly, all but one interview was conducted online using video software which presents some potential challenges. Video provides great advantages to non-video communications, as it emulates an in-person setting, but it also presents a different environment and ambiance making it harder to create a rewarding relationship (Iacono, Symonds, & Brown, 2016). This carries the risk of interviewees not sharing as openly as they would face-to-face which potentially impacts the depth and accuracy of findings (Schreier, 2012, p. 22). Consequently, it was important to create a positive relationship with the interviewee to ensure comprehensive and honest answers and discussion. The interviewers started each interview with a positive approach of creating rapport with the interviewee and a few introductory questions which were formulated based on acquaintance with the work achievements and background of the interviewee.

Thirdly, the duration of most interviews was approximately 1 hour, which allows for a certain degree of detail but is not sufficient for extensive or exhaustive discussions. This concern was handled through well-prepared interview questions and a clear purpose for each interview. Coupled with the different expertise areas of the interviewees, the need to be very efficient during interviews created some interview variability, as interviewees presented different topics for discussion and some planned questions had to be discarded. This variability can potentially influence reliability when analysing interview data (Bryman, 2012, p. 210).

Lastly, although the interviews were conducted with industry experts, the questions reflected the depth of knowledge of the interviewers, which can potentially mean that certain topics, reflections or opinions were not explored. To minimise this potential issue, the interviewers spent considerable time exploring the specific expertise area(s) of the interviewee before the interview and ended each interview with the following question: “Are there any topics you’d like to comment on that we’ve neglected to bring up, or would you like to expand upon anything you said earlier?”. None of the interviewees added new topics or viewpoints that had not already been discussed.

### 4.7 Ethical considerations

In relation to the interviewees, the research adhered to Swedish law and the guidelines of Malmö University and Lund University. This includes considerations of purpose transparency, information confidentiality and consent. The study is based on the semi-structured interviews with industry experts, representing different organizational bodies, corporations and small to medium enterprises. Thus, the effect of the study on the participants has also been taken into a consideration. Firstly, during the research process different actions were undertaken in order to establish trust with the interviewees, as trust is the classic key to good field relations (Silverman, 2011). The interviewees were approached in a professional manner via e-mail and introduced to the main purpose of the research. Upon request, they were provided with additional information about the researchers and the focus of the interviews. Secondly, regarding confidentiality, the interviews do not contain any sensitive or vulnerable data that could in any way risk the integrity of respondents or the organizations they represent. Interviewees were informed that their data would be used in a Master’s thesis and no interviewees requested confidentiality or were opposed data being used in the research. Thirdly, consent is a high priority in research ethics (Silverman, 2011). Thus, all interviewees were informed prior to the interview that the
conversation is recorded for the research and gave their consent. None of the interviewees expressed a concern regarding the matter nor asked for a consent form. The majority of the respondents declared their interest in a copy of the thesis, hence all respondents were offered a copy of the thesis upon completion.
5 Analysis

This chapter presents and analyses the findings from the research data. The five sections represent the five categories identified through thematic coding and lumping with sub-headers to further specify sub-themes. The chapter uses existing theories and previous research on BCT, SC transparency and sustainable fashion to further conceptualize the findings.

Reading note: Interviewees will be identified by the codes in Table 1 (BC1, SC1, F1 etc.) instead of by name. The codes are used to make reading the analysis easier and making the expertise area of the interviewee easily recognisable. To avoid misinterpretations, ‘blockchain’ will not be abbreviated to BCT and ‘supply chain’ will not be abbreviated to SC in this chapter.

The analysis is categorized by the five themes identified from the research, which are the following: transparency for sustainable supply chains; the influence of transparency on supply chain entities’ power structure; transparency and supply chains’ environmental challenges; incentives and barriers for transparency; and blockchain implementation for transparent fashion supply chains. Each theme includes insights from multiple interviewees with different expertise areas. Using this approach, the study seeks to find relevant overlaps in potential practices, possibilities and challenges which are necessary to answer the research question. The sequence of the findings begins with the link between transparency and sustainability in the fashion supply chain as the context for further analysis. Subsequently the analysis focuses on specific issues of transparency, firstly related to social issues of transparency referring to supply chain entities and later to environmental challenges related to transparency. Lastly, based on these findings regarding the context of fashion supply chain, the role of blockchain implementation for transparency in this specific environment is analysed.

5.1 Transparency for sustainable supply chains

Seeing that the lack of transparent supply chain is a recognised issue in fashion, a portion of all interviews was dedicated to examining if and how this low transparency can be linked to more sustainable supply chains. The role of retailer is clearly highlighted here, as it has been illustrated in Figure 6 that the retailer has a central role in the fashion supply chain, and thus is the one with the greatest power to influence transparency in supply chain.

5.1.1 Internal incentives – retailers’ active responsibility

When discussing the link between transparency and sustainability, and whether retailers are interested in making that link, the interviewees tended to have very differing views. Interviewee SC1 highlights how companies are “setting goals that require them to take responsibility for their product”. Part of this responsibility is having the knowledge about what goes on in their supply chain and addressing issues in their existing supply chain. Furthermore, interviewee F1 also argues that the industry is taking responsibility and points out that since transparency is an enormous challenge it must be approached by appreciating
the need for systematic changes. She finds that taking on more responsibility for the supply chain can become a necessary approach when striving for transparency. On the other hand some companies chose a narrower approach of implementing singular measures to become more transparent and sustainable. SC2 mentioned how these measures can include having suppliers sign a Code of Conduct or joining the UN Global Compact. Also, due to due to the complexity and opacity in supply chains the signing companies (and possibly suppliers) may not be aware that compliance downstream will not make a difference upstream. This statement reflects how the most severe environmental and social impact occurs in the upstream supply chain (Fashion Revolution, 2017; Macchion et al., 2018) and due to low transparency the signing companies (and possibly suppliers) may not be aware of the actual consequences of their entire supply chain.

5.1.2 External pressure - retailers’ lack of responsibility and forced compliance

On the other hand, many interviewees expressed an opposite opinion. SC2 pointed out that companies are aware they have a social and environmental impact but unaware of the scale and the short-term and long-term implications. This circumstance was also mentioned by SC3 who pointed out that much information is being kept from downstream supply chain companies making a comprehensive understanding of the processes and effects less visible outside the companies that directly manage them. This is despite SC3 recognising transparency as a key factor in supply chains across numerous parameters including sustainability, pricing and quality.

Furthermore, SC2 reasoned that the companies do not care, as she had repeatedly introduced sustainably sourced materials to designers and purchasers only to find that the source was not a valued parameter like price or quality. The provenance of the material was not considered important and no more detail was needed than the country of origin. Interestingly, although SC2 didn’t find that the fashion industry is interested in knowing the social and environmental issues it causes, she pointed out that when change is made based on transparency it doesn’t benefit the societies where issues have been revealed. Instead of investing in the existing supply chain, companies instead opt to find alternative suppliers that can comply with sustainability measures. This does not happen often though, as she finds that this compliance leads to higher manufacturing prices as it requires moving production to countries with stricter legal requirements and higher production costs.

When aiming for accountability, interviewees did not agree whether more information about supply chain practices can lead to more sustainable SCM. Interviewee SC2 told that in her experience transparency did not lead to sustainable sourcing decisions. When selling silk produced from the first factory to implement water treatment for environmental processing, SC2 experienced that the price point remained the only relevant parameter. Interviewee F3 presents a similar pessimistic view of the fashion industry, stating that fashion companies will need to be “shamed” into implementing more sustainable practices. In this view transparency is a tool for external forces to push sustainable development into supply chains. This view correlates with literature that identifies external pressures as the main driver of sustainable development, e.g. consumers and external stakeholders (Beard, 2008; Pookulangara & Shephard, 2013; Seuring & Müller, 2008) or legal and governmental pressures (Griffis, Autry, Thornton, & Brik, 2014; New, 1997; Wright, 2016). The notion that consumers have a high degree of influence over sustainability in business strategy is identified as a key issue by one interviewee as she experiences that consumers simply do not care enough. Interviewee F2 identifies consumer indifference as the principal obstacle for
companies to pursue transparency. In her opinion consumers express interest in transparency of fashion provenance but in the end they “don’t want to sacrifice from their personal convenience for the sake of future generations”. This obstacle undermines the business model of transparent supply chains and in her opinion supersedes any challenges of implementing transparency for sustainable development. The view of consumers as interested in but not invested in sustainability is also presented in literature (Dickson, 2000; Pookulangara & Shephard, 2013) with the notable perspective that consumer perception of fashion sustainability may eventually influence buying behaviour (Shen et al., 2014), and ethically observant consumers do in fact respond to brands that market themselves on sustainable parameters (Shen, 2014).

However, relying on external pressure through either “shaming” or consumer demand for sustainable change does not necessarily correlate with the view that sustainability must be a core aspect of business strategy and supply chain strategy found extensively in literature (Krause, Vachon, & Klassen, 2009; Macchion et al., 2018; Taticchi, Tonelli, & Pasqualino, 2013; Xia, Zu, & Shi, 2015). When reflecting on the link between supply chain strategy and sustainability SC3 points to corporate and supply chain strategy as “the most important factor” and asserted that if a company has sustainability as a core principle then the transparency of the supply chain is a key part of this strategy. This strategic approach is also supported by literature on the subject (Pagell et al., 2010).

All in all, the discrepancy of companies actively trying to implement responsible practices or merely complying to the external forces is also reflected in the literature with some sources pointing out that the industry is not willingly and actively addressing transparency unless it carries a financial benefit (W.-Y. Li et al., 2016; Vachon & Klassen, 2008), while others point out that major steps are currently being taken towards transparent supply chains and that the industry is actively involved in this development (Barnes & Lea-Greenwood, 2006; Fashion Revolution, 2017; Global Fashion Agenda & The Boston Consulting Group, 2017; Pookulangara & Shephard, 2013).

### 5.1.1 Transparency as a tool for accountability

Both interviewee F3 and SC3 pointed out that having a transparent supply chain does not make the supply chain activities sustainable. Transparency on the provenance and processing of a product can be perceived as a form of sustainability and inspire confidence in the responsibility of the brand (Beard, 2008; Pookulangara & Shephard, 2013) but they remain two different concepts. Interestingly, there is a broad consensus that transparency can lead to more sustainable practices although the interviews presented very different reasons for this relation.

SC1, SC3 and F4 all describe information as a prerequisite for changes to sustainability in supply chains. SC1 focuses on how this information can “point out both where the problems are and probably where the opportunities are too”. Having transparency and knowing which issues there are with unsustainable practices can “help zero in on problems and then find possible solution to them”. SC1 sees transparency as a starting point for sustainability and for action towards creating change. SC3 focuses more on the use of auditing and presence to ensure the correct information, as this can keep suppliers and sub-contractors from using practices that are not in compliance with previous agreements. He sees auditing as a possible way of safeguarding against issues with both quality and sustainability. However, he also argues that this is not always an efficient method and mentions an example of visiting a manufacturing site which exceeded expectations, only to find out later
that this was a sham “show-and-tell” site and was not where his product was in fact manufactured. Prior to reaching out to suppliers, F4 argues, it is necessary to really know the roles and responsibilities in the supplier network. Choosing suppliers based on their social and environmental sustainability will ensure certain aspects of sustainable practices, but by mapping the supplier network it becomes possible to set up an auditing process as well. The results of these audits can then be used for implementing improvements. These statements all support the view that transparency can lead to improvements that would otherwise not have happened (Nidumolu et al., 2009; Turker & Altuntas, 2014).

Interviewee SC1 called transparent supply chains a “really powerful opportunity to create change” and stated that using supply chains for sustainable development is a way for companies to fulfil corporate visions without relying on how external stakeholders perceive sustainability. In her view sustainability is a way for companies to explore new opportunities especially in situations where an industry or company experiences a burning platform. This view was expanded by CF1 who expressed hope that companies would soon become more mindful of social and environmental source usage. Her perspective was that as cheap and available resources dwindle, either through stricter worker’s legislation or environmental protection, companies will be forced to innovate to sustain their production. This incentive will be apparent in transparent supply chains as issues will be more clearly identifiable.

5.1.2 Collaboration as a crucial aspect for transparent supply chains

A common topic when discussing the potential effect of transparency on sustainability was collaboration. Depending on the background of the interviewee different ways of collaborating across the supply chain was linked to different ways of working with sustainability. Interviewee F2 suggested that sharing knowledge and resources with suppliers can lead to a more successful and efficient collaboration. This was expanded on by F4 who told of a current collaboration with another brand. Due to a common interest in social and environmental features at their shared production site the two companies are collaborating to become more sustainable. The other company has developed a tool for measuring the environmental impact, while F4’s company runs a recurring social audit. The two companies share their resources to find and solve both environmental and social issues in their shared production site. Interviewee SC1 also mentions this approach of pre-competitive collaboration among retailers and sees this approach as a way of “addressing bigger systemic issues that just one company can’t solve alone”. She then brings it up one step further and calls for companies to create “eco-systems” in which they engage consumers, municipalities and competitors towards sustainable goals. Both SC3 and F4 point out the increased efficiency of collaboration in supply chains, and while they respectively focus on non-competitive and competitive collaboration, they agree that by having something to gain from collaborating, companies can run better and more efficient processes while also advancing sustainable parameters.

The expressed views of collaboration are widely supported. By focusing on collaboration and dialogue rather than auditing or coercion suppliers are more prone to compliance and will improve their social sustainability (Jiang, 2009; Sancha et al., 2016). Furthermore, supply chain collaboration facilitates the implementation of GSCM with suppliers (Chin et al., 2015) and can lead to a different power dynamic between retailers and suppliers (Anisul Huq, Stevenson, & Zorzini, 2014) and collaborative advantages (Cao & Zhang, 2010).
5.2 The influence of transparency on supply chain entities’ power structure

In order to understand the social dimensions of transparency issues, this part of the analysis is based on the discussion around transparency in the supply chains and how does it influence different entities across the supply chain.

As presented in Figure 6 currently the fashion supply chain is imbalanced, with the major players having a very high leverage in the production and a high influence on the suppliers. The findings are aligned with the interviewee F4’s opinion, who states that it is the brands at the end of the SC, who holds the biggest power. She makes the distinction that the power is usually shared across the SC, however that is not the case for brands with a very high leverage on factories. Furthermore, regarding transparency, interviewee SC1 points out that the most powerful company in the supply chain is the one capable of making the biggest change. She claims that the retailers, who has a lot of power in a supply chain can demand the change that it would like to see happen.

In addition, the interviewee F4 points out there are different dynamics in the SC, once the company implements, or attempts to implement, sustainable practices. She states that sustainable brands with less quantity do not have such power over their suppliers. What is more, the dynamics of the supply chain are skewed, as sustainable supply chain is more difficult when it comes to finding the right suppliers versus operating in a traditional supply chain. Finally, F4 explains that even though the process of finding the right suppliers that share the same values is more challenging, the sustainable values and the brand of a sustainable company can help establish the relationships with the right suppliers, as it is something the suppliers really appreciate and thus, want to work with the company.

Regarding transparency in fashion supply chains and its influence on intermediaries, interviewee F1 argues that providing transparency of the labour workers manufacturing the clothing can be a way of empowering them. Furthermore, regarding the intermediaries, interviewee SC3 states that transparency can facilitate the optimization of the flow of goods and more efficient processing of the stock in the production level.

Transparency arguably can also lead to certain disadvantages for the different entities in the SC. Firstly, according to interviewee SC3 revealing information about harmful business practices inevitably leads to negative press coverage both for the supplier and the purchasing company. Furthermore, interviewee F3 expresses her opinion that transparency can potentially serve as a tool for the external pressure on the different entities to comply with sustainability standards. She argues that only through “shaming” the companies for their bad practices and revealing them to the public, will the companies feel pressured to actively change their supply chain. Finally, interviewee SC2 reflects that transparency can lead to certain suppliers losing their contracts or business partners, or not receiving new orders, as the companies can see they do not comply with their standards or values.

5.2.1 Trust and Confidentiality among the supply chain’s entities

One recurring theme regarding transparency in supply chains is trust and confidentiality. Firstly, interviewee SC3 stresses that companies should be mindful on what they choose to share. He mentions that the company’s data holds its commercial value and serves as the competitive advantage. Thus, the interviewee argues that sharing too much information could lead to losing such advantage, as the competitors could use it to harm your business and supply chain processes. Furthermore, he reflects upon the fact that he has seen
transparency being implemented across the supply chain due to CSR policies, certain rules and contracts with suppliers and vendors that oblige them to comply with specific standards. Thus, he concludes that transparency should rely on contracts, regulations and auditing. Finally, SC3 points out that unauthorised sub-contracting is a major concern across the supply chain regarding transparency and trust. He discusses that there are several possibilities of addressing this issue. Firstly, companies can place their orders with suppliers that are not located in regions with a high-risk of sub-contracting. Secondly, the company should ensure that the authorities at the factory have a strong position with a high focus to ensure good-working conditions. On top of that the company can enforce a third-party to conduct audits.

Finally, when discussing trust, interviewee SC2 states that loyalty is the key to implementing transparent practices. She argues that in case of not having the power over a supplier, when trying to influence their practices through a partnership – the loyalty between the two entities already needs to be established. Such relationship, however, takes time to form. Lastly, SC2 reflects that loyalty and long-term commitment with the supplier, motivates them to meet the companies demands.

5.2.2 Collaboration for a more balanced power structure in a fashion supply chain

Power structure and transparency in the fashion supply chain often link to the discussion of collaboration. According to interviewee SC3 if the company in power misuses their power the relationship will most likely break. Interestingly, he also reflects that suppliers are treated differently by the companies depending on their importance. Furthermore, interviewee SC2 expresses an opinion that competing companies in a supply chain will not collaborate, even though they could save on ordering in bigger bulks together from the suppliers, that they are all anyway ordering from.

Significantly, interviewee SC3 expresses an opinion that the more equal the power of influence between two companies the better the relationship will be. He claims that “if the power is more or less equal you can actually have the best relationship going forward. So the more equal the power or influence between two companies the better in my opinion the relationship is going to evolve.” This opinion is supported by the recent literature on power balance in supply chains by X. Chen, Wang, & Chan (2017). The authors prove that from the whole supply chain point of view a more balanced power across the supply chain, and in particular between the manufacturer and retailers results in the best economic performance for all stakeholders.

Finally, several interviewees expressed an opinion that collaboration is a key factor for reaching transparent supply chains. Interviewee SC1 stresses that collaboration can create shared value. She explains that it is very rarely that fashion brands own their own factories, thus they need to establish partnerships with their suppliers. If such partnership can be established and both sides can be engaged in the process that can create value on both ends. What is more, another interviewee F1 points out that regarding creating innovation in the supply chain, collaboration is crucial. Implementing innovation requires the companies and suppliers to be more agile and work together towards the same goal. Finally, interviewee SC2 expresses an opinion that partnerships can create more sustainable practices, as they allow to get closer to the company/supplier and have a better understanding of both their work scope, needs and current practices.
5.3 Transparency and supply chains’ environmental challenges

Notably, the transparency issues in the supply chain do not only relate to the social dimension, but also to the environmental one. Thus, this chapter of the analysis provides interviewees’ view points on the environmental challenges linked to transparency.

5.3.1 Global and complex supply chains

The global nature of fashion supply chains has other consequences than obscuring transparency. Interviewee BC5 points to a disconnect between the way supply is managed in different parts of the world. This disconnect can lead to very different outcomes when applying supply chain models and tools. One reason was mentioned by interviewee F3 who observed that sustainability is approached in different ways depending on the societal context and that societies experiencing pollution and scarcity of resources may value different efforts than those called for by the downstream supply chain.

5.3.2 Product quality and a longer garment life-cycle

Product quality was mentioned as a key issue when working towards environmentally sustainable fabrics. According to SC2 the organic materials are often harder to work with and quantities are harder to procure if the retailer is not large enough to meet minimum quantity orders. A related issue is the long implementation since finding suppliers that meet all requirements can be very difficult, and the existing supplier network may hesitate to invest in environmental process adjustments if the retailer is not a principal client. This issue is also brought up by F4 who mentions losing suppliers and spending six years reforming their supply chain when implementing organic fabric dyeing. She also points out that environmental sustainability entails continual alterations to the supply chain due to the numerous processes between raw material and finished apparel.

A key aspect of environmental sustainability is the product life cycle (Seuring, 2013) and this is reflected in the approaches described by two interviewees. Both work with prolonging the life cycle of their apparel. Interviewee F4 has implemented free repairs at shops where seamstresses stitch, patch and restore worn products. Interview F2 mentions a similar model where worn products are resold both online and in stores, but stresses that consumers using products for longer is always preferable. In the current setup they rely almost entirely on second-hand leather to produce leather jackets and bags, which entails an extensive process of finding, dismantling, reassembling and stitching parts together without discarding materials along the way. To ensure quality material the company offer a lifetime take-back guarantee. Both interviewees highlight the repairs and take-back policies as a clear competitive advantage as consumers are more likely to spend more on a product where quality and repair is part of the deal.

5.4 Incentives & barriers for transparent supply chains

Incentives and barriers for introducing transparency in supply chains are key aspects frequently mentioned by the interviewees. Therefore, these aspects are also discussed in the analysis, as they serve as a relevant information to investigate the role of blockchain when
5.4.1 Incentives

With the increasing consumer interest in sustainable products comes an increasing interest in product provenance (Joy, Sherry, Venkatesh, Wang, & Chan, 2015; Pookulangara & Shephard, 2013) and SC1 described transparency of supply chains as an unavoidable future parameter. This provides a powerful incentive for implementing measures for more open supply chains. However, there are other more direct incentives for companies to be more transparent about their supply chains practices.

Changing consumer demographic

One such incentive is consumer demand which can drive change in business processes (Barnes & Lea-Greenwood, 2006; Pookulangara & Shephard, 2013) and F4 pointed to increasing awareness of sustainability. Previously this demand was restricted to specific consumer groups, but now younger generations tend to see sustainability as a prerequisite. These generations have a different mind-set for consumption and take it for granted that companies consider their sustainable profile. One way of meeting this demand is through independent product certifications which F2 presents as a way of sharing supplier information in a responsible way. Furthermore, SC1 experienced that consumers are expecting specific information and data to prove the sustainability of product. Consumers are no longer satisfied with products being labelled “green” or “environmentally friendly” and expect more details and proof. For companies to cater to this demographic they must find ways to show their improvements in sustainability which requires them to have transparency of their own supply chains. Having transparency and being able to correctly portray your product information therefore becomes a competitive advantage. Retailers are meeting this demand in different ways, and F3 offered the example of retailers creating capsule collections where part of their assortment is produced in more environmentally and/or socially responsible ways. In her opinion this signifies a huge shift in how sustainability is viewed as part of fashion and culture since this business model requires retailers to re-think their supply chain.

The normalisation of sustainability

Coupled with the increasing interest, sustainability has become more common in product descriptions. As sustainability is becoming mainstream SC1 experiences that companies are actively choosing to take responsibility for their supply chains. External pressures notwithstanding, she experiences that corporations are actively engaged in learning more about their supply chain network and that they do not necessarily use it for positive PR. She sees companies working to incorporate sustainable processes into their business strategies and processes in ways that benefit both the environmental and social aspects of their business, while also gaining cost savings and finding new product opportunities.

A related aspect is how becoming more knowledgeable about the supply chain can lead to them becoming less complex, either through new possibilities for collaboration or new practices. This was the experience of F2 who had found ways of specialising in certain production methods and relying on collaboration with other companies that specialised in
other methods. This eventually became a system of shared value. Another example is production on-demand instead of stock production which F1 has based their business model on. By knowing their supply chain well, they can produce only what they intend to sell, and as they scale up the business this focus remains the same.

Interestingly, some companies may choose to investigate their supply chain due to external pressure from investors or other groups with influence, but SC1 stresses that this positive feedback loop of savings and optimisations carries sustainability into the corporate strategies. Adding a longer time perspective to this, SC1 sees the changing climate and related infrastructural changes as a growing incentive for companies to comprehend the full setup of their supply chains as she expects this to cause major changes to production sites.

**Pressure from governmental regulations and other external factors**

While SC1 expresses that companies are actively pursuing sustainable activities regardless of external pressures, F2 directly disagrees. In her view the only real motivation for companies to know their supply chain setup in detail and act on the issues they find is regulations and political initiatives. This would force retailers to disclose detailed information about product provenance and production practices, and it would create a system in which fashion was inherently transparent. Interviewee F4 prefers another approach where cross-sectoral collaboration can incentivise companies to become more transparent. This involves NGO’s reaching out to companies to offer assistance for both transparency and sustainability but can also include government involvement. Contrary to using force, this approach would be based on a collaborative effort.

The interviews revealed many views on what can drive retailers to have more transparent supply chains, and interviewees offered very different perspectives on the topic. Depending on the interviewees perspective a driver can also be perceived as a barrier. One such example is F1 who suggested that transparency in major supply chains can lead to businesses being held more accountable while also being an inspiration for retailers to follow. Depending on the perspective these outcomes can be viewed either negatively or positively. F1 counted on retailers to recognise their responsibility for everyone involved in their supply chain, or at least be incentivised enough by other factors to choose a more transparent supply chain setup.

### 5.4.2 Barriers

The interviews revealed several barriers to implementing more transparency in fashion supply chains. The obstacles mentioned by interviewees falls into five main types: Novelty of the topic, Complexity of SCs, Industry opposition, Systems in place and Lack of consumer pressure. One interviewee (F3) summed all these obstacles into the statement that “Fashion is about opacity, it's about control, it's about power. Transparency is not a core part culture”.

**The novelty of transparency in fashion**

On April 24, 2013, an eight-story clothing factory called Rana Plaza, near Dhaka, Bangladesh, collapsed killing 1,127 people (Huynh, 2015). This disaster sparked an international debate about social sustainability in the fashion industry which is still ongoing (Sancha et al., 2016). Although much has happened in the industry since then F1 emphasises
that the changing consumer demands and new approaches to sustainability in supply chains require a lot of changes and that 5 years is a short timespan to achieve the desired transformation. Awareness of social issues in fashion is still a relatively new concept and F1 sees the novelty as a key barrier. Many retailers are still not completely knowledgeable about their supply chains because of its complexity and the investment required to both clarify and control it. Also, BC5 points out that transparency can be perceived in different ways, which leads to retailers being content with knowing the environmental and social conditions at their suppliers without being concerned about suppliers further upstream. Adding to this point SC1 states that even when companies decide to pursue more transparent supply chains they are often unsure how to manage that goal. Companies know they need data from the very first upstream suppliers and make that data flow along with the materials, but they are unaware of how to capture the right data at each step. Elaborating on this, F2 finds that the method for creating this transparency is equally important. Using certified materials is one way, however she finds that the overwhelming number of certificates does little to transparency. She states that most certificates do not in fact reveal much about the product provenance and using certified materials does not require a business to be knowledgeable about any of the entities in their supply chain as this is then the responsibility of the certifying organisation.

The complexity and fragmentation of global supply chains is a key barrier to transparency, and both F2 and SC2 stresses that knowing the full supply chain requires a lot of investigation. One way to understand the whole chain is by visiting the different suppliers, which F2 mentions as her preferred method, however this is only possible in supply chain setups with few suppliers. SC2 also points out how subcontracting cannot be avoided unless you are present at the supplying facilities through ownership or partnerships as regular contractual clauses with suppliers are not sufficient. This is supported by F4 who points out that while an increasing number of retailing brands publicly list their main suppliers few chose to reveal the different steps that their products go through from raw material to end-product. This keeps the supply chain hidden as only the first-tier suppliers are shared. F2 suggested industry benchmarks as a possible solution to this opacity but conceded that this would be hard to implement due to the many differing interests and business strategies in the industry.

Fear & Opposition

Several interviewees experience that the fashion industry considers supply chain transparency a threat. SC3 argued that any new practice will be regarded with a certain apprehension, and with supply chain transparency being a relatively new approach the industry is understandable wary. Brands that use material provenance as a selling point want to control the information about their products and F2 mentions examples of brands that use a very low percentage of organic cotton while marketing themselves as supporters of organic farmers. This discrepancy is potentially harmful if SCs become more transparent. Another harmful influence could be the unknown factors in SCs which retailers are not aware of. F3 sees these unknown factors as a major barrier, since retailers will no longer be able to claim they were unaware of any problematic circumstances. Another important reason for opposition is the commercial value of concealing your SC. Both BC5 and F4 sees the lack of transparent supply chains as less of a data issue and more of an attitude issue. In an industry where brands are keen to protect their designs, companies are simply less willing to disclose any information regarding any business aspect.
Several interviewees also experience that supply chain transparency is seen as an obstacle for profitability and existing business strategies. Since fashion trends change and the industry continually produce for new seasons and collections, the supply chain must be both flexible and adaptable. Both SC2 and SC3 highlights the difficulty of maintaining a transparent and sustainable SC. Firstly, studying the full supply chain requires time and resources. Secondly, new suppliers will continuously be required as trends demand different materials for the next season. Lastly, creating and maintaining a relationship with suppliers to ensure transparency is an ongoing process. Neither of these circumstances fit well into the variable sourcing needs of the fashion industry. Businesses that need to scale up their production will find it even more demanding when trying to keep track of their full supply chain network while it expands. Therefore, if the business strategy involves scaling up the production, F4 finds that transparency is a potential obstacle.

Challenges from systemic change

The complexity of the fashion SCs also means that a systems approach is necessary to create transparency. F2 finds that this need for a change of the entire system is a major obstacle to transparency as this can possibly lead to a lack of incentive to make any smaller changes in supply chains. Also, making systemic changes would require more information and knowledge of the supply chain setup than is currently in place. F4 mentions that going beyond auditing and instead relying on partnerships is a step towards this holistic approach but that information about suppliers cannot only be company names and locations as this does not explore anything about which kind of collaboration or influence the retailing company is pursuing with the suppliers. SC3 points to the setup of IT systems - another potential issue as changes to the current supply chain approach will demand changes to the information sharing setup. He highlights the many challenges of changing existing structures both formally, informally and in IT systems as a potential obstacle for companies to pursue more transparency. Overall F2 sums it up with saying that “the whole infrastructure is set up based on the existing old system and making changes towards a new system is a major challenge”.

Lack of consumer pressure

Consumer pressure was mentioned by several interviewees as an incentive for having more transparent SCs. However, others made the opposite argument, expressing the view that consumers generally do not care enough to change their spending patterns. F3 mentions this contradiction and sees it as an inherent contrast in how the fashion industry views transparency and sustainable practices. She states that on one side there are the retailers defending their lack of transparency with a lack of consumer interest. Simultaneously, there is a growing market for transparency and sustainability. The literature is less torn on this issue and finds that while consumers sustain a fashion industry of cheap styles and short-term usage, consumers also express a desire to make sustainable decisions. However, their actions often directly contradict their declared intentions (Dickson, 2000; Pookulangara & Shephard, 2013). One possible explanation is offered by F2 who observes that fashion consumers do not care enough because they do not see the need to know the provenance of fashion products. The manufacturing of fashion and textiles is indeed often regarded as low-value, and consumers are prone to purchase clothing based on current styles and purchase new clothing when styles change (Hu et al., 2014; Pui-Yan Ho & Choi, 2012).
5.5 Blockchain implementation for transparent fashion supply chains

Grounded in the knowledge about the current state of fashion supply chain and transparency issues; this chapter of the analysis focuses on the discussion around implementation of blockchain in the fashion supply chain. It pulls the discussion directly related to understanding the role of blockchain for transparent fashion supply chains and its implementation.

5.5.1 Technology for transparent supply chains

Within the revolutionary context of transparency in supply chains and the role of emerging technologies that have the potential to implement transparency, blockchain could provide a solution to the current issues of data sharing, traceability and more.

Exploring companies’ motivations behind the implementation of blockchain in their SCs, interviewee BC2 reasons that companies are interested in the technology, as they either want to understand the potential threat to their business model or investigate, if it could serve as a competitive advantage.

Further discussing the potential impact of blockchain for transparent supply chains, interviewee SC1 argues that the new technology has the potential to positively influence supply chains towards transparency. The interviewee points to the global interconnectedness of people due to the wide availability of technology, in particular smartphones, that enables a new form of transparency. Nevertheless, she recognizes that the technology itself is incapable of changing the supply chain system; on the other hand, efficient implementation of technology together with engaging different stakeholders, such as customers and powerful companies, holds such potential. This view is aligned with the interviewee BC1, who claims that blockchain can optimize the current processes, such as administration. However, he argues that the blockchain will not change “how we upgrade supply chains as a whole”.

What is more, interviewee F3 indicates that companies that do not implement sustainable practices into their SCs and business models, in the long term will cease to exist. She emphasises that companies will not have efficient resources and enough capacity to have the flow of goods on such scale in the future via the current, non-transparent system. Therefore, F3 claims there is a strong urge on the companies’ side for the adaptability, which further requires implementation of the new technology.

Finally, interviewee F2 reflects upon the fact that companies already implementing sustainable practices, as well as having the knowledge about their whole supply chain, are not afraid to disclose information and implement a new technology for such purpose.

5.5.2 Advantages of blockchain for transparent fashion supply chain

Many aspects are discussed to understand the role of blockchain for transparency in the fashion supply chains. To comprehend the whole scope of this important question, the analysis firstly investigates the advantages of blockchain for transparency in the fashion SC.
Beyond the borders and the first-tier

To begin with, interviewee BC1 argues that the main advantage of blockchain is that it can be implemented both across different industries and countries. As fashion supply chains involve a wide range of global stakeholders the technology must allow the implementation across the borders. Blockchain permits such actions and can potentially serve as a solution in the opaque, global SCs.

Secondly, fashion supply chain consists of many tiers of stakeholders. The majority of brands have a very limited knowledge about their suppliers beyond the first tier, which leads to the lack of accountability and an impossibility to improve the current set-up (Fashion Revolution, 2017). Further it results in the customers’ and other stakeholders’ lack of knowledge regarding the complexity of SCs and other tiers involved (Lake, Macalister, Berman, Gitsham, & Page, 2015). According to interviewee BC5 all of the above issues, can potentially be addressed with the blockchain that allows to transparently show all different tiers of suppliers, beyond the first row.

Single source of truth

Furthermore, following interviewee BC5, he argues that the current complex fashion supply chain results in many sources of different data coming from different silos. That consequences in having separate points of view, where all stakeholders need to reconcile such data. He points out that blockchain can provide transparency as it can break down silos and provide a single source of truth. This view correlates with the interviewee BC3, who also claims that blockchain can bring “the single source of truth or one truth scenario”. What is more, BC3 points out that there is a need for one standardization tool and blockchain could be employed as such standard. Additionally, BC5 recognizes that blockchain can provide a positive incentive to the stakeholders across the supply chain and provide data insights, thus visibility. Finally, he points out that one of the blockchain’s advantage is automation – machine to machine transactions and regarding the single source of truth – “the end of people fighting over things from coming from one system to the other”.

Anonymity and Traceability

One of the main advantages of blockchain is that it provides anonymity. As pointed out by the interviewee BC5, one of the reasons for the current lack of transparency is the protection of the commercial value of data across the SC. As argued by the interviewee BC5 “for that, blockchain provides the potential solution by on the one end offering anonymity and on the other still providing traceability. To be able to deal with the suppliers, Blockchain provides opportunity and has a really unique selling point compared to other applications”. This claim is also supported by the interviewee BC1, who explains that blockchain provides anonymity, but gives access to the information about the time and place of the journey of the product. BC1 further explains that it is also possible to put attributes that inform who interacted with the product – was it a normal person or a supplier or someone else. Further, it allows getting these variations that can be later examined by everyone having the access to the blockchain. Finally, BC5 argues that it allows the consumers to check the product and retrace all the certificates that belong to the product “and really trace back to each and every supplier while the on the other ends, each supplier is somehow made anonymous, yet you know that this is the real supplier.”
**Immutability and Accountability**

Notably, interviewee BC5 recognizes that a significant advantage of blockchain is the immutability of data. Once everyone on blockchain has agreed that the information put on blockchain is the truth, the data is then authorized and can never be tampered with. That provides the digital trail where everyone on blockchain “can always trace back transactions and the data of those transactions.” Such mechanism can clearly positively influence the transparency in the SC.

Interviewee BC3 acknowledges that if the blockchain is implemented across the supply chain it can lead to a greater accountability among all the stakeholders. The available data allows everyone on blockchain to see what’s going on across the SC, which in turn makes it easier “to dictate accountability but also to follow up on making sure that people are actually held accountable for what they’re doing.”

**Knowledge sharing**

Moreover, interviewee BC5 describes knowledge sharing as one of the benefits of blockchain. Interviewee BC3 also agrees with the claim. BC3 indicates that the key point in blockchain is its openness without hurting the companies. He argues that the more knowledge everyone has across the SC, the more agile everyone can be regarding identifying variety of issues and meeting different needs. He claims that even though “a lot of companies are afraid of opening up, essentially they’re just giving the same data they are giving now.” Finally, BC3 recognizes that such transparency can help not only the ones in the blockchain, but also different third parties needing access to such data.

**IoT Integration & Combating counterfeits**

Significantly, interviewee BC5 recognizes that the increasing development of technology, in particular the rise of IoT (Internet of Things) device results in a need of connecting more devices to systems than ever before, which then requires new technology. He argues that the real value of blockchain, does not only lies in a business to business integration, but primarily blockchain adds value is the IoT to IoT integration, as it can allow a totally decentralized world. Such efficiency and data integration across different IoT devices can bring more transparency and data availability across the whole SC.

Finally, an important aspect brought to the attention by interviewee BC2 is combating counterfeit products with blockchain. BC2 presents blockchain as a technology that can considerably impact the fight with counterfeit products. He indicates that the ability to track the order of the original products by the vendors, from manufacturing at the place, where it is originally produced, the vendors can immediately see if the product is forged. BC2 argues that therefore blockchain also provides a quality assurance across the SC. Finally, products with greater value could be authorized with a certain label or certificate, whereas blockchain could potentially be a digital space where all such information is stored.
5.5.3 Barriers to blockchain implementation for transparent fashion supply chains

Secondly, throughout the interviews the theme of barriers to implementing blockchain was reoccurring. Interviewees discussed several main barriers that could potentially prevent the implementation of blockchain in the SCs.

Fear and Hierarchy against decentralization

To begin with, interviewee BC2 pointed out that all companies, who have something to hide or are corrupted will never use blockchain, as it has the potential to expose all the firms that are corrupt. Furthermore, interviewee BC3 argues that companies are afraid to use blockchain, due to the lack of knowledge and understanding of it, particularly on the top management level. Interestingly, he also says that a strong hierarchy in his organization, as well as lack of diversity, especially on the top management level serves as a barrier to the blockchain implementation. BC3 suggests that the management “can very easily get scared and don’t want to admit it all and then can either go with it [blockchain implementation] but know nothing about it or reject it right away.” Finally, he believes that for this reason the biggest challenge is to shift people’s mindset.

Interestingly, interviewee BC5 discusses the influence of governments and powerful corporations that could potentially serve as a threat to the blockchain implementation. He recognizes that “the whole idea of decentralization is basically 180 degrees different from how governments look”. Thus, he argues that the main challenge lies in these forces that got a lot to lose and strongly oppose decentralization of power. What is more, he concludes that it is not only governments, but also powerful corporations that do not need blockchain, “yet they are so powerful already that they could really prevent the use of the technology”.

External regulations

Notably, interviewee BC4 discusses the role of external data regulations that could potentially impact blockchain implementation. She recognizes that EU is already working on standardized regulations of blockchain systems across all European countries. The regulations include records regarding how data can be stored on blockchains, how it can be sent and received, as well as who has the authorities within the different countries. She points out, that in a long-term this could potentially serve as a barrier to the implementation of blockchain systems across borders, as the entities on blockchain systems outside of EU would have to comply with the requirements of the standardized EU regulation in order to work together with the EU partners. Finally, BC4 concludes that even the recently implemented General Data Protection Regulation (GDPR) commissioned by the EU, demonstrates that the regulations regarding data and privacy are getting much tighter. For instance, companies are not allowed to keep the data unless they have a reason for it, which could potentially serve as a barrier to blockchain implementation since all data - once authorized - can never be removed from blockchain.

Supply Chain Complexity

What is more, interviewee BC5 reflects that our current world is made extremely complex, and blockchain is not going to solve this issue. He claims that “as long as it stays as complex as it is, we will have a hard time automating it”. This view correlates with another
interviewee’s point. BC3 discusses that the biggest issue is a variety of separate entities and legal entities that need to get on board in order to implement blockchain. Finally, he concludes that “it’s quite ironic how if you need to implement blockchain across different industries, you probably need some sort of governing centralized body going in and facilitating that, which is everything that blockchain essentially goes against”.

**Credibility of data**

An important aspect discussed throughout the interviews is the credibility of data entered on blockchain. Interviewee BC1 disputes that the issue of credibility of the data put further in the system, is not only regarding the blockchain. He claims that “blockchain secures the data from the moment it has been put in and until you receive it, but it’s not improving how does data get onto databases in a transformative way”. This holds true for another interviewee BC4, who agrees that people can still find ways to circumvent the system or in the extreme cases, violate others to put incorrect information on blockchain. Furthermore, she highlights that there is still a need for the underlining system that is functioning in order to implement blockchain. This can serve as an issue, especially for the developing countries, where the infrastructure, government body and civil society are not as developed. Nonetheless, BC4 concludes that the issue of data credibility is a generic issue with data, and she sees the development of blockchain as something that makes the society and companies question it more. Finally, interviewee BC3 also notices the issue of data credibility and points out to the human factor as a barrier to the accurate information. He suggests that the ultimate solution to this issue could be taking out the human out of equation, since humans can both easily make mistakes as well as cheat.

**Private blockchains**

Finally, the discussion of barriers for applying blockchain for transparency also revolves around private blockchains. Interviewee BC3 questions if private blockchains can truly provide transparency, as the entity setting up such blockchain can accept or decline other entities to join. Furthermore, another interviewee BC2 also agrees with the reflection and argues that different types of blockchain have different permission mechanisms. For instance, looking at hyperledger companies can choose what data do they allow their customers to see and there is a fine line between disclosing business information and revealing business secrets.

5.5.4 Blockchain’s influence on different supply chain entities

The power structure of a supply chain is a significant factor for how blockchain can influence the different supply chain entities. Consequently, it is necessary to consider each entity separately.

Firstly, the interviewee BC3 reflects that the most optimal scenario would be if the power would have been distributed evenly. This could be achieved due to the knowledge being shared across the supply chain, whereas as BC3 points out currently the information is mostly held by the large entities or by the middleman facilitating the supply chain connections. That results in the lack of power in the beginning of the supply chain.
What is more, BC3 indicates that the middleman could potentially be cut out of the equation due to blockchain. Blockchain provides an opportunity for the suppliers and sellers to communicate directly, thus the intermediaries’ role in the supply chain can become obsolete. Interviewee BC5 agrees with this viewpoint. He argues that any trusted third party that is not going to add any value, except for providing the information will lose out in a long-term. He further states that “if your role is really buying bulk and then selling it in small amounts, I think you’re doomed as a retailer or a wholesaler. You are capable of providing additional services, then I think it’s, it doesn't necessarily mean that it's the end of the wholesaler or the intermediary.” Finally, one more interviewee also shares the same opinion on that matter. BC1 discusses that blockchain will enable improving the supply chain network, which will result in getting rid of certain vendors in order to improve efficiency and having a more direct connection with suppliers.

**Powerful entities**

Another point of discussion involves the most powerful entities, with the biggest leverage across the supply chain. Interestingly, interviewee BC5 brings closer the concept of capacity to the discussion. He claims that blockchain can enable a more efficient way of using capacity and hence, can put an end to overproduction. That could potentially result in the end of big supply chain companies like Zara or Wal-Mart, where supply chains are based solely on capacity and predictability of the ever-sustaining product flow, which they “have really executed to a level of excellence that’s sometimes scary”.

**Low power entities**

Furthermore, relating to the upstream low power entities, interviewee BC1 claims that even though their working conditions might improve and in a long-term they might gain more power through knowledge, in the very beginning they will have a little negotiation power. He also reflects on the fact that such low power entities, usually located in the developing countries can potentially gain a great opportunity, as they can skip several stages of technological development. They have the prospect of implementing a very advanced technology and not having to improve or build on the new systems – directly implement the most efficient one. This could potentially positively impact their role in the supply chain and leverage their influence among other stakeholders.

Finally, regarding implementing blockchain across the SC, interviewee BC3 argues that it is the role of a governing body to firstly start the implementation. He claims that initially, there is a need for a top-down approach, however once blockchain is in place the power is being “middle out, the information is shared, and power is truly decentralized.”

### 5.5.5 Blockchain - collaboration as a crucial implementation strategy

Finally, the last point of the analysis and the reoccurring theme is collaboration. According to Evans et al. (2016) blockchain is more about collaborating than competing. Furthermore, expending resources on blockchain only provides a real value when multiple entities are transacting at high cost and with imperfect trust. Thus, the opportunity to implement blockchain is for the entire transaction network, not only to an individual participant (Evans et al., 2016). The majority of interviewees shared this opinion. Firstly, interviewee BC5 states that blockchain requires companies to collaborate, as it makes absolutely no sense to
implement blockchain on your own. In addition, interviewee BC4 claims that blockchain can potentially make collaboration easier. Referring to the knowledge transfer between different entities, she sees the opportunity for companies to ease collaboration “in relation to releasing transportation of goods, payments; if you change company and you are sending your work data, skills, to the next company.” What is more, interviewee BC2 sees blockchain as a tool that could allow the development of eco-systems between companies with different sizes. Finally, interviewee BC1 recognizes that blockchain can also serve as a tool to showcase best practices and share knowledge within and across the organizations. It can provide incentives for good practices, as the person/organization could be instantly recognized and rewarded with a digital token such as monetary benefits/certifications etc. for their good practices.

5.5.6 The world with machine to machine trust

The aspect of trust regarding blockchain is a noteworthy discussing. Looking again at the definition of blockchain - the interaction via blockchain is enabled by a global network of consensus – it protects a common database from failure or attack; eliminate duplicate record keeping and associated delays and errors and convey trust across the network (Bauman et al., 2016; Evans et al., 2016). On the other hand, interviewee BC3 argues that blockchain eliminates trust, however it also depends on the permission mechanism, if blockchain is completely open, then in his opinion it can eliminate the issue of trust. Yet, if it is permissioned, then it might not have the same effect. Interestingly, another interviewee BC5 claims that blockchain ensures trust only between machines. He says “with blockchain, we have now a way to allow machines to trust each other and do transactions together without having to worry about whether things are being done. Whether somebody is trying to cheat or not”. Further he points out that trust between people will remain relevant. People need to trust each other to some degree in a first place to start the blockchain project. He concludes that he does not “think that we can totally move to a trust less world. We can at least make trust something that machines can understand and that allows for automation.” Interviewee BC3 also reflects on the fact that there are certain difficulties with trust, as one can trust the technology and blockchain mechanisms, but not necessarily the entities on blockchain.

5.6 Preliminary findings - the role of blockchain for transparent supply chains

All in all, the analysis investigated the context of transparency in fashion supply chains; incentives and barriers for fashion supply chain transparency, influence of transparency on different entities’ power in the supply chain and lastly environmental challenges linked to transparency. This context presents the setting for potential blockchain implementation.

The preliminary findings of the analysis indicate a need for suitable conditions for blockchain to act as an instigator of transparency in supply chains. To begin with, blockchain can potentially act as a single source of truth in the fashion supply chain. The finding implies that blockchain can unite the currently fragmented data across the supply chain. Instead of storing it in data silos, blockchain can provide one standardized tool. Furthermore, due to its consensus algorithms (all entities on blockchain need to approve the information registered on the block) and immutable registry (once approved by all entities on the block, the data can never be tampered with), blockchain has a great advantage over other technologies that could, in theory, serve similar data sharing purposes.
That leads to the right conditions that need to be met for blockchain to reach its full potential as an instigator of transparency. The analysis specifies that blockchain brings real value only when the implementation is a joint effort of all stakeholders involved in blockchain application. Thus, collaboration is crucial. In addition, the power structure of the supply chain serves as a central consideration. As the analysis indicates, the power in the supply chain needs to be evened out across the supply chain, to reach full transparency. That is due to large entities in power that can choose to use blockchain and shared data to their advantage, which then can prevent the shared knowledge and empowerment of other entities in the upstream supply chain.

Interestingly, in case of an imbalanced power in the fashion supply chain with the retailer playing the central role, blockchain does not act as an implementer of transparency. Instead blockchain serves merely as a tool for optimization and more efficient practices. This approach can be suitable if the purpose is process optimisation (as seen in business practices like Lean and Six Sigma) but will not lead to process transparency. Furthermore, the information to a large extent may not be shared across all entities due to the retailer’s power over the whole supply chain. The retailer may also deliberately leave out some information on blockchain or set up private blockchains. This means that the retailer can act as a central entity which includes and excludes entities from joining blockchain. Figure 9 pictures the main findings of the analysis and distinguishes two different scenarios of the fashion supply chain environment, when (1) the right conditions are met and blockchain plays a role as a single source of truth, unifying data and a tool for incentivizing more transparency due to shared value and knowledge sharing; or (2) the imbalanced power structure and central role of retailer persist and blockchain can only act as a tool for greater optimization and efficient processes.
6 Discussion

This chapter provides a broader scope of the issues related to transparency in SCs and BCT. The issues are not at the core of the research, yet still noteworthy for discussion. Three main notable points derived from the research that serve as an oversight to the analysis, namely: ethical and sustainable issues of BCT; tension between the economic, environmental and social sustainability; and lastly, the future of transparency and sustainability in the fashion SCs.

6.1 Ethical and sustainable considerations of blockchain implementation

As visible from the analysis, blockchain is a great tool for transparency in SCs that provides many opportunities. Nonetheless, its future implementation on a broad scale triggers a discussion regarding ethical and sustainable considerations that are significant to mention. Notably, there are several points relevant to understand the broader scope of BCT and its implementation for sustainability.

To begin with, the interviewee BC1 discussed the fact that blockchain does not have the power to change the current system. However, it can positively impact it to some extent. He firstly argues that by making all decisions and actions transparent it becomes clear that it is extraordinarily expensive to have such lifestyle, as the western world currently leads. Further, he continued: “that means we get to make those fancy, ethical decisions. But that’s not the case for everyone. It’s not going to change the system.” He also argued that even though many people believe technology can change the world to be more sustainable, this is only true to some extent. Taking blockchain as an example, it “can facilitate that on systems level. However, it’s not going to take away the real work.”

Markedly, interviewee BC1 also draws the attention to the fact that companies can choose to disclose only parts of their SC, however still market themselves as using blockchain and being transparent. Such practices can lead to the customers’ confusion and misunderstanding, as they would believe the transparency aspect is fully covered by the usage of blockchain. If presenting their SC using BCT, consumer may think that they are being introduced to the whole journey of the product, even though certain aspects are left out. Hence, that can result in consumers purchasing products that are not as sustainable as they think.

Another important aspect is the fact that blockchain only optimizes the processes, which can serve as a sustainability challenge once blockchain is implemented. Once blockchain is implemented in a setting with unsustainable practices, it will only make the performance of the practices more efficient. As the interviewee points out “if you make the system more efficient, that predominantly causes bad consequences for certain people, then you increase the speed, the pace of bad consequences for these people.” Finally, BC1 stresses that there needs to be the predominance of responsible practices, before the highly efficient systems can take over and automate the processes. It is the responsibility of all stakeholders involved to make sure that the human consequences “are put in place correctly, so that we ensure that these systems are not producing outcomes that we don’t intend as humans.” Interviewee BC4 also expressed a parallel opinion, claiming that blockchain is not a tool that inherently creates good future and well-being for all – “it can be a tool for a complete utopia and a complete dystopia. Information on blockchain can potentially be used against people”.

Finally, from a more ominous perspective, interviewee BC1 stresses that blockchain usage can potentially lead to international political issues, as the full extent of human rights and
other violations become evident. He underlines that there is a potential risk for tremendous conflicts and a cut down on international relations, once all the information is available and out in the open.

6.2 Tension between economic, environmental and social sustainability in the fashion supply chain

Remarkably, another important point of the discussion regarding transparent SCs is the evident tension between the environmental, social and economic sustainability. Many interviewees have discussed the issue of being profitable as a business and at the same time having the right environmental and social practices in place. Interviewee F1 argues that there is an important question of “how sustainable can a business actually be?”. She points out to the challenge of business development and scaling the production and managing to produce sustainably. Furthermore, regarding their own business model, F1 claims that it is challenging for the company to scale up and still be social responsible. She sees the challenge in living up to their own promises of stable employment for their employees, as once they scale up and the demand for the products is not high enough, there is a risk of not being able to sustain the business and all employees. Thus, interviewee F1 points out to the tension between wanting to have the positive social impact, but also to be economically sustainable.

Furthermore, interviewee F3 also agrees with this opinion. Based on her own experience, running a socially and environmentally responsible fashion business, she sees huge challenges in terms of economic sustainability. She, in fact does not consider herself running a sustainable business, as she is unable to live off it, as the currently the costs of sustainable practices are higher than the actual profit. Finally, interviewee F2 argues that such tension derives from the current, inherently unbalanced system, where the only business incentive is profit. She argues that competition and monetary value are the ones driving the current SC infrastructure. Thus, to take on the initiative of having environmental and social business practices, the company stands in the opposition to the old system and the current infrastructure and leads towards a new system. That serves as the biggest challenge to the right balance between the three sustainability dimensions. Finally, the opinion is also supported by industry experts. According to Dame Ellen McArthur with the interview for McKinsey, instead of just trying to “do less bad,” companies need to change the way they make and use clothes so that their production and use builds economic, societal and natural capital rather than depleting it (McKinsey, 2017).

6.3 The future of transparency and sustainability in fashion supply chains

Finally, regarding the future opportunities for transparent and sustainable SCs, many interviewees have expressed different views on this future can potentially unfold. The interviewees mainly discussed the future of companies that are not transparent and the ones that are becoming increasingly transparent; the future of fashion with a closed-loop; and the future role of consumers. As mentioned in the Delimitations (chapter 2.2), consumers are excluded from the main analysis in this study. Nevertheless, since the topic is discussed by several interviewees, it was decided to include the consumers in the discussion, to provide a broader perspective to the research. Finally, a noteworthy fact is that those interviewees who
focused on the customers’ role either have a background in or work with sustainable fashion businesses, where the customer is inherently in the centre of their work.

Interviewee F4 expresses her opinion that non-transparent brands, which do not implement sustainable practices will slowly eradicate from the market. She sees the industry going towards more sustainable practices, which will eventually become mainstream. Furthermore, interviewee F3 voices a similar opinion, arguing that sustainability is the future and any business that is built without such consideration will be outdated.

Interviewee F1 sees the future of the industry being increasingly transparent with a more scattered market that is not only run by few global players. She perceives BCT as a tool for creating more transparency for fashion industry in the future. The view is in line with an NGO Fashion Revolution, working closely with the fashion industry, which recognizes transparency as the first step for brands and all the other stakeholders in the fashion SC to take responsibility for their actions (Fashion Revolution, 2017).

Another future narrative for the fashion industry is expressed by interviewee SC1. She argues that closing the loop will be a key consideration for the industry and that currently, there is not enough action towards implementing this solution in the industry. That is in line with the analysis of Global Fashion Agenda & The Boston Consulting Group (2018), which define closed-loop fashion system as a transformation priority for fundamental change in the industry.

Furthermore, SC1 defines precompetitive collaboration as an approach that can address bigger systemic issues. As there is a need for a strong collaboration, it is a great potential for new opportunities to create change across the SC. Global Fashion Agenda & The Boston Consulting Group (2018) also point out that collaboration and thus, closer relationship, constant dialogue and intensified supplier engagement will boost flexibility and transparency. Moreover, it will allow for better workforce planning and it will limit working with unknown third-party suppliers.

Finally, many interviewees expressed an opinion that consumers will play a big role in the future of the fashion industry. Interviewee F1 states that consumers’ demands will bring more positive change for sustainability and transparency in the future of the fashion industry. Furthermore, the fact that younger generations are more attuned to sustainability will accelerate the change and lead to fundamentally re-examining the entire fashion value chain (The Global Change Award, 2017). Notably, the era of globalisation will also lead to consumers and workers in rich countries scrutinizing the labour standards in the production countries (Elliott & Freeman, 2003). Additionally, interviewee BC1 states that companies will be able to build relationships with customers, based on tamper proof data, once entered on blockchain. This can result in the increased trust from the consumers’ side, as they do not need to trust the company, but the technology behind the data. The idea of companies building stronger relationships and joining forces with the consumers is also discussed by Global Fashion Agenda & The Boston Consulting Group (2018), which claims that companies can see consumers demanding for more transparency, as an opportunity for pushing for better practices and transparency in the value chain together. Finally, regarding the consumers, interviewee SF4 reflects that the change in the consumers’ mind-set and approach will spread out across several generations, as overconsumption and purchasing cheap, disposable products has been an integral part of the society for a long time.
Last but not least, interviewee F1 predicts that financial incentives will be put in place for more transparent and sustainable SC. She sees the rise of innovative ways to produce more sustainable materials, packaging and more, that will in turn increase their value and demand, lower the cost of production and in a long-term implement them on a large scale.
7 Conclusions and recommendations

7.1 Concluding remarks

The purpose of this study was to examine the role of BCT for transparency of fashion SCs in the context of social and environmental aspects of sustainability. To fulfil this purpose, the study first used peer-reviewed literature and industry-specific reports to investigate the current setup of global fashion SCs, from raw material producers to retailers, and identified several social power dynamics and environmental SC conditions that linked to low transparency. Both primary data from interviews and secondary data from literature were used in this research. In addition to understanding the role of BCT in fashion industry, the thesis also explores incentives and barriers for the fashion industry to implement blockchain in SCs. Furthermore, the study revealed the linkage between SC hierarchical power, complex SCs and transparency. By conducting a qualitative study, the authors have gained extensive insights into both BCT, SC transparency and the sustainable fashion industry and succeeded in answering the research question:

What is the role of blockchain technology for transparency in the fashion supply chain?

The summary of the answers to the research questions are as follows:

The study found that blockchain has the potential to become the single source of truth for the fashion SC and provide transparency across the SC. Currently, the industry is scattered with data being stored in silos and with a variety of certificates that often create confusion among the SC stakeholders and customers. Hence, there is a need for one standardization tool that could provide the information in one place. Blockchain could potentially play the role of making such information available in one place by breaking down the data silos, currently existing in the industry, and storing the data in a shared database. Furthermore, BCT can be employed as the single source of truth for all the global stakeholders, as it can be implemented across different countries and SC stages. Notably, it can transparently show all the different tiers of fashion SC and go beyond the first tier, which can address the issue of unauthorized sub-contracting and the lack of transparency on the bottom of the chain.

Moreover, throughout the research, the study discovered that blockchain can serve as a tool for internal and external incentive in the fashion industry for a transparent SC. The internal incentivisation is driven by the decisions and approaches of organisational stakeholder (employees and managers) while external incentivisation comprises the influence from economic (customers, suppliers, competitors etc.) and societal stakeholders (regulators, communities, NGOs etc.) as defined by Werther & Chandler (2011, pp. 34-35).

Firstly, by providing the necessary data across the SC and increasing the knowledge sharing, blockchain can incentivize stakeholders to innovate their SCs. With the usage of blockchain and more transparent data across the SC, fashion companies can optimize their practices and turn the newly discovered challenges into opportunities. More knowledgeable stakeholders in the SCs can lead to less complexity in the SC, by discovering the unnecessary practices and entities and cutting down on untrusted third parties and intermediaries that do not bring real value. That can result in an increased efficiency in terms of cost and time savings. Furthermore, due to the BCT being decentralized and distributed, entities across the SC
need to collaborate together in order to gain the real value of data in a shared database. That can give rise to a shared value across the SC with stakeholders creating their own ecosystems, sharing best practices and facilitating the implementation of full transparency and efficiency across the SC.

Secondly, blockchain can provide an external incentive for the stakeholders in the fashion SC. It can serve as a tool for the external regulators to monitor and enforce transparency in the SC more efficiently. With blockchain providing transparent data on a shared database, external regulators such as governments and NGO’s can hold the fashion SC stakeholders more accountable for their actions. Thanks to the technology, the regulators can trace the journey of each product and in case any information about the part of the product journey is missing, can enforce the stakeholders to disclose the information or question the lack of the specific information. Hence, blockchain can directly lead to increased transparency across the SC.

The study found that blockchain has the potential to significantly increase the transparency of fashion SCs. However, this advancement of transparency can only occur if the current hierarchical power in fashion SCs become more equal and incorporates collaboration between SC entities in a less complex SC. Furthermore, the increased transparency will only lead to more socially and environmentally sustainable practices if fashion retailers are committed to sustainable development.

Notably, the study discovered that fashion industry is currently being influenced by two opposing pressures. The first pressure is internal and seeks to maintain the existing power dynamics and only adapt business practices in ways that uphold the hierarchical power structures. This is driven by a systemic corruption, opposition to change, complexity of the industry and a perceived lack of consumer demand. The second pressure is external and is driven by the sustainable mindset of new consumer demographics and other external parties, who seek to bring transparency to the fashion SCs and ultimately induce more socially and environmentally sustainable practices.

Furthermore, the study of power structures in fashion SCs found that the downstream entities have a significantly higher level of power compared to upstream entities. This hierarchical imbalance means that an implementation of blockchain across SCs can only be initiated and achieved by downstream entities. Therefore, blockchain will not disrupt the current power structure unless the downstream entities choose to utilise it to this end. This is especially significant as the role of blockchain is to make people across the industry collaborate and knowledge share. This can only happen if downstream entities adapt the existing business practices to support this approach.

Another consequence of the current power structure is that it sustains the complexity of fashion SCs. This complexity is perpetuated by the downstream entities through business practices that directly and indirectly create complex SCs without sufficient requirements for transparency. Directly, through (1) Managing the SC without becoming sufficiently acquainted with the supplier or seeking collaboration or partnerships, (2) Not proactively selecting certified suppliers or not working with existing suppliers to improve practices, (3) Relying solely on formalised influence through a Code of Conduct or auditing, and (4) Accepting sub-contracting without securing sufficient knowledge of the sub-contracted entity. Indirectly, complexity is perpetuated by (1) measuring supplier performance mainly on demand parameters rather than on their ability to meet transparency and sustainability
objectives, and (2) Not proactively showing an interest in creating transparency in SCs. The direct and indirect preservation of complexity is therefore rooted in the SC power structure.

7.2 Contributions to theory and practice

The combination of blockchain technology, transparency and fashion supply chains presents a novel contribution to knowledge field of sustainability in the fashion industry due to the originality of the research and the emergent nature of blockchain.

It therefore adds to the current theoretical understanding of blockchain as a potentially disruptive technology by exploring the systemic, influential factors upon the implementation of BCT in the context of the power structure and complexity of the fashion industry’s SC. This consequently contributes to future research on blockchain, transparency and sustainability by revealing that transparent SCs based on blockchain will not necessarily and inherently be sustainable. Transparency per se can only provide better conditions for the fashion industry to be sustainable.

Furthermore, this study offers relevant insights for SC professionals seeking to apply blockchain in SCs with high power in the downstream entities. This relevance applies to professionals in all entities of the SC.

The study also contributes knowledge on the link between transparency through blockchain for SC professionals intending to find sustainable solutions to their SC.

7.3 Limitations and recommendations for further study

As BCT is an emergent technology the current body of knowledge in peer-reviewed literature is not extensive. This is further compounded by the fact that much of the available literature examines aspects of BCT that is not relevant to this study. The condensed period of time available for the study and the human resource of two researcher also presented a limitation. In-depth research was made less feasible and rapid availability of data and interviewees was an important consideration.

Even though some of the findings might be transferrable to further research in BCT for transparency, the findings are specific to fashion SCs. Through the numerous interviews and extensive examination of literature the study has identified areas for further research that would strengthen the knowledge field of blockchain, transparency and sustainable fashion. Further research could be conducted into the following topics:

1. Due to the emergent nature of BCT there is not yet a broadly accepted definition of the concept. Further research into BCT could identify common characteristics more precisely and lead to one or more specific understandings and definitions based on technological aspects, application aspects or other factors.

2. The study found that when BCT can lead to process improvements and efficiency and that intermediaries that do not add value to the product can be eliminated. This fits into other topics of research, such as Lean and Six Sigma. Further studies could be done to establish these possible uses of BCT for business optimisation.

3. Several interviewees with BCT knowledge had not previously considered the possible implications of BCT for sustainability. This connection represents a new area
of study which could be conducted in various industries. A notable point would be
to include research of the social responsibility of having immutable data on
blockchain for persons or organisations that may not have had the power or
knowledge to refuse the gathering and logging of this data.
4. This study has focused on fashion companies that has a sustainable approach to their
business practices and findings are therefore not necessarily applicable to companies
seeking to implement BCT while concurrently adapting business practices to make
them more sustainable. Further study would be needed into the concurrent approach
to ascertain the influence of BCT, transparency, complexity and collaboration under
these circumstances.
5. Regulations for BCT introduced in countries and world regions may present issues
for collaboration across country borders. This is relevant for any international
application of BCT including global SCs. Further study of the role of BCT regulation
may be necessary as both regulatory bodies and private organisations examine the
possible uses of BCT.
6. Finally, this study has pointed out several incentives and barriers to fashion SCs
implementing BCT without proposing any solutions. Consequently, further research
can focus on assessing and addressing these incentives and barriers through
recommended actions and SC practices.

Research into the above-mentioned topics can lead to the understanding and application of
BCT in ways that support sustainable development across industries and country borders.
Reference list


Bruce, M., Daly, L., & Towers, N. (2004). Lean or agile: A solution for supply chain


Johannon, T., & Hanna, M. (2013). Environmental Sustainability in the Fashion Industry “ A company is no more sustainable than its supply chain.”


End notes

i The Higg Index is a suite of tools that enables entities in the fashion industry to accurately measure and score a company or product’s sustainability performance - apparelcoalition.org/the-higg-index

ii Extreme compliance is the calculation of 120% of minimum wage being equal to a living wage, as defined by the International Labour Organization (ILO) - see Cowgill and Huynh (2016)

iii Eco-fashion is apparel (and other fashion products) produced using practices that are not harmful to the environment, e.g. with recycled materials or raw material grown without the use of pesticides.

iv IoT (Internet of Things) is the concept of connecting any electronic device to the Internet (and/or to each other). This is relevant to blockchain as physical objects can be equipped with trackers making the physical flow of goods linked with the information flow, making information would be accessible.

v GDPR is an EU regulation on data protection and privacy that addresses the export of personal data for both EU and non-EU citizens - gdpr-info.eu

vi Hyperledger is an “open-source collaborative effort launched to advance blockchain technologies across such industries as banking, IoT, manufacturing and supply chains” (Tapscott et al., 2017).
Appendices

Appendix 1 – Introduction to interviewees

The interviewees are categorized by their area of expertise: Blockchain, Supply chains and Sustainable fashion with their specific area of expertise in the header.

Area of expertise: Blockchain

**BC1** Nordic Blockchain Association

Specific expertise: *Supply chain and sustainability*

The Nordic Blockchain Association is a newly started NGO located in Copenhagen, Denmark. Their aim is to bring students, blockchain developers, companies and other relevant stakeholders together to discuss and explore the many applications of blockchain technology. Their vision includes a social aspect: “We envision a future where society and the Scandinavian values of individual freedom, independence, and powerful social security systems are all strengthened. We believe that blockchain technology can help us eradicate corruption, add transparency to public affairs, and improve our legal systems making them far more efficient, more secure, and simpler.” The association was started by students and retains a strong focus on making blockchain in business a part of graduates’ work in business development.

BC1 has a background in social innovation and entrepreneurship and works with strategy and sustainability initiatives in the Nordic Blockchain Association. He works as a graduate researcher and project manager for Social Entrepreneurship & Impact Investing at Copenhagen Business School and is also involved in the implementation of the Principles of Responsible Management Education (PRME) from the UN Global Compact. He is currently finishing his Masters’ in in Social Innovation and Entrepreneurship.

nordicblockchain.com

**BC2** Nordic Blockchain Association

Specific expertise: *Blockchain and organisational innovation*

BC2 works for the Nordic Blockchain Association (company is described in the previous section). He is a self-proclaimed *Blockchain Innovator* with knowledge of the current and potential application of blockchain across different situations and industries. He has worked with blockchain for five years and is the co-founder of three different organisations working with cryptocurrencies, capital investment and blockchain integration, respectively. He is currently finishing his Masters’ in Organisational Innovation and Entrepreneurship at Copenhagen Business School.

nordicblockchain.com

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**BC3** Carlsberg Global Business Services  

*Specific expertise: Blockchain in supply chains and business applications*

BC3 started working with blockchain in 2015 in his own start-up and joined his current Danish company, a major corporation selling consumer goods, in 2017. He is responsible for identifying use cases for blockchain application for either financial or commercial uses and for providing insights into which business aspects would be affected by the application. His focus is broad and his (potential) goal for blockchain implementation in the company is to eventually replace all or some functions of the current Enterprise Resource Planning (ERP) system.

**BC4** Co-founder of CryptoWomen  

*Specific expertise: Blockchain security*

BC4 is a former tech start-up community manager and currently part of a team responsible for the European General Regulation Data Protection (GDPR) implementation in a Danish political party. Her expertise is in aspects of blockchain security and the specific benefits and challenges of blockchain immutability. Furthermore, she is the co-founder of CryptoWomen, a community dedicated to bringing women together for debate and knowledge-sharing on current and future blockchain application. CryptoWomen organise regular panel debates focused on making blockchain more accessible to women business professionals and other blockchain enthusiasts.

[cryptowomen.global](https://cryptowomen.global) | [facebook.com/CryptoWomenCPH](https://facebook.com/CryptoWomenCPH)

**BC5** BlockLab  

*Specific expertise: Blockchain technology in logistics operations*

BC5 works with logistics and technology for the Dutch company BlockLab. With a background in Logistics Engineering he has more than 20 years of logistics experience from systems implementations within logistic service providers in the Far East, Middle East and Europe. The company provides research and development of blockchain solutions for logistic purposes. The development process includes consulting services for advising logistics service providers and government bodies on how to best implement blockchain solutions for the client’s specific purposes. The company does not necessarily develop the application but facilitates the combination of IT specifications, business needs, business strategy and blockchain possibilities into recommendations for developing the technical solution.

[blocklab.nl](https://blocklab.nl)
Area of expertise: Supply chains

SC1  Environmental Defense Fund

Specific expertise: Green Supply Chain Management

SC1 works in the supply chain team EDF+Business in the Environmental Defense Fund. She has extensive expertise in green supply chains, corporate partnerships and in environmentally sustainable business practices. The focus of her work is to identify the company in a supply chain that has the most power and then seek out a partnership towards implementing more sustainable practices throughout that supply chain. Her responsibility includes working with major corporations in consumer product retail and food companies to accomplish the EDF programmatic goals of climate, ocean, ecosystems and health. She has worked on corporate partnerships between EDF and private organisations for the past 21 years.

edf.org

SC2  PANDORA

Specific expertise: Sustainable sourcing

SC2 originally trained as a pattern maker and advanced into the role of purchaser for different Danish fashion brands with the responsibility of sourcing from the Far East and Eastern Europe. She worked with sustainability as a Production Manager for a sustainable fashion company, with responsibility for an organic cotton farm project in East Africa which was the result of a collaboration with DANIDA, a development cooperation body in the Ministry of Foreign Affairs of Denmark. She also started her own company as a sourcing agent in China, working as a go between for Danish design companies wanting to start up production in China. In this role she worked closely with the local factories where she sought out companies with a sustainable profile and sourced their materials to her Danish clients. SC2 left the fashion industry some years ago.

SC3  Novo Nordisk

Specific expertise: Supply chain strategy

SC3 has 17 years of working experience with suppliers, SCM, procurement and outsourcing. He has experience from a wide range of industries, although not including fashion, and has worked in both Denmark, Thailand and China, focusing on indirect procurement, driving efficiency and quality improvements with subcontractors, mass production in China and other supply chain operations. Also, he has extensive experience in supplier relations and strategies for securing successful supply chain operations through supplier collaboration, contracting and auditing.
Area of expertise: Sustainable fashion

**F1  Carcel**

**Specific expertise: Socially responsible fashion**

F1 works with ethical trade at Carcel, a Danish slow fashion eCommerce start-up. Carcel’s business model is based on social sustainability and high-quality products. Their products are ethically produced by women imprisoned for poverty-related crime. Carcel aims to empower these women with “new skills and good wages, so they can support themselves, send their children to school, save up for a crime-free beginning and ultimately, break the cycle of poverty” (Carcel, 2018). Prior to working at Carcel, Katharina had gained experience in value chains at Greenpeace and has a Master’s degree in food supply chains and sustainable development in agriculture.

carcel.co

**F2  Better World Fashion**

**Specific expertise: Fashion upcycling**

F2 work with strategy and business development for the Danish company Better World Fashion. Better World Fashion operates with a sustainable business model based on upcycling of leather products, mainly leather jackets, produced almost exclusively from upcycled and reused leather. Better World Fashion focuses on responsible production practices and collaborates with a sewing company in Poland. The company has introduced a product rental business model, allowing their customers to rent and share their product instead of buying and has therefore developed their own sharing economy model.

betterworldfashion.com

**F3  Slow Factory and The Library**

**Specific expertise: Fashion activism**

F3 is a designer, activist, entrepreneur, MIT Director’s Fellow and self-described fashion activist. She is the founder of Slow Factory, a fashion house that merges the traditional functions of a design studio with a high-tech materials lab and the application of open source data. Also, she is the co-founder of The Library: Sustainable Fashion Archive, which is a sustainable initiative for sharing resources, frameworks and methods for positive change within the fashion industry. Her aim is to empower farmers, weavers, artisans and makers in the apparel industry. She applies her background in art, technology, and information design to fashion projects and uses her work to support the efforts of the World Wildlife Fund, UNICEF, and ANERA.

slowfactory.com  |  thelibrary.eco
F4 Nudie Jeans

Specific expertise: Non-toxic & Closing the loop fashion

F4 is responsible for sustainability at the sustainable fashion company Nudie Jeans. She has a Master’s in Development Studies and several years of experience from different field studies at apparel factories in Vietnam, Sri Lanka and Bangalore. Nudie Jeans specialises in denim and strive for sustainability in production practices and the promotion of sustainable consumption patterns. Their clothing is made of 100% organic denim, from a socially responsible manufacturer with high transparency of production practices. Furthermore, Nudie Jeans focuses on prolonging the lifecycle of their apparel, by offering free repair service, re-selling their second-hand products online and in physical shops, as well as by recycling worn out denim.

nudiejeans.com
Appendix 2 - Interview guide: Blockchain

Opening segment: Introductory and contextual questions (5-10 mins)

- What are your responsibilities at <company> and what are you currently working with?
- How long have you worked with blockchain and what got you involved?
- What is your main area of interest within blockchain?

Middle segment: Questions on the expertise area and its relation to SC transparency (25-65 mins)

Supply chain and transparency
1. How would you define transparency in supply chains?
2. Which benefits do you see in having more transparency in supply chains?
3. Which key barriers do you see for reaching more transparent supply chains?
4. What role do you see transparency playing when aiming for more sustainability in supply chains?
5. In supply chain management, where do you see the biggest potential impact of BC?
6. Which actors in a supply chain do you see benefitting the most from BC?
7. Which actors in a supply chain do you see facing the biggest challenges due to BC?
8. Which benefits do you see for intermediaries (e.g. wholesalers, distributors etc.) in supply chains from implementing BC?
9. Which disadvantages do you see for intermediaries in supply chains from implementing BC?

Trust and Collaboration
10. How do you see BC impacting trust and collaboration specifically in supply chains?
11. In supply chains, do you see Blockchain as a form of collaborative action or as centered around a single company? Why/Why not?
12. How do you consider BC as relevant for trust and collaboration when confidentiality is a key concern?
13. Do you have examples of companies that collaborate using BC despite being competitors?
14. Can supply chain entities collaborate through a Permissioned blockchain despite internal competition?
15. Regarding data verification, the “garbage in/garbage out” issue,
   a. How would you characterize this in regard to transparency?
   b. Which solutions do you see that ensures accuracy of information logged in BC?
16. Which actors in a supply chain do you see as the most powerful? Why so?

Technology
17. How do you see flexibility and instant availability of information affecting sustainable SC processes?
18. Do you see this availability of information as a tool that can be used to make supply chains more sustainable? Why/why not?

Power structures
19. How would you explain the power structure between the suppliers and the purchasing companies?
20. Which actors in a supply chain do you see as the most powerful? Why so?
21. Considering that supply chains are closely linked to company strategy, can you elaborate on the role of the retailer in implementing sustainable practices through the entire supply chain?
22. Which possibilities do you see for avoiding unauthorized subcontracting seeing that the practice is actively being kept secret from other actors in the supply chain?
23. Do you see Blockchain disrupting this power balance? How?

Sustainability
24. Have you considered BC related to responsible business practices?
25. How would you say that transparency can be seen as a part of sustainability?
26. Blockchain has been linked to responsible practices in different ways (Factory audits, Carbon emissions, Fair trade, Conflict minerals etc.),
   a. How do you see transparency from BC creating more responsible business practices?
   b. How do you see transparency from BC hindering responsible business practices?

Future perspectives
27. In your opinion, what are the most interesting/pioneering projects within supply chains and Blockchain?
28. What persistent/main challenges do you see with BC for transparency/sustainability?
29. How would you gauge the progress of BC to becoming a tool for transparency or sustainability?
30. It has taken a while for the fashion industry to catch up with what is happening in the tech world. What advice would you give to bridge the gap?

Concluding segment: Follow-up questions and elaborations (1-5 mins)
- Thanks for meeting with me for this interview. We’ve asked all the questions that we had prepared for, but I’d like to open it up a bit before we finish. Are there any topics you’d like to comment on that we’ve neglected to bring up, or would you like to expand upon anything you said earlier?
Appendix 3 - Interview guide: Supply chain

Opening segment: Introductory and contextual questions (5-10 mins)

- What are your responsibilities at <company> and what are you currently working with?
- What experience do you have with fashion supply chains and sustainability?
- What is your main area of interest within sustainability?

Middle segment: Questions on the expertise area and its relation to SC transparency (25-65 mins)

**Sustainability in supply chains**
1. What motivates companies to incorporate sustainability into their supply chain strategy?
2. Which main opportunities do you see for businesses to adopt sustainable practices in their supply chain?
3. Which main challenges do you see when businesses adopt sustainable practices in their supply chain?
4. Currently, what are the biggest challenges within the fashion supply chain in your opinion?

**Transparency**
5. How do you see transparency linked to sustainable practices in the supply chain?
6. Which benefits do you see in having more transparency in supply chains?
7. Which key barriers do you see for reaching more transparent supply chains?
8. What are the most interesting business case studies you have worked with at fashion companies regarding transparency?

**Power structures in supply chains**
9. How do you see sustainability in supply chains being influenced by the difference in power between actors in a supply chain?
10. What is your view on the level of influence that different actors have in a fashion supply chain?
11. Which benefits do you see from adding the sustainable aspect to the work of fashion companies?
12. Which challenges do you see from adding a sustainable aspect to the work of fashion companies?
13. Which key barriers do you see for making fashion supply chains more socially responsible?
14. Subcontracting is one of the biggest issues in the fashion supply chain, leading to the lack of transparency and accountability. Which possibilities do you see for avoiding unauthorized subcontracting?

**Collaboration and corporate partnerships**
15. How do you view the role of partnerships among companies to developing sustainable practices in the fashion supply chain?
16. Among competing companies?
17. What differences have you seen in the ways companies collaborate from when you started your career to now?

Future Perspectives
18. What are the biggest challenges within the fashion industry for sustainability in your view?
19. Which possible solutions do you see to these issues?
20. In your opinion, what can incentivize the fashion industry to become more sustainable?
21. How do you envision the progress of sustainability in the fashion industry?
22. Looking into the future, which role do you see transparency playing when aiming for green supply chains?

Concluding segment: Follow-up questions and elaborations (1-5 mins)
• Thanks for meeting with me for this interview. We’ve asked all the questions that we had prepared for, but I’d like to open it up a bit before we finish. Are there any topics you’d like to comment on that we’ve neglected to bring up, or would you like to expand upon anything you said earlier?
Appendix 4 - Interview guide: Sustainable fashion

Opening segment: Introductory and contextual questions (5-10 mins)

- What are your responsibilities at <company> and what are you currently working with?
- How long have you worked with that role/area?
- What is your main area of interest within sustainable fashion?
- What made <company> decide on a business model with sustainability at its core?

Middle segment: Questions on the expertise area and its relation to SC transparency (25-65 mins)

Supply chain setup
1. How would you explain the set-up of the <company> supply chain?
2. Your supply chain is quite unique, since <unique characteristica>. How do you handle <unique related challenges>?

Sustainability and transparency
3. Challenges with scaling up in regard to sustainability?
4. What are the biggest challenges within the fashion supply chain in your opinion?
5. Which possible solutions do you see to these issues
6. What motivates companies to incorporate sustainability into their supply chain strategy?
7. Which main opportunities do you see for businesses to adopt sustainable practices in their supply chain?
8. Which main challenges do you see when businesses adopt sustainable practices in their supply chain?

Power structures
9. How do you see sustainability in supply chains being influenced by the difference in power between actors in a supply chain?
10. Which key barriers do you see for making fashion supply chains more socially responsible?

Collaboration and corporate partnerships
11. How do you view the role of partnerships among companies to developing sustainable practices in the fashion supply chain?

Future Perspectives
12. What do you think motivates big fashion companies to work towards a more sustainable development?
13. In your opinion, what can incentivize the fashion industry to become more sustainable?
14. How do you envision the progress of sustainability in the fashion industry?

Concluding segment: Follow-up questions and elaborations (1-5 mins)

- Thanks for meeting with me for this interview. We’ve asked all the questions that we had prepared for, but I’d like to open it up a bit before we finish. Are there any topics you’d like to comment on that we’ve neglected to bring up, or would you like to expand upon anything you said earlier?