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ANA CLAUDIA WIERMAN TERRA

BLOCKCHAIN AS A TOOL TO IMPROVING WORK CONDITION IN THE FASHION SUPPLY CHAIN

Rio de Janeiro

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Master's dissertation presented to the COPPEAD Graduate School of Business, Universidade Federal do Rio de Janeiro, as part of the mandatory requirements in order to obtain the title of Master in Business Administration (M.Sc.).

Supervisor: Prof. Leonardo Marques, Ph.D.

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The fashion supply chain has social issues known for a long time. The characteristics of its SC, such as the need to change collection at a fast pace to the large range of suppliers' locations make it easier for them to happen. It is in this context that traceability shows itself as a tool that can help to improve the work conditions of the fashion industry workers by giving them the ability to trace the provenance of a product. Blockchain arises as a new technology used to trace all the information and bring information and trust in a complex relationship. Although it is mainly used in financial transactions, there are other utilities it may fit, such as improving work conditions by giving companies the ability to keep tabs on suppliers scatter in different places. The objective of this study is to show how blockchain can be used to solve social issues in the fashion SC by creating a guideline of how it can be implemented in the Brazilian fashion SC, using a successful case study to support the theory behind it. The purpose of this study is to deeply explore how blockchain can be applied to solve the issue of precarious work conditions in the fashion industry by using traceability to hold companies accountable for their actions and decisions. It was selected a case study that elaborated an app that uses blockchain to have a daily audit for the brand, suppliers, and seamstresses. The research analyzed the content of the data acquired by the archival documents and interviews for a deeper understanding of the case. It was found that the literature regarding the subject fits into the practical use of the technology, and Blockchain is an effective tool to trace information throughout the SC. Furthermore, it was established a framework with the main points regarding benefits, usability, challenges, and improvements that organizations interested in implement this project may find useful to guide them through the adoption of it.

Keywords: Blockchain, Traceability, Fashion Industry, Work Conditions, Social Issues

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1. Introduction

Slavery has a long history coming from officially legal practice in the past to a current criminalized activity of the informal and it has a controversial and hard to detail, for its ambiguous nature that englobes more than just economic ventures (Clark et al., 2019). While its activities increase, it is more and more difficult to come up with a straightforward solution to solve the problem itself. That occurs because it is difficult to face an issue that is hidden in places where legal standards protect them (Broad & Turnbull, 2019). Not everything legal is going to be ethical. Adding to it, it is not a topic that is going to be evident in any company, there will be a lot of policies and influential discourses behind it (Broad & Turnbull, 2019). Unfortunately, the informal economy is where modern slavery has more chances to occur, but extending labor rights, strengthening rules and policies, and have an enforced way to monitor it can prevent and protect workers to be explored (International Labor Organization & Walk Free Foundation, 2017).

Modern slavery is not only when a person works without payment. While it can be an unpaid job, it can be simply a limited financial (or not) remuneration, or dehumanization and restriction of freedom (Clark et al., 2019). Due to the divided reception of human rights orientation, many places do not have a clear policy to identify, control, and prevent unfair work practices (Broad & Turnbull, 2019). There must be a system that will enable the possibility to inspect supply chain management and also be effective to identify victims of modern slavery and unfair work practices (International Labor Organization & Walk Free Foundation, 2017).

A supply chain can be described as the whole process of developing, manufacturing, and distributing products from suppliers to end consumers (Azzi et al., 2019). In the fashion industry, the negative impact on social and environmental issues has been a

source of criticism for long. Impacts range from environmental issues such as pollution to social issues, such as worker exploitation and child labor (Rafi-Ul-Shan et al., 2018). Forced labor, precarious work conditions, poor wages, excessive hours, and unsafe structures, are some of the few issues workers in the fashion industry face still to this day (Sustain Your Style, 2013). All of these indicators being hard to track and control, it gives space for a new tool to arise and try to improve a serious problem that is known for a long time, but still lacks in useful frameworks to monitored. In a time when sustainability is gaining more space for discussions in the academic field, social issues are particularly recognized and acknowledged as fundamental within the fashion industry (Gold et al., 2015). The diagram below illustrates the main particularities of the fashion SC.

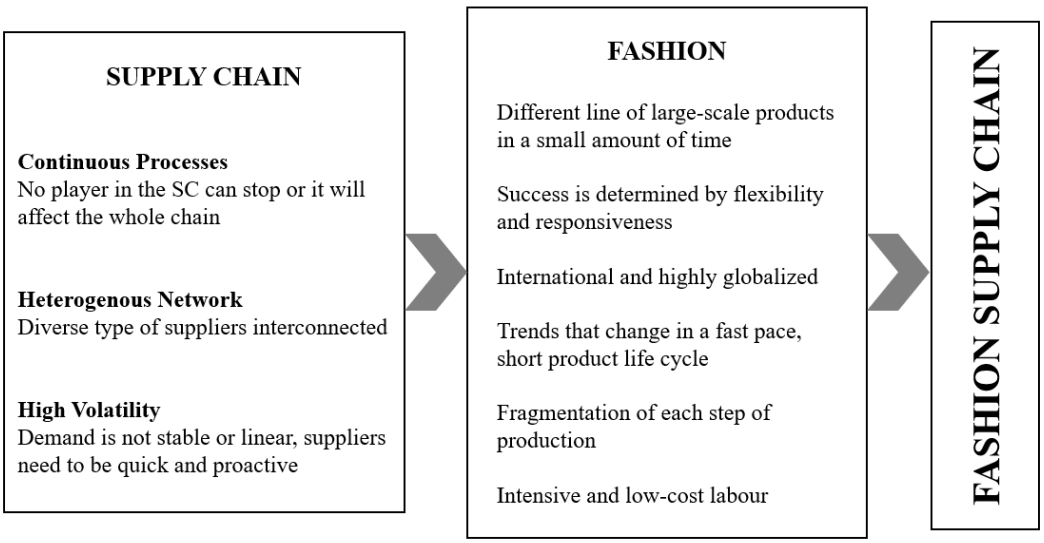

Figure 1: Fashion Supply Chain Diagram

Source: Author

This pressure comes from stakeholders and NGOs and it is the main reason why companies engage themselves in measures and policies regarding environmental and social risks (Freise & Seuring, 2015). On the one hand, a recent literature review shows some of the key problems that need to be solved (Yawar & Seuring, 2017). Besides the fact that different stakeholders pressure for different priorities, social and working

standards are a sensitive issue in global supply chains as what can be defined as legal in one country can be considered modern slavery (Gold et al., 2015).

Social dimensions are also taken into consideration when assessing a companies' performance in supply chains, and this discipline is labeled as sustainable supply chain management (SSCM) (Touboulic & Walker, 2015). The development of sustainability has been in the spotlight, which results not only in economic growth but also in social and environmental issues gaining space outside the organization limit (Marshall et al., 2015). Companies are more conscious about the challenges of managing a complex supply chain, which is why they are more focused on developing new practices to fix the unethical and unsustainable aspects of their business (Touboulic & Walker, 2015).

Studies show that SSCM has a positive impact on performance regarding the environment (Tachizawa & Wong, 2015). Being a high complexity relationship, creating collaborative relationships is hard to develop and trust is difficult to be earned (Touboulic & Walker, 2015). There is a unique value that organizations can assemble only by being collaborative (Touboulic & Walker, 2015). Plus, it must also use some kind of code of conduct that all suppliers in a supply chain should follow. Corporate social responsibility (CSR) ensures governance in supply chains when inserted in a complex scenario of different forms of regulations and labor law (Perry et al., 2015). In order to gain a competitive advantage using CSR as a strategy, firms must realize that it goes beyond just results in profits, but a way to connect with partners to reconcile social and environmental goals (Perry et al., 2015).

As new tools arise to help different aspects of SSCM, it is important to understand their full potential and how they could help to improve the current system (Treiblmaier, 2018). There is a need to boost transparency and traceability into the manufacturing supply chain (Azzi et al., 2019). Having a tag that gives the consumer the power to see

how a product was made and what type of companies are involved can change the modern slavery scenario since they will refuse to buy any product that was made in this context. Thus, it gives the consumer confidence about their choices (Kraisintu & Zhang, 2011).

Having a more trustworthy, authentic, and transparent character, blockchain is proposed to improve traceability in the supply chain (Azzi et al., 2019). This new technology is a network of multiple nodes in which tons of information that records and shares all data and transactions that occur in the network, which will be validated somehow to be added into the block (Azzi et al., 2019). Additionally, it has transparency, reliability, and invariability as its properties, which helps secure recording transactions resulting in an excellent choice for companies that want to share the history of their product (Baralla et al., 2019). Reducing errors, fraud, and delays to identify issues in the supply chain, blockchain has great potential to increase trust between not only consumers and suppliers, but also suppliers to suppliers through the whole ecosystem (Azzi et al., 2019).

Blockchain permits the SC managers to have a way to track and trace transactions within their operations, being secure, resistant to outages, and transparent (Härting et al., 2020). Although it can be seen as an asset, the tool also presents some challenges to overcome. As stated by Jardim et al., (2020), some of them are: The acceptance of the whole SC in participating using the tool; the brands must have some sort of influence and provide assistance in the implementation process; and, though blockchain helps to create trust between different parties, it also may be a challenge to trust that your partner will use it properly. Aslam et al. (2021) show the benefits to adopt blockchain as a tool to improve the flow of information and highlight that the textile and clothing industry are a good example of areas that need traceability as there are information problems and low visibility.

The purpose of this study is to deeply explore how blockchain can be applied to solve the issue of precarious work conditions in the fashion industry by using traceability to hold companies accountable for their actions and decisions. There is a need to explore the process of using blockchain as a key tool to make companies more sustainable. Blockchain can be a tool to provide a transparent and reliable platform that will be useful to all actors in the supply chain (Baralla et al., 2019).

This research is important because there is an urgency in bringing even more awareness to a social issue that, despite being known for a long time it still openly exists, and presents a possible beginning of a solution that can change the current scenario. Furthermore, there are some studies about using traceability and blockchain in the supply chain, but it lacks information about how it can help real-life businesses and the practical benefits and challenges. To conclude, the literature shows an opportunity to explore the postadoption of blockchain and the implications of it (Pournader et al., 2020). That is why in this study there are going to be case studies of a project that uses blockchain in different ways to improve work conditions.

2. Literature Review

2.1. Corporate Sustainability

Corporate Sustainability awareness has been growing in the supply chain business for some time. From a secondary topic to a compelling new trend in the SCM literature, sustainability has gained its share in the sector (Carter & Washispack, 2018). It is known that environmental issues ought to be a concern for the industrial society, both in practice and research (Martell, 1994). Becoming more relevant each day, there is a social movement with the sole goal of attempting to highlight the importance of being

sustainable. Reducing consumption levels and changes in society's values are key aspects that must change in order to achieve the common interest (Martell, 1994).

Changing the status quo of the industry is not easy or fast to do. Modifications and developments come with a lot of research and time to introduce adjustments without breaking productivity and damaging businesses. Furthermore, sustainability requires diverse engagement and decisions to be made concerning countless aspects of a company. Some examples are not only technical decisions about the choice of technology, energy, and water usage, and forms of production but also acknowledge the importance of resource extraction, recognition of the need for certain restrictions on growth, and awareness of the pollution made by its activities (Martell, 1994).

In this context, the Triple Bottom Line (TBL) arises as a guideline for the sustainable impact of a company as a whole. This framework aims to measure the economic, social, and environmental performance of a corporation over a certain period of time, and by perceiving the relevance of taking into consideration these three aspects, the TBL contemplates the full cost involved and impact of a company (Elkington, 2018).

Though a nice start, it is essential to be aware of how any sustainable framework will easily not be enough since they lack pace and scale to make a significant change (Elkington, 2018). However, being able to measure the impact a corporation has is important to be able to begin a new conscious. By keeping track of the environmental repercussions of a business, the usage of resources and disposal of waste can be improved. By all means, CSR's research shows that companies must have a responsibility that goes beyond only the economic e legal requirements, they must be aware of the need to address more than just the needs of the firm (Perry et al., 2015). Plus, by improving the aspect above, a company can reduce costs and invest in new opportunities which will create new economic value. Lastly, by engaging in sustainable arrangements, companies will also be

able to cut down their risks. More than just turning a brand image green, stakeholders must consider making the supply chain more sustainable as well (Schmidt et al., 2017).

By definition, CSR is a way to ensure the commitment of partners to share the same ethical structure of a business as a whole and contribute to its economic development, affecting not only the life of an employee but also society in general (Perry et al., 2015). Social issues, though many times being set aside for the difficult to measure and control, are a big topic to explore with opportunities for improvement. In light of this fact, there must be some regulator that is unbiased to hold the firms responsible for the actions (Stevenson & Cole, 2018). Summing up, there will always be a trade-off when talking about the challenge of being profitable but also improve your CSR policies, so there is an equilibrium to balance in a network that is introduced in a highly complex and competitive setting (Perry et al., 2015).

2.2. Modern Slavery as a Key Social Issue

According to the newspaper (Guardian, 2020), when talking about slavery, it is common to think of a practice of the past that does not happen anymore. However, there are more enslaved today than in any other period, it is estimated that up to 40.3 million people in the world are living in some sort of modern slavery condition (Hodal, 2020). This new concept is considered when a person is forced to work against their own choice, or when they are controlled or owned by an employer, or even if they have limited access to freedom, treated as commodities, or are dehumanized according to Anti-slavery Org (2020). Moreover, the concept of modern slavery has many different degrees of variability, with a large range of faces of human exploitation, which is why there is a lack of theoretical insights about this matter (Clark et al., 2019).

The economical state of a country is the prime characteristic of the establishment of slavery and how it can rise and fall, but it is a structural feature of capitalism and free trade (Munger & Holcombe, 1995). Slaves have as key traits the lack of awareness, education, and usually, they are unemployment, adding to that, poverty is the crucial point that enables this type of practice to happen because when there are no opportunities, even a situation like this is viewed as the best option for a family (Clark et al., 2019).

Modern slavery is not only being forced to work against your will or not being paid a fair wage, it goes beyond human trafficking, slavery itself, and domestic servitude. This kind of subjective point about what to consider modern slavery or not is where companies normally take advantage to explore. Depending on the location, law enforcement regarding work conditions is different than the basic human rights, lacking in a lot of opportunities to improve and combat social issues in general (Broad & Turnbull, 2019). In light of the difficulty to measure and come up with a universal law, it is very hard to define and even find information about these types of jobs (Broad & Turnbull, 2019). Even so, one universal rule for all is also not going to help to solve the cases, it has to be taken into consideration that each country has its reality, and what can work for one place it will not necessarily work in the other. Being a complex issue, modern slavery has a lot of diverse and inconsistent frameworks to address the problem, though with no absolute positive response (Broad & Turnbull, 2019).

Another key challenge when debating modern slavery is that it often is associated with the matter of working conditions and the notion that all employees in the industrial capitalism are “wage slaves” (Clark et al., 2019). The way slavery is unfolded is strongly related to how some perpetrators act toward social and cultural systems (Clark et al., 2019). To be able to end modern slavery, it will be necessary to have a response that can be customizable to address multi-faceted problems and that it will be regulating diverse

measures, such as economy, cultural and social background, and legal issues. There is no "one-size-fits-all" solution, that is why the need for a tool that can be adept for each reality (International Labor Organization & Walk Free Foundation, 2017).

Studies have shown that firms that are closer to the final consumer are the ones that have greater advantages related to its performance when speaking about sustainability (Schmidt et al., 2017). Companies that do not necessarily sell directly to consumers are more likely to have less care about these issues because it does not affect them so much. That is why in the logistics sector, the supply chain in specific, it has so many cases about improper work conditions. Being scattered all around the globe, SC has a highly complex system in having a close relationship with suppliers, which is the reason why a price-based relation is common in this sector, and englobing all nodes in a goal to work together is a great issue. (Marques et al., 2020). To achieve a successful result of any goals to improve social issues in the supply chain, there must be an antecedent of trust and commitment, that would require collaborative efforts and development of new strategies to enhance the supply chain performance (Yawar & Seuring, 2017).

2.3. Sustainable Supply Chain Management

As defined by Pfohl H, Ko¨hler H (2010), "Supply chain risks involve risks that can be attributed to disturbance of flow within the goods, information, and financial network, as well as the social and institutional networks. They might have negative effects on the goal achievement of single companies and the whole supply chain, respectively, with regard to end customer value, costs, time, or quality". Needless to say of the importance to reduce the risks in a supply chain to work properly and not impact in any role. Companies must understand that to avoid any disruption in the business, they should

integrate sustainability into their strategy and ensure viability and continuity in the whole chain (Rafi-Ul-Shan et al., 2018).

According to Carter and Rogers (2008), SSCM is the "strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains". In an industry with so many steps and complex processes inside the supply chain, there normally is a huge quantity of suppliers in a company's production. To ensure the company's standards are being respected throughout the supply chain, it is fundamental to have policies in case any misconduct is noted (Freise & Seuring, 2015).

Being socially sustainable can be challenging if a firm has to make sure all tiers of its supply chain respect their values and conduct themselves in the stipulated ethical contract (Busse et al., 2017). Not only that, but companies need to construct sustainable goals that will endure and have a substantial change in the scenario (Busse et al., 2017). Fashion supply chains have high complexity because it is common to have many tiers and be geographically broad. Disruptions in business to sustainable issues are commonly due to be about the supply chain for this reason (Rafi-Ul-Shan et al., 2018). It is paramount to keep control through all the chain, since the material, passing through all suppliers and to the end consumer (Freise & Seuring, 2015).

Yet, it is almost impossible to build a strong commitment and trust if a company has a large number of suppliers, who may have their suppliers as well, produce on a large scale and outsource their productions to a different company. The most difficult part is keeping track of all your supply chain activity, which requires significant ties of collaboration in the SC. A key aspect that is needed in SC relationship is trust between

the partners, to look forward to collaboration and not only compliance, which means a relationship that is relying purely on power (Touboulic & Walker, 2015).

Being able to diffuse the knowledge a company has to its network of suppliers can be a strategic capability to a sustainable supply chain (Marques et al., 2020). Partnerships and a strong form of collaboration is the most advantageous way to conduct the business, as shown in SSCM research. Focusing on this thread of thought, intense collaboration is extremely necessary to achieve sustainable goals and balance the trade-offs for there is no firm that has full expertise in every subject (Marques, 2019). Differently of compliance that has a negative perception and is associated with coercive approaches (Touboulic & Walker, 2015). Though it is known that formal mechanisms are not appropriate to influence tiers in the SC because it can make them barely reach for the minimum necessary when adding an informal type of accord in a collaborative environment can motivate suppliers to do better and achieve greater goals (Tachizawa & Wong, 2015). Because of the dependent aspect of the relationships, there can be seen different types of influence of distinct organizations in the same SC. Some smaller firms can rely significantly on another, and this must be revised to be able to build some new opportunities to approach the sustainability issues in the business overview (Touboulic & Walker, 2015).

Supply chain sustainability can be seen as a change of idealization of a company and its network with its suppliers (Marshall et al., 2015). Cooperation might be seen as a tool to reduce the environmental impact of your business while maintaining the competitiveness of the market (Touboulic & Walker, 2015). To define the type of relationship, it is important to understand all the players in the network. Research shows that corporate environmental engagement in all tiers of the supply chain means a lot for a company (Schmidt et al., 2017)**.** What some studies may not consider but it must be

taken into account is that the final consumer is still part of the supply chain, which means they should have access to the network itself (Schmidt et al., 2017). Moreover, when operating B2B, companies tend to not have a popular brand among final consumers, which causa them to be distant and have low engagement in sustainable practices (Foerstl et al., 2015).

Having an effective SSCM means that a firm also needs to be able to control the uncertainty conditions of supply chains, which can result in setting limits of what type and quantity of uncertainty a supplier's data can bring into a report (Busse et al., 2017). Uncertainty in the SC may come from the difficulty to process information about green practices (Busse et al., 2017). How companies may manage and process information about their environmental issues is a key challenge to address to accomplish SSCM (Busse et al., 2017). The way information is handled is very important to achieve the goals a company sets up for its suppliers. They should be aware of the need to be able to process it all or to reduce the data input they receive (Busse et al., 2017). It is only possible to have this information if the company truly commits to adopting this approach and take into consideration all its tiers and historical data to understand their historical data and prepare SSCM tools and methodologies. A precedent presents green practices and collaboration as ways to gain higher benefits with suppliers and they are directly related to competitiveness and economic performance as well (Touboulic & Walker, 2015).

According to Estrada (2020), discussing the costs to run an economic system is known as Transaction Cost. This concept can be important when talking about monitoring, traceability, and collaboration because a firm can only grow until the limit of its capacity to keep the costs of an additional transaction. By all means, a firm can only embrace a certain type of project and approach with it has the resources to do it. For that reason, that is evidence that shows that data collection technologies may reduce cost, risk

opportunities, and efforts to build relationships and turning performance monitoring simpler (Rosemberg, 2019). All in all, having a higher level of management in the supply chain will reduce the costs of coordination (Estrada, 2020).

Studies show that depending on how much a company disclosure its information, it should aim to be either Transparent (strong zero tolerance for breaking the code of conduct) or Ethical Leaders (True leaders that not only make sure their operations are doing more than just the bare minimum but also being a role model for the market) (Stevenson & Cole, 2018). When a scandal is brought out into the light, big companies often respond about how they cannot be held responsible for their suppliers' procedures, when in fact, by adding transparency policies can change this reality and eliminate this excuse (Busse et al., 2017). Companies must realize that what their suppliers' are doing is and ought to be their responsibility as well because of the negative weight it can add to the supply network (Marques et al., 2020).

Because of the easy way to get information and social media, some social problems are highlighted every now or then and require companies to take a position and change their operations (Yawar & Seuring, 2017). Being a pioneer to prioritize sustainability in the '90s, the fashion industry was put in the spotlight with a scandal involving Nike and child labor, which the company regretted at the time, but today, unfortunately, it is still possible to see that this kind of activities still happens in the sector (Khurana & Ricchetti, 2016). Many initiatives and NGOs try to inform consumers about a large number of denunciations about the dark side of the industry that makes a great negative impact on social issues (Moretto et al., 2018). The globalization of it turned the fashion supply chain complex, and over the years, it collected a long history of issues concerning work safety, labor standards ad condition that is always being confronted when a new scandal come into the news (Khurana & Ricchetti, 2016). Moreover, fashion

SC is all based in fragmented suppliers located in low labor cost countries, which are normally on the edge of what is acceptable on social regulations and makes it important to bring awareness of this matter (Moretto et al., 2018).

2.4. Modern Slavery in Fashion Supply Chains

The Fashion Industry is projected to have a net worth value of 1.5 trillion US dollars in 2020, and every year, there is a demand of 80 billion articles of clothing to be produced for the consumers (Style, 2020). These numbers have been growing at a fast pace in the last 15 years, with the change in the availability of cheap and trending clothing. The need to decrease the time in production to be able to respond to the fast trends in the market, altogether with the outsourcing of production to have the lower price in labor and higher profits can be observed in the industry (Rafi-Ul-Shan et al., 2018). The product journey is where the uncertainty of the supply chain is the major issue. Knowledge about how the product is made and its place of origin is highly needed to control risks (Azzi et al., 2019). Defined as a system that ensures the quality of goods through all the moving process includes not only the organization but also pieces of information, people and resources, the supply chain is a complex mechanism due to its high number of intermediaries from the raw material to the final consumer (Azzi et al., 2019).

The exponential growth is the new trend in the market that produces more than 400% more clothes than 20 years ago is a characteristic of Fast Fashion, a new trend that has a distinct feature of the nonstop development of new products and the need to engage the consumer to always buy more (Rafi-Ul-Shan et al., 2018). Short product life cycle, high and fast demand, low predictability, and high impulse buying are the main characteristics that make the fashion supply chain difficult to manage (Rafi-Ul-Shan et al., 2018). As a result, clothes are becoming an article easy to be thrown out and being

replaced, which is the reason why a lot of the articles are bought, used only once or a few times and, when their trend is dead, discarded to make room for new items.

Exploring this prospect, the fashion industry itself has a long list of wrongdoings on its manufacturing processes that once in a while calls attention. There are a large number of reports about the conditions of workers in the supply chain, as well as environmental and ethical issues through all the production processes (Freise & Seuring, 2015). Undoubtedly, it is fair to understand the reason behind it. Being a low-tech and labor-intensive manufacturing product, the clothing industry has a low barrier to entry of new suppliers and competitiveness (Rafi-Ul-Shan et al., 2018). Developing countries have a competitive advantage in the manufacturing market because of these characteristics as well (Perry et al., 2015). Companies add more geographically complexity into their supply chains to be able to have lower costs. So, the productions of the apparel goods are made in countries with questionable workers' rights, which means they are limited or even do not exist at all (Sustain Your Style Report, 2013). Consequently, some of them change the location regularly to exploit cheaper labor (Get Green Now, 2020).

Companies must be aware of the importance of acting on sustainable matters so they can avoid negative backlash, competitive disadvantage, and keep a positive image to their stakeholders (Freise & Seuring, 2015). Worker conditions in the fashion industry should be an important topic to explore, taking into consideration the dimension of the industry, the economic importance, and the rapid growth of the segment. Although there is a lot of data about the subject, there is a lack of effective actions to improve it. Outsourcing the manufacturing activities of a company may be a strategy to have more profits, but it also reduces visibility and control over all your SC, which results in a highly complex network (Perry et al., 2015).

Child labor, safety issues, forced labor, and low minimum wages are problematic points that are unacceptable in any workplace but can be associated with the clothing industry (Freise & Seuring, 2015). The most common matter that is known for most people is the low payment for the workers and their inadmissible working hours. There is a difference between living wage, the minimum necessary for a family to be able to live, and minimum wage, legally lowest amount to pay your employee (Sustain Your Style, 2013). People buy the clothing pieces mostly in a different place that the product is produced (Gold et al., 2015). In this way, it is clear to understand how consumers lack the awareness of how they are produced. For this reason, most consumers are more aware of hazardous substances in textiles than of work issues of the industry (Freise & Seuring, 2015).

Beyond that, health and safety conditions are also unreliable. Most employees have to work in buildings with no structure to secure employee's well being and are constantly exposed to toxic material (Sustain Your Style, 2013). Plus, there is also forced labor, which refers to a person who is coerced to work through violence, debt, retention of documents, or other reasons according to the a NGO report (ILO, 2020). Moreover, restriction of freedom of association also guarantees the industry to take advantage of the workers, given the lack of unions to defend their rights (Style, 2020). To conclude, it is difficult to verify the scale of this type of work conditions, but it is widely known that its existence is widespread (New, 2015).

According to Marques, 2019), having a low-rank performance in transparency in the public and private sector, Brazil legislation characterizes slavery as forced labor, exhaustive work hours, and degrading conditions. Focusing on the Brazilian reality, in the past 15 years, it is estimated that more than 35,000 people in the country were rescued from bad work conditions or that fit in the modern slavery concept. Though a significant

number, 600 of them went back to similar circumstances after that. Trying to give consumers better assessment and holding companies accountable for their actions, the late Brazilian Ministry of Labor created the “Lista Suja do Trabalho Escravo”, which is a list of companies that have conditions analogous to slavery in their production.

That is why modern slavery must be recognized as more than just an external which firms have to address, it ought to be part of a constituted system that would never be allowed it to happen (New, 2015). One way to achieve this goal is to enhancing transparency, accomplishing accountability, building partnerships that share the same values and others would some of these responsibilities would be a path to improve this reality (Raja Shree & Abi Shek, 2018).

Corporate social responsibility creates an opportunity to gain some advantages with the public, enhancing ethics into the business (Raja Shree & Abi Shek, 2018). Improving the performance of the social responsibility of a company means, in the supply chain management, to build a relationship with all the providers and suppliers to guarantee a wider approach (Raja Shree & Abi Shek, 2018). Corporate social responsibility upgrades standards and highlights the future of an organization to new opportunities (Raja Shree & Abi Shek, 2018).

Thinking on this side, many companies are changing their strategy, and focusing their strategy on sustainability, taking part in social initiatives (Sodhi & Tang, 2019). Even though firms may spend millions of dollars on social actions for compliance, issues keep surfacing now and then (Asif, 2020). The struggle of some organizations to implement their standard plans to address sustainability must be taken into consideration, companies have institutional problems like antecedents that keep them from achieving the result wanted (Asif, 2020).

When speaking the fashion manufacturing industry, applying CSR measures often means using codes of conduct and audits to make suppliers responsible for their practices (Perry et al., 2015). Companies should elaborate on social standards to provide a tool for measuring their processes' impact and manage requirements that are further than domestic regulations (Asif, 2020). Research shows that the effect of how a company's positioning regarding how they manage their networks is still vague and with no clear understanding of it (Marques et al., 2020). To be able to detect illegal practices of suppliers, companies must use a collaborative approach and define a set of regulations (Stevenson & Cole, 2018). When a company disclosure its suppliers and its processes to the public, it is enabling accountability, which can make them guilt by association (Sodhi & Tang, 2019)

Furthermore, it is important to keep a close relationship with suppliers since adopting social-environmental standards can be costly to suppliers (Asif, 2020). Moreover, companies are being held responsible not only by their actions but also their suppliers and subsuppliers (Stevenson & Cole, 2018). So it is interesting for a firm to aid and support a supplier to improve their social environmental compliance, not only will make their relationship stronger and reliable, but also will result in the supplier's goodwill and desire to bring benefits for them (Asif, 2020). Building a trustworthy long-term network with suppliers will help to disseminate knowledge among them (Marques et al., 2020).

2.5. Modern Slavery Traceability in Supply Chains

Even though there is a rising number of companies disclosing the provenance of their production, it must be highlighted that this trend can be expensive and benefits are still unclear (Sodhi & Tang, 2019). There is a difference between supply chain visibility

and supply chain transparency. The first is related to the effort of a manager to gather information about upstream and downstream operations in the supply chain. The latter means the disclosing information of the company is for the public, including investors and consumers, about the upstream and the products they sell (Sodhi & Tang, 2019). While supply chain visibility is necessary to avoid any disruptions in the upstream and downstream of their operations, supply chain transparency's importance is becoming a pressing point for post-consumer waste and sustainability (Sodhi & Tang, 2019). Traceability is a tool used by a company to gain visibility about the provenance of their resources (Sodhi & Tang, 2019).

Traceability in the supply chain is all about the ability to trace back the path of the materials used to manufacture a product (Sodhi & Tang, 2019). Traceability allows not only monitoring the effectiveness of production and logistics but also can improve consumer trust and confidence in a brand (Baralla et al., 2019). Providing information about the origin, the processes, shipment, and retail of a certain product, traceability is needed in the supply chain to ensure the quality of a product and how it was manufactured (Baralla et al., 2019). Traceability enables transparency and accountability, which will build up the supply chain social responsibility (Raja Shree & Abi Shek, 2018).

It can also help to solve social issues because it can answer the question of "what/when/where" and tracking all the social conditions of suppliers of different tiers (Pournader et al., 2020). Social issues can have a traceability system that consumers could use to collect useful information about the products they acquired, its provenance, and quality as well. It also reduces problems with suppliers that do not comply with regulatory requirements, which decreases risk for companies that have many ties in their supply chains and make suppliers more careful about their practices (Kraisintu & Zhang, 2011).

Going deeper into the research, there some main features that traceability can give to the supply chain that can help social issues in it.

Though the benefits of adding traceability in the SC is above, it must be highlighted the risks regarding this approach as well, i.e. consumers may not respond well to the information disclosure, which is possible risks to the business supply chain regarding losing competitive advantage and also it might be costly to have a tool to gather this kind of information (Sodhi & Tang, 2019). Some points are important to take into consideration before adopting this business positioning. There is no telling how information disclosure should be done which means that it is a field with diverse statements and studies considering this subject (Stevenson & Cole, 2018). On one hand, it can be differentiation to your competitors, on the other it can also be an overload of information.

Nonetheless improving the value-adding activities and processes is the main base to achieve a good traceability performance, when discussing social issues, traceability has some barriers to overcome. Contrary to environmental problems, that can be measured and have a universal understanding of what is acceptable or not, social problems are hard to pinpoint (Kraisintu & Zhang, 2011). For this reason, traceability would only enable a way to reduce, prevent, and control occurrences disclosed by companies.

In order to incentivize producers to get a better perspective of all the actions through the whole system, the supply chain must facilitate transparency (Azzi et al., 2019). For its complexity that has a mix of different activities in different stages and logistics, the supply chain has a set of connections through the surge of raw material to the final delivery to the final buyer (Raja Shree & Abi Shek, 2018). By improving the tracking system, traceability can minimize bad quality and unsafe productions (Azzi et al., 2019).

As Yawar & Seuring (2018) discuss in their research, there are a couple of indicators that need to be observed to improve social issues. To better visualization, social issues are listed in the image 2 below.

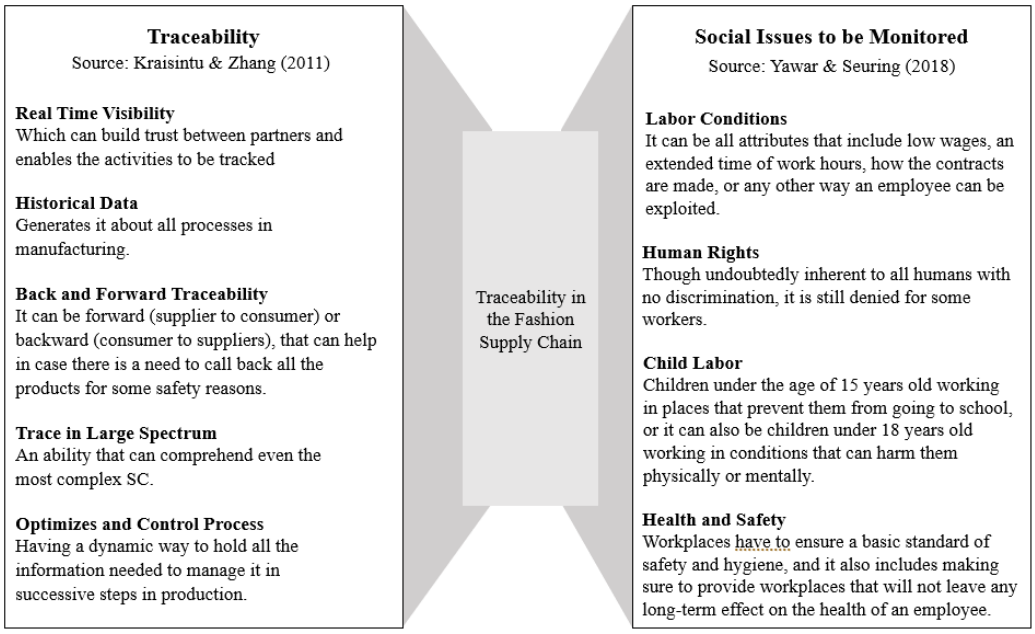

Figure 2: Traceability in the Fashion Supply Chain

Developing new forms to inspect supplier practices is one key benefit of improving the supply chain's visibility and control the indicators above (Sodhi & Tang, 2019). Generally, companies have stronger control over tier-one suppliers and make it into their responsibility to manage the sub-suppliers, which is why there can be many risks and lack of information in this dynamic (Stevenson & Cole, 2018).

One possibility that could help collaboration and also improve sustainable performance is having a tool to assess suppliers throughout the SC using traceability, even though that alone will not suffice, as the implementation and investment of collaborative practices are paramount (Touboulic & Walker, 2015). Having a collaborative environment will reduce costs from the company and the supplier considering that a reciprocal commitment between all elements in the SC will enforce the compliance approach (Marques et al., 2020). Having an open collaborative ecosystem in the SC may

give smaller suppliers the courage they need to share their problems and struggles, aside from helping disseminate their strategy towards sustainability (Touboulic & Walker, 2015).

The only way to know if sustainable initiatives can succeed or fail is to endorse a mechanism to manage the SC, it could even be formal or informal tools (Tachizawa & Wong, 2015). The difference between the system and technologies used in a collaborative SSCM can be the main challenge since it makes it hard to work with different standards but with the same goals (Touboulic & Walker, 2015). Summing up, Table 1 shows the main information about traceability can be seen below.

Table 1: Traceability Overview

Traceability Overview	
What it is?	"The ability to discover information about where and how a product was made; the ability to find or follow something" (Dictionary, 2020)
How does it work?	It needs to have calibration to overcome some bias Being identify since the raw material, it can lead the map of the whole production and processes the goods go through Accurate information based on tracking a data Monitor if suppliers are following the standard regulations
What is important regarding social issues?	To gain visibility about the provenance of products Give consumers a tool that allows them to make a conscious decision Ability to answer the questions about "who/what/where" things were made

Source: Yawar & Seuring (2018) and Touboulic & Walker (2015)

2.6. Blockchain's Potential for Traceability in Supply Chains

Accurate data collection and a secure way to store the specific data are paramount requirements to attain transparency, which could be very demanding in a reality that is full of third parties with all the information centralized in only one place (Azzi et al., 2019). Blockchain emerges in the scenario with a differential that can disrupt the sector, created in the financial world and it brought with itself security, transparency, and immutability (Azzi et al., 2019). That is why it can address the need for transparency and

traceability in the textile industry (Rusinek et al., 2018). Blockchain is a non-centralized database in a structure of “chain of blocks” of public or private records which has as key characteristics: Reliability, being almost impossible to fraud; Traceability, each step of the process is recorded in one block and people can have all the information about an object using this technology; Authenticity of information, the person responsible to verify the information that is upload into the system has no bias and is as much impartial as possible.

Each block contains one head, with a set of rules to be followed to be validated, and a body, that has all the transactions and information about different stages of the process in which the object suffers, with date and time registered and also store the information about who is participating using a unique signature. The Genesis block is the first one. After that, each block contains the information necessary to be approved by the mining process turning the whole process secure and distributed (Azzi et al., 2019). It is important to understand that all nodes are authenticated before joining the network by a certificate authority (Azzi et al., 2019).

Blockchain can be permission-less, open distributed ledger in which any node can join the network and there is no need for authentication from a central agency, or permissioned, controlled distributed ledger in which the validation of data is controlled by an agency (Azzi et al., 2019). If the objective is to gain the consumer’s trust, there are indicators that the permissionless blockchain is ideal in this perspective, since the permissioned blockchain can give control, but also a sense of doubt about what information is allowed or not (Baralla et al., 2019). As soon as an approval transaction occurs, it has to be verified by the aide of the network of computers. Once stored in a block, the information inside cannot be changed.

Some benefits that can be seen are the creation of a more transparent and accurate end-to-end tracking, built of trust between suppliers and consumers, facilitating to keep in track with all parties in the supply chain, and reducing some barriers and paperwork (Azzi et al., 2019). One important detail is that sometimes there is information about where the good comes from, but because they are difficult to check, it is not necessarily accurate (Baralla et al., 2019). On the whole, it is necessary to have a way to identify the provenance of certain goods, but in order to keep it reliable, there is a need for a system that is unmodifiable and certificates transparency in the chain of production (Baralla et al., 2019).

To inspect a supply network performance, there can be two different approaches: Monitoring, which is auditing suppliers and applies tools as questionaries to make sure of the compliance; and Collaboration, though not as formal as the former, it builds a closer relationship with suppliers and englobes training and development of new processes (Tachizawa et al, 2010). It is argued that monitoring and keep tight control over suppliers is not enough to ensure compliance with environmental standards in a SSCM (Tachizawa & Wong, 2015). In a collaboration environment, coercive approaches will not stand and it will result in a negative impact, meanwhile in a non-coercive drive will work in both methodologies (Tachizawa et al, 2010). Coercive and strict relationships in the network may endanger the business because it can disincentivize suppliers and build mutual distrust between partners (Tachizawa et al, 2010). One challenge to keeping track of a supplier's performance is the need to have a tool that can disclosure real-time information about the processes (Handfield, 2016).

Using blockchain will enable consumers to gather information about a supplier's performance and compliance, as well as shape the node regarding its attitude and practices (Marques et al., 2020). Companies using this technology will have the ability to

implement traceability at a high level of transparency. Knowing that improving sustainable processes needs a collaborative effort in the whole network (Tachizawa et al, 2010), it is very important to act in the whole chain. All in all, as a network have diverse links and nodes, if something happens to one node can have a deep ramification through the whole network (Tachizawa & Wong, 2015).

For this sole reason, it is my belief that each node can become a block and blockchain can be used as a tool to improve performance in a sustainable supply chain. However, in order to truly state its importance and role in this scenario, there are a couple of questions that must be studied to fully explore and understand the power behind using this new technology to an old problem that is difficult to overcome. There must be evidence of how blockchain will disclosure and for who it will be working for. Aside from that, how can companies ensure that all suppliers are going to agree with changing the approach to add traceability to all tiers of the business? Even more, how do firms will know that the information that is inputted in the blocks are real e, not just a fake data to please them? Another question is what are the benefits and risks by indulging all networks in a more transparent environment? All these doubts should be answered by the end of this study, by taking a look at real initiatives that use this instrument.

When there is a lack of trust between a buyer and a supplier, it is uneasy to impose transparency in audits (Tachizawa & Wong, 2015). Blockchain can be seen as one of the most anticipated unbiased applications to improve social sustainability of companies and their partners (Pournader et al., 2020), because of the possibility to provide better human rights assurance and fair and safe work practices in general and also to reduce the chance of opportunistic behavior (Saberi et al., 2019). For all the research shows, blockchain will be much more effective to control and improve economic and environmental issues than social sustainability, the former will only be effective if combined with a proper incentive

system to motivate companies to have better social values to uphold (Saberi et al., 2019).

Below is a framework to sum up blockchain's concepts.

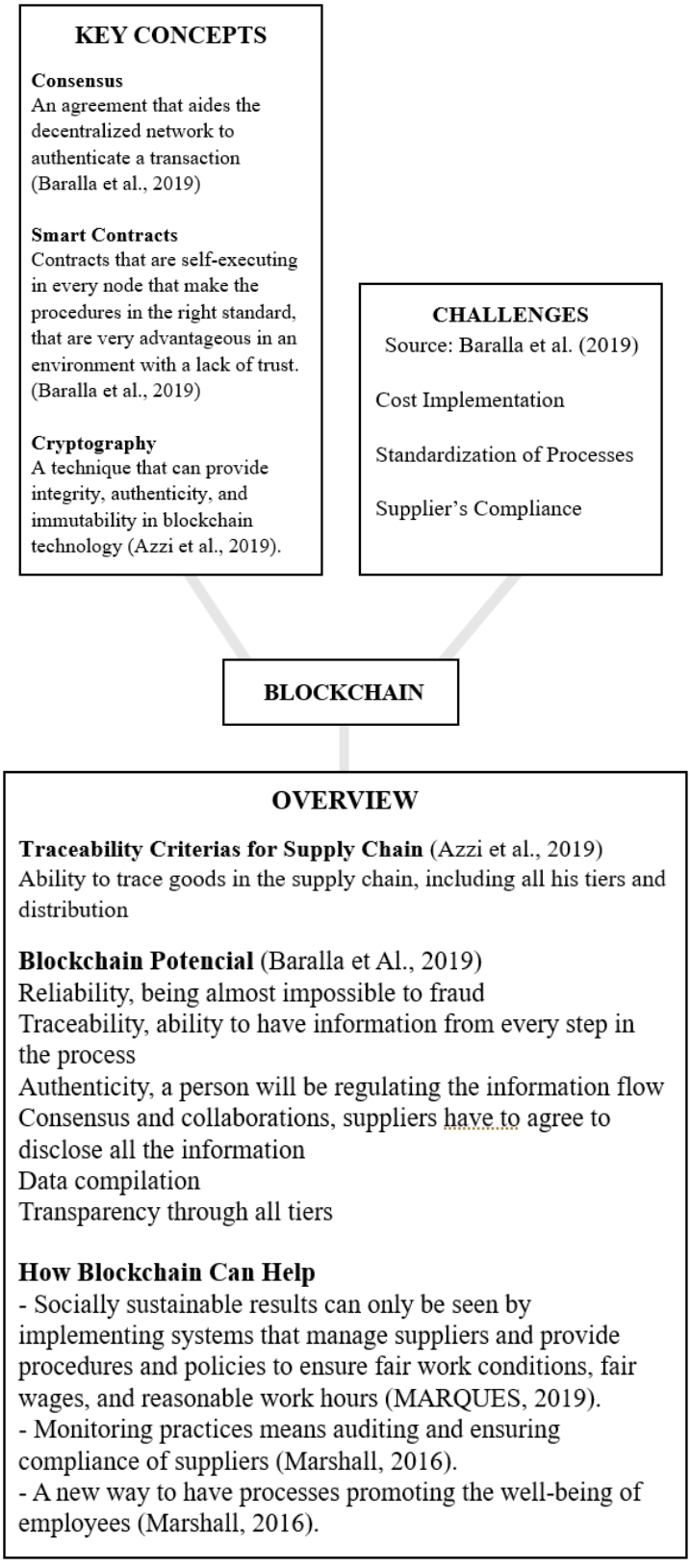

Figure 3: Blockchain framework

Social issues in supply chain management is not a topic matured and have yet to be better defined (Saberi et al., 2019). The reason behind it is because of how difficult is to measure social issues. Adopting blockchain will not change this scenario as a whole, given that social performance takes into consideration many immaterial and subjective traits, such as cultural context. Trying to create a universal measurement tool for social issues can be now sensitive and, worse, cannot improve and work in all different realities we have worldwide (Saberi et al., 2019). A challenge in implementing blockchain is regarding the immutability of the information once it is in the chain, which can make erroneous data irreversible (Pournader et al., 2020).

Implementing blockchain in SC practices improves the integration among all the actors in the SC which also enables an increase performance of it as well (Aslam et al., 2021). Traceability turned out to be a requirement for a multi-tier production (Agrawal et al., 2021) and as Jardim et al. (2020) states, Blockchain could be a sing source of information to report several parties in the SC. Härting et al. (2020) claims in his study that implementing blockchain in the SC has six different influences: trust, efficiency, costs, control, privacy and scalability, which turns the tool useful within the logistic sector. Overall, Blockcahin turns processes into automate ones in a holistic view of the business and it can reduce the bullwhip effect, aside from reducing cost overall (Jardim et al., 2020).

It can (Jardim et al., 2020). Traceability is the main feature to motivate SC managers to implemente the tool and smart contracts are a differential when applying blockchain in the SC, because they undoubtly promote transparency and data verifiability (Jardim et al., 2020).

There are some academic papers regarding blockchain in the supply chain management subject, but it still is scarce and does not contemplate the implementation and real-life examples of the usage of it (Pournader et al., 2020). The main focus of the literature on this specific topic is related to technology, trust, how it can be used to achieve traceability/transparency. However, there is a lack of academic research about cases in which blockchain is applied to solve social issues in the supply chain (Pournader et al., 2020).

To fully understand the real impact blockchain can have in the sector, it is essential to identify and keep up with companies that are using this technology and explore how this change happens and what are its results (Saberi et al., 2019). This study is about exploring what is traceability and how can it be applied in the fashion industry. The research question is: *How can traceability in the supply chain based on blockchain improve work conditions in the fashion industry?* Below, it can be seem in table 2 that best defines this study's objectives and main questions to answer to fill the gap in the literature review.

Table 2: Research Script

Research Framework	
Social Impact Measures	Highlight possible new tools to solve social issues Bring awareness about the importance of disclosing information and being transparent with consumers
Issues to be explored	Modern Slavery Real work conditions of employees in the fashion supply chain How traceability can help improve social issues Blockchain as a tool to improve social issues
Work Conditions Aspects	Working hours per day Wage per piece Infrastructure of workplace Access to basic needs such as water, toilet and
Reflections	How can traceability affects in the fashion supply chain? Is blockchain an asset when thinking about tools to improve work conditions? What is the impact a company can make by disclosing their data
	Real practices of blockchain in the fashion supply chain

What is going to be observed?	How is blockchain being used to explore how clothing pieces are being made What are the difficulties and challenges to be addressed What are the benefits of giving visibility by using blockchain What can be the next step to improve the current scenario
Questions to be made	Are there any smart contracts in the blockchain you use? Who can authorize the insertion of new information? How to implement this technology in suppliers? Is it expensive? Are the sewers and employees of suppliers able to give proper information? How can you guarantee it? How do you make sure the inputted information is genuine and not just for show? What type of suppliers and stores seek this new type of technology? What are the main benefits and challenges they have when implementing this tool? What is the main bias that can affect your business when dealing with the stores and suppliers? What are the requirements a store/supplier needs to have to affiliate? Aside from the data collected in the blockchain, is there any other measure you do to ensure the tool is being used correctly? What are the changes in a company you see when they disclosure all this data to the public? Have you had any response from consumers? Do they seek you out to find new stores? What is the direct and indirect cost to transition to this platform and to keep it running?

3. Research Method

3.1. Research Design

This research is qualitative study focused on one case study with the aim to compare and contrast the existing knowledge on SSCM, modern slavery and blockchain as a tool for traceability to the practical case. Thus, research has been done by collecting multiple sources of data by examining documents, newspapers, journals, and interviewing participants. The data analysis has allowed a holistic account of the problem. The qualitative research allowed to explore explanatory questions from the technical knowledge of implementing Blockchain to a SC up to the experience of all that were be affected by it (Creswell, 2013). Developing an understanding of how and why this tool

can be used to improve work conditions has been the main objective as a guideline to help future projects to implement the same resource.

According to Erthal et al. (2020), although there may be different nuances and issues to take into consideration, the choice of one case study helps to understand how such a tool was implemented and its results in a more particular matter, considering the context,the involved stakeholders such as the brands, suppliers, sewer workshops and NGOs, and the scenario in which these stakeholders are inserted. In line with Yin (2014), this research has taken into consideration the unique aspects of the case, without imposing standard questions focusing on closed answers. In line with Ketokivi & Choi (2014), this research has been based on transparency to allow readers to access the logic and the premises of a study. Still stated by the authors, this work can be labeled as case research and theory testing, where the main driver is theoretical deduction.

Because it was drawn from a work that proposes practical relationships with the theory, Edmondson & Mcmanus (2007) say that the study poses as an intermediate theory. In other words, after extensive research of the theories and concepts in articles and academic work already published, the main focus of this study is to highlight the connection between those concepts with the results of practical use of the theory. As for the primary method of data collection, Eisenhardt (1989) states that a primary methodology of data collection, such as an interview, and archival data, are protocols used for this type of research.

The fashion Supply chain is composed of many distinct actors. It is important to highlight that the focus group of the Fair Fashion project was the seamstresses. Though the project also gathers data about other players, they are a huge member of the fashion SC. Fair Fashion’s survey compiled data not only about them but also other vulnerable players in the SC. Because seamstresses are easy to be replaced and their job does not

require a specific skill, seamstresses often have to endure poor work conditions that are offered to them. Brands normally have several workshops producing their products, many of these workshops can even outsource some of that work. In light of these characteristics, it can be concluded that seamstresses play a major role in the manufacture of fashion products, but they do not have a space to give visibility for their reality.

Fair Fashion pilot project started in 2019 and had its final activities by the beginning of 2020. During this period, the project developed the app, analyzed the data of the focus group, and applied 60 surveys with the seamstresses of the workshops that participated in it. All the considerations in this specific study are after the project has been concluded. All the data collected in the project was used as secondary data to be complemented with interviews with the people that were part of the project. There were four people responsible to bring this project to life. Considering that one of them may cause some bias in the case study because of the close relationship with both, the project and this research, it was interviewed three people as a whole.

The secondary data available is all the historical data compiled during the project was still ongoing. It had information about meetings, benchmarks, survey responses, and more technical material that was uncovered to make the project develop the app. The survey that the Fair Fashion app applied to the seamstresses has information about their routine and work conditions and shows indicators that must be analyzed to assess the real picture of the scenario. The interviewers of this study were present in the project for its development, and the data acquired by their interviews are focused more on how they developed the tool and key points to guide the implementation of it.

3.2. Case Selection and Description

For the research to have a practical view, it ought to have a case study of some company or project in the Brazilian fashion industry that used Blockchain as a tool to gather information related to the work conditions in the supply chain. Fair Fashion was selected as a case study for being a project born in the institution COPPEAD and for the links and easy access for all the people involved. There were many data about it that was collected during the pilot project, but there was a need to explore futher to understand how it can fit alongside the academic theory available on the subject.

The leader of the project was COPPEAD Graduate School of Business, a public institution part of UFRJ (Universidade Federal do Rio de Janeiro) known worldwide for its excellence in education (COPPEAD, 2021). The original research team has developed the concepts and main objectives of the project driven by a demand from its brand partner, C&A Foundation. C&A is a major player in the fashion industry in Brazil (C&A, 2021a). Founded in 1841 in the Netherlands, it opened its first store in the country in 1976. Nonetheless, it was the first brand in Brazil to be concerned about sustainability, including the subject in their campaigns. Instituto C&A is an initiative of the brand that was born to invest in projects that can change the fashion industry globally. It supports innovative projects that aim to develop the fashion supply chain and make a significant change regarding sustainability (C&A, 2021b).

For the technological part, Blockforce was responsible for developing the technological part such as the app that utilizes blockchain to disclose the information. André Salem, Alexandre Brisolla, and Pedro Paulo Liz were the focal related to this sector. Blockforce is an organization founded in 2018 that seeks to research and develop blockchain, offering consulting, digital products, and services to burst social-environmental projects on a scale (Blockforce, 2021).

The project started in February 2019. First, Non-disclosure agreements (NDAs) were signed bewtween COPPEAD and the participant stakeholders. Then, it was conducted a kick-off workshop to align the organizational chart of the project to the main stakeholders: COPPEAD, Blockforce, Instituto C&A, and C&A being the Brand 1, to explore the objectives of the project, the timetable for the actions, and what indicators would be studied about work conditions. For this stage, it was supposed to be two brands participating, but one of them took a step back, which caused the team to go further with the project with Instituto C&A and C&A but taking measures to find a new partner for the future.

Using design thinking , the main team developed a questionnaire for the fieldwork, where the project leaders (Coppead and Blockforce) would interview the tier-1 suppliers (apparel manufacturers) and tier-2 suppliers (sewer shops). The questionnaire was elaborated with three different interviews in mind: tier-1 supplier manager (Part A), tier-2 supplier owner (Part B), and seamstress working at either supplier tier (Part C). The Part A script included questions about: interviewee profile; management, demand, and control of the supplier's production; work conditions; relationship with the workshops; suggestions, improvements, and doubts. The Part B script included questions about: interviewee profile; management, demand, and control of the workshop's production; working conditions of seamstresses; suggestions, improvements, and doubts. The Part C script included questions about: interviewee profile; cell phone use; productivity; working conditions of seamstresses; expectations, suggestions, improvements, and doubts.

The development of questionaire were developed based on the in the Brazilian Retail Textil Association (ABVTEX) annual survey. The ABVTEX program was created to be a mark in the fight against modern slave work and child labor in the Brazilian fashion supply chain and a model of the best practices regarding compliance between brands and

suppliers (ABVTEX, 2021). Since 2010, ABVTEX has been a response in favor of worthy work in the supply chain using auditors and monitoring 100% of a supply chain, allowing brands to Only acquiring products that are approved by its standards. Any person who is interested in open up their office can be offered the opportunity to have their local work audit to gain the certification. The program's ambition is to develop a union between sewer offices, all together for one cause: developing the supply chain in a more sustainable place and applying compliance policies in it.

Once the questionnaire as ready, the project leaders developed field trips to develop the survey that would be the basis of the blockchain application to assess working conditions. The second brand was only chosen in June. Osklen is a partner brand with COPPEAD and alongside Instituto-e, they embark on the project looking forward to disclosing their information to increase transparency. Founded in 1989, Osklen is a Brazilian clothing company that is a pioneer in sustainable actions, such as using organic cotton as raw material for its products, Pirarucu fish leather, and other initiatives to motivate the awareness of consumption in the market aligned with the ASAP mindset, as sustainable as possible, as soon as possible (Osklen, 2021). Thus, NGO 2 is Instituto E, with its main mission to connect and gather knowledge and practices from different areas to promote sustainable human development (E, 2021). A table with all the information and a timeline of the actions of the project is going to be in the appendix.

3.3. Data Collection

In light of the number of secondary data available due to documents about the pilot project, first, it was analyzed the material already available by the reports of the research team as they would lead the project along. Then, in order to close some loose

points and conclude the analysis, it was interviewed people close to the project to feed more information about key topics not included in the material that is accessible.

After this first step, there were three interviews with members of the initiative, researchers that were part to implement the project. The interviewers were all present from the beginning of the project, and the interviews consisted of an average of 20 questions, depending on each part of the project each one had been focused on. All of them were conduct in video calls in Portuguese, in reason of the pandemic scenario of COVID-19. For further details, the whole transcript of the interviews will be available in the appendix.

Table 3: Documents details

TYPE	CODE	FILE	WORDS	SOURCE	AUTHOR
DOCUMENTS	D01	PPT	2.480	Laudes Proposal	COPPEAD
	D02	DOC	2.105	Instituto C&A Report	COPPEAD
	D03	PPT	751	COPPEAD Report	COPPEAD
	D04	DOC	2.023	COPPEAD Proposal for funding	COPPEAD
	D05	PPT	1.540	COPPEAD Report	COPPEAD
	D06	PPT	5.920	Final Report	COPPEAD
	D07	DOC	8.205	Activities Memorial Report	COPPEAD

Table 4: Interview details

CODE	AGE	GENDER	NATIONALITY	FUNCTION	WORDS	DURATION
SSCM Expert	33	Female	Brazilian	Researcher	2.477	55:56:00
Statistics Expert	32	Male	Brazilian	Researcher	2.479	60:01:41
IT Expert	31	Male	Brazilian	Blockforce founder	1.868	32:49:00

3.4. Data Analysis

The data analysis, as describe by A. Edmondson (1999), is the investigation of the content of the data acquired by the archival documents and interviews for a deeper understanding of the case. Firstly, all the data was organized in an excel sheet and coded

in subjects deriving for their main point. As some questions could be answered by both, archival data and interviews, each one of them had different columns to compare information for the same line. From there, it was easier to elaborate an extensive table with all the main points of the case.

To discuss the results, it was observed that all the information acquired could be separated into different steps (or phases), which could include more than only one subject. As an example, when talking about traceability, the information could be inside the step of “Benefits”, as the gain in productivity and impartiality also could be in the same step, supported by the statements of the interviewers. Finally, talking all the main ideas from the data acquired with the practical case, the analysis finalizes with a comparison of key concepts highlighted in the theoretical research of this study.

4. Case Analysis

4.1. Case Synopsis

The project's original plan was to access four direct suppliers and eight sewer workshops, resulting in an expectation of 300 seamstresses to participate using the app, but in the end, only 60 surveys were able to be collected with seamstresses. Fair Fashion started as a project to increase how factories and sewer workshops disclose their information and also improve the transparency in the fashion supply chain in Brazil, transitioning from a few face-to-face audits to regularly collects data directly with sewers. Furthermore, the objective was to develop a tool to engage traceability in the supply chain, being it a driver of better working conditions in the fashion sector. Blockchain is a new technology that enables an easier way to store data input, manage it, and help its dissemination, based on a shared ledger that gives visibility to all participants of the

network. The technology needed to be tested to see the real viability of using it in the Brazilian reality.

The framework of audits before Fair Fashion depends on the presence of an auditor, having three stakeholders in this process. First, the brand, which audits the factory and the sewer workshop once a year; Second, the factory, which audits the sewer workshop three to six times a year, and also goes through a process of regularization from ABVTEX once a year as well. Fair Fashion aims to bring a more productive, responsible, and traceable way to supervise the supply chain. Collecting the information directly with the sewers and their managers in order to have the information straight from the source and more regularly, using a random sample six times a year.

Each stakeholder will receive a customizable recurrent report created by the Blockchain database. By crossing audits and the data collected directly with the sewers, it makes it possible to have more transparency in each area of the chain. Thus, it will provide traceability from the beginning to the end of the production, make stakeholders accountable for their actions, and responsible for the work conditions, employee satisfaction, and worked hours demanded.

The project brings each stakeholder a new perspective about their opportunities in the subject. For the brand, the social responsibility awareness is awakened, aside from having better control over the work conditions in suppliers and sewer cells and the ability to improve the way to quantify productivity in them as well. For the factories, better control of the work conditions and productivity in sewer cells, and also enables the construction of deadlines, awards, and priorities in procurement for the best factories in the long term. For the sewer cells, it gives them to highlight to the factories and workshops that hire their services, and for the long term, it is the same as the last. Finally, to the sewers that are, essentially, the most vulnerable part of the chain, it gives them the voice

to truly disclose their work conditions and information about their day to day, which can result in the improvement of them in the long term.

Table 5: Fair Fashion Details

Project Details		
Risks	**Brand**	No compliance of the suppliers of sub-suppliers, that can be avoided by keeping track of productivity and not only responsibility will bring better results in the long term, making it interesting for the whole chain to adapt to it Difficulty to find 1 or 2 brands to be part of the project, however, it can be negotiated with other brand and the mockup will be used as a communication tool
	Sewer workshops	Resistance with the factories and sewers to collect data with more frequency, though providing an easy tool to access and use can guarantee the process is done correctly Resistance in the adhesion of other brands after the pilot is implemented during the roll-out phase, that can be avoided by using KPIs that are relatable with ABVTEX priorities, which already has the alignment with 20 more brands
Strengths	Collection of data directly with the sewers, plus, they are also involved in the initial design and establishing priorities, giving them a voice Increase visibility and data transparency that can have long term results Past initiatives had problems with data confidentiality, low frequency of collection of data, and only one main focus in the social responsibility aspect. Using blockchain characteristics of traceability, productivity, and ability to hold stakeholders accountable, this project has the potential to have a lasting result in the fashion supply chain	

4.2. Project Benefits

First, it was observed that the main benefit of the project was collecting data with a trustful data security tool which not only enables the sewers to expose the truth without being able to track and put their jobs on the line but also the certainty that the data inputted there is immutable. The reasoning is in agreement with IT Expert that states that "*we managed to have immutable records that one necessarily leads to the other and this sequencing brings visibility to the network and makes us have more reliable information*". Azzi et al. (2019) claim that blockchain is a network of multiple nodes in which tons of information that records and shares all data and transactions that occur in the network added to a block, backing up the statement of the interviewer IT Expert.

Aside from that, SSCM Expert said "*I believe that we saw mainly that the seamstresses need to have security when they know, for example, that their shop manager will not be able to track this information and know exactly who it was*" in this subject. Along with the words of IT Expert, "*So, the important thing is that each user has his own key and that the project management has everyone's key. Not that we can delete the information, but we managed to hide and throw away the key*.", it is possible to assume that all the information gathered in the app is confidential, giving the SC the ability to control uncertainty conditions (Busse et al., 2017) that sewers may be going through.

Another key benefit is real-time and impartial information, traceability and capillarity, risk reduction, and productivity improvement. Kraisintu & Zhang (2011) have stated that traceability may have regarding productivity and all its main focal points. The literature review is very rich concerning this area, with Azzi et al. (2019) declarations of how blockchain is proposed for cases that aim to have a more trustworthy, authentic, and transparent character SC. Additionally, Baralla et al. (2019) state how it can be an excellent choice for companies that are committed to sharing their products' history. Plus, Sodhi & Tang (2019) also collaborate with this statement by reinforcing that traceability is the tool to gain visibility throughout all the processes and provenance of the resources. Nonetheless, using Kraisintu & Zhang (2011) theory of how social issues are difficult to pinpoint and be measured, Pournader et al. (2020) defend that transparency can solve social issues because it can answer the question of "what/when/where" and tracking all the social conditions of suppliers of different tiers.

Still exploring the key points, it was brought to attention is that blockchain can be a standard tool that enables information flow, giving brands and workshops the ability to be proactive about some subjtects, instead of just reacting. Touboulic & Walker (2015) exposes how complex relationships are in SC, which makes trust development very hard

to accomplish. As stated in the response of interviewer SSCM Expert on the matter, "*The moment the brand has the same access to information as the supplier and with the same speed, perhaps they will be able to have a more collaborative and equal relationship. The benefit also comes from this quick access to information and truthfulness. I think the brand becomes much less "hostage" than I can only act when I have been given this information*". From this statement, it is clear to see how blockchain can create a relationship between brands and suppliers, for it would be easier to see and understand their struggles and success.

Thus, Freise & Seuring (2015) also highlight that it would ensure that all standards are being respected, and it would help to impose policies when misconduct occurs. Being socially sustainable can be challenging when a brand needs to make sure all tiers follow their rules and policies according to Busse et al. (2017). Furthermore, to improve social issues performance, there is a need to build a relationship with all suppliers (Raja Shree & Abi Shek, 2018), which makes it extremely necessary to have an intense collaboration of all tiers to achieve this goal (Marques, 2019). In other words, Tachizawa & Wong (2015) study proves that the success or failure of a sustainable initiative depends on the mechanism used to manage it.

There is also the side of risk control, which is the ability companies will have to make a point that they are willing to disclose their information and be able to adapt and make changes as issues come to light with transparency. Interviewer Statistics Expert said "(…)*in the sense that for the brand it is difficult to get there at the end, that is, in the workshop and to know that it is working correctly and within safety standards. When there is an accident or a report of some kind of irregularity, the tendency is that it will hit the marks in some way and cause some impact*" complementing the words of interviewer SSCM Expert "*I believe that blockchain and this movement of exposing yourself put you*

in a position that: "-Look, I'm here doing my best and if something escapes, you can see it and I too and together we will try to be proactive to reduce that and avoid that situation".

By disclosing the inside of a supply chain, transparency will make pressure on the companies to change their work conditions. They will become responsible for how their seamstress is treated through their direct and indirect suppliers. Any disruptions in business to sustainable issues are common because of the complexity of a SC (Rafi-Ul-Shan et al., 2018). However, when a company is interested to combat social issues, it is essential to have control and visibility through the whole chain (Freise & Seuring, 2015). Blockchain reduces fraud, errors, and delays to identify any misconduct in all tiers, creating trust between not only consumers and suppliers, but also suppliers to suppliers through the whole ecosystem (Azzi et al., 2019).

4.3. Project Barriers

The main point of this section is that suppliers may not see the long-term benefit and find that the tool may harm business. Because the relevance of the project may be difficult to grasp, workshops were concern about allowing the sewers to take time to learn how to use and participate in the project. As interviewers, IT Expert said, "*their daily lives are very busy, you know, they have their goals, the goals of results for survival, so we go there to do a research, it is a setback for them*". The app needed to be adjusted by the time the test started with all the feedback on the sewers usage, which made the time of response longer than needed for the pilot. Workshops were not easy to convince about the importance of the project for their business, and sewers had to take time from their lunch break to participate. It was more difficult to have access to the sewer workshops

than the sewers themselves, which is why a low barrier for them to join the project is important for further studies, and clear end benefits as well.

Interviewer Statistics Expert also elaborated on this subject, "*they need to be able to make these workshops and suppliers stop to serve us at some point during the project. The brands have even promised to pay for the downtime of these workshops, but honestly, I don't know if they paid or not. But, it is a bottleneck*". Interviewer SSCM Expert added that "*what we were unable to make real were the numbers we wanted for the final tests. In the end, we wanted to analyze with much larger numbers of seamstresses*". Like Sodhi & Tang (2019) explain in their article, though there is a large number of companies disclosing information about their production, it is important to understand that it can be expensive (not manly financial) and benefits are still unclear for brands. Because of this issue, it was difficult to have a planned number of os responses which was not a setback to the project itself but remains the need to scale after the pilot. So, it can be assumed that even though it was difficult to have access to the workshops, a recognition program should have also be considered.

Furthermore, there was also a prejudgment that the brand would make the workshops participate and ensure some sewers to respond the questionaries, but the brands do not have absolute authority under the chain, and even though they may impose the use of the tool, many workshops may refuse. During the research, it was clear that coercive and strict relationships in the network may endanger the business because it can disincentivize suppliers and build mutual distrust between partners (Tachizawa et al, 2010). So, it makes sense that, even though the brands have the "power", they do not have the visibility of the suppliers' actions. If a brand is going to use the tool, it must be prepared to monitor if all suppliers are open to the change and if not, they also must be ready for the possibility to have to change suppliers.

The last challenge the project faced in the pilot phase was the struggle with mobile internet. Interviewer Statistics Expert explained that "*going to the field and find out that, for example, 3G in some inland cities that we went to doesn't work or works very badly*". Not only that, but some sewers did not even have cellphones to install the app, which was an aspect that was not fully clear in the beginning and it was a technological bottleneck.

4.4. Usability Challenges

As for the experience of the usability of the app, blockchain ensures that the information inputted in the system is truthful, but it can not ensure that the sewers are going to input what they think. Interviewer Statistics Expert explains that "*we have no way of making sure that no person is lying or being lighter for fear of retaliation. What we believe is that you can dilute this if you have a large record of information and then, of course, I think that our solution is not definitive in itself in the sense that it can be a good indicator for brands, but it can be also a good indicator for face-to-face auditing*". Thus, interviewer IT Expert also elaborates that "we trust the information the sewer is putting, that is, there is no way to guarantee that the information she is putting is correct. What we can guarantee is that she is anonymous and that is why she will want to speak as realistically as possible and without any conflict of interest". With that said, it is possible to see that is essential for the sewers to be comfortable and trust that there will no retaliation for what they are inputting the app.

The usability of the first version of the app required changes to adapt to the public. It would make it easier if there was a type of incentive for sewers and workshop to participate. As stated in the challenges, it was a bottleneck for the project the lack in the number of participants free to use the app during work hours. However, their feedback was the most relevant to bring the concept to life and improve the experience they have.

As interviewer Statistics Expert discussed "*we noticed a very large barrier to accessibility to the application, among them where many of the people interviewed were not in the habit of using this type of technology on their cell phones, did not have or did not use e-mail or even from what we can subtly perceive were illiterate or functional*".

The survey that the seamstresses had to answer were divided into: Legal condition, questions about how the employee was registered to the government, what was their wages and benefits (transportation, alimentation aid), or if the workshop follows the Conduct Code of the brands; Management communication, if the seamstresses have access to complain or make suggestions about leadership or their work conditions; Work conditions, questions focusing about their everyday life inside the workshop, if they feel safe in the environment and have all the resources and tool needed to perform their activities, some questions related to work safety regarding the facilities, and their workload per week, extra hours worked if the payment is done correctly, if their schedule changes a lot and how they feel after their workday. All these indicators were put together using as an example the ABVTEX survey. As Freise & Seuring (2015) described in their article, safety issues, forced labor, and low minimum wages are some of the most problematic points to explore regarding modern slavery. Considering it is a difficult topic to go deeper into questions without creating a bias, the survey was well executed. It helped to frame the key points to look after to ensure the basic need of the workers is being attended.

4.5. Fair Fashion's Outcome

In this section, it can be highlighted how after the implementation the brand turns responsible for its actions and will be held accountable for its supply chain. As blockchain is seen as one of the most anticipated unbiased applications to improve the social

sustainability of companies and their partners (Pournader et al., 2020), interviewer SSCM Expert claims "*I believe that in an initial moment it generates a positive impact for the brand to be making itself available to this by placing itself to receive this information. But, it is necessary to be prepared not to have a negative impact in the sense that she is not prepared for all the consequences that this can cause*". Saberi et al. (2019) see Blockchain as an opportunity to ensure fair and safe work, as well as a way to provide human rights and reduce opportunistic behavior hidden in the SC. That is why, interviewer Statistics Expert says that "*Now if the brand is not concerned with social responsibility, with workers and their suppliers, it can have a great difficulty to execute this. In fact, they may end up running away*" because if a company decides to reveal such pieces of information for all to see, they must be prepared to either: change and ensure that is no issue with their suppliers' practices or be prepared to take punitive measures.

Plus, brands that are inserted in the competitive economic environment and have a demand to differentiate themselves and also brands who are "born" with and committed with the cause of bringing transparency to the consumers are clearly the main target for this project. Interviewer IT Expert said "*I believe in two types of brands mainly: one of the brands that have already done a lot of audit work and want to prove to themselves and the market that they are clean and want to bring that value in an objective way to the trade. And then the other, brands that are committed to this and that really need to improve their chain and want instruments for that*". The differential of giving the consumer the confidence about their choices that blockchain can give (Kraisintu & Zhang, 2011), also complements the ability of this app to spread the information in social media, which a brand must be aware since it can also cause some issues to be brought into light every now or then and require companies to take a position and change their operations (Yawar & Seuring, 2017).

As Perry et al. (2015) states, brands need to understand that CSR strategy goes beyond focusing on the profits, but the way to gain competitive advantage is to connect and standardize social goals between them and suppliers. Likewise, Raja Shree & Abi Shek (2018) claims one way to have an effective SC is to enhance transparency and accomplishing accountability. That is why blockchain can be the tool that (Handfield, 2016) declares necessary to disclose real-time information and keep track of the supplier's action.

To conclude, there were also some interesting comments about the next steps of the project. "*Another important factor is the incentives for seamstresses to use the application, at least in a short-term strategy in which you need some incentive for them to use this technology. So, these internet awards or packages would be a very relevant tool to start creating an interest*", as interviewers SSCM Expert states, there is a need to have an incentive program for the workshop and the sewers to use the app. Aside from that, there is a high demand to increase the number of participants, as elaborate by interviewers SSCM Expert, "*The next brands that are going to enter are already aligned that it is necessary to have a concern, not only with the scheduling suppliers but also with the workshops. I think we need to apply more to the seamstresses because we didn't get these higher numbers, but that's not just getting to the seamstresses and applying. It is necessary to create all this alignment with the brands that enter*", and Statistics Expert, "*doing it with a larger number of participants and this pre-test with a large volume of data, we didn't do it either, so it is something we would have to elaborate*". In Appendix 2, there is a table with all the information collected.

5. Discussion

The main focus of the theory regarding social issues is the need to highlight possible new tools to solve them. Sustain Your Style (2020) claims that forced labor, precarious work conditions, poor wages, excessive hours, and unsafe structures are hard to track and control. For this reason, a useful framework to monitor this indicator is much needed. Touboulic & Walker (2015) reinforces that companies are focused on developing new ways to change this unsustainable aspect for the business because of the challenges in the SC. The importance of disclosing information and being transparent with consumers is getting more awareness in order to reduce risks.

According to Kraisintu & Zhang (2011), traceability can help improve social issues by giving visibility, compiling historical data, cover all capillarity in a complex SC, and gaining the ability to trace back information about the provenance of products as also stated by Sodhi & Tang (2019). These characteristics would thrive in a complex relationship with a difficulty to develop trust (Touboulic & Walker, 2015). Aside from that, traceability also helps to map process and find ways to optimize them to gain better performance as Kraisintu & Zhang (2011) continues to detail. So far, traceability implemented in the project was used to compiled historical data about the work conditions of the seamstresses.

Raja Shree & Abi Shek (2018) state that traceability enables accountability, which will build up the supply chain social responsibility for their actions and those linked to them. Pournader et al. (2020) believe that traceability can help by answering the "what/when/where" of how a product is made. According to the SC Specialist: "*Increase access to information, increase the speed you have with this collection, decrease costs and maybe you have a greater connection with the supplier. The moment the brand has the same access to information as the supplier and with the same speed, perhaps they will*

be able to have a more collaborative and equal relationship". The SC Specialist confirmed it in the interview saying that "*Increase access to information, increase the speed you have with this collection, decrease costs and maybe you have a greater connection with the supplier. The moment the brand has the same access to information as the supplier and with the same speed, perhaps they will be able to have a more collaborative and equal relationship*".

When thinking about how blockchain can be an asset when thinking about tools to improve work conditions, the SC specialist says that "*the blockchain being able to operationalize this (data security with confidentiality), but communication and how it reaches each link and the confidence that each of them actually has in the tool*" is the main detail that brings a differential to the technology. As stated by the IT Specialist "*It is an advantage of the tool because it immutably records the information that is being passed through a chain*". When thinking about the SC as an environment difficult to trust as stated by Touboulic & Walker (2015), having a more trustworthy, authentic, and transparent character (Azzi et al., 2019) is a regulator that both sides can trust to create a stronger relationship. Table 6 shows the information gathered in the literature review with the data collected in the case study.

Table 6: Blockchain Overview Analyzed

Characteristics	**Case Study**
Traceability Criterias for Supply Chain	By disclosing the inside of a supply chain, transparency will make pressure on the companies to change their work conditions. They will become responsible for how their seamstress is treated through their direct and indirect suppliers.
Blockchain Potential	**SC Specialist:** "Increase access to information, increase the speed you have with this collection, decrease costs and maybe you have a greater connection with the supplier. The moment the brand has the same access to information as the supplier and with the same speed, perhaps they will be able to have a more collaborative and equal relationship. The benefit also comes from this quick access to information and truthfulness. I think the brand becomes much less "hostage" than I can only act when I have been given this information. "

	IT Specialist: "It is an advantage of the tool because it immutably records the information that is being passed through a chain. " **Statistics Specialist:** "The ability to guarantee trust over certain information can be used by several areas, specifically in terms of working conditions, you are sure of the information that is recorded and you are confident that it is reliable and has not been changed."
How can blockchain help	**Statistics Specialist:** "The view I have of the blockchain is that it is a reliable tool, in the sense of bringing it to certain information. Not as much as the registration of information, because it still goes through a human factor, after all, it depends on what we insert on the blockchain, but from the moment something is placed on the platform: we are sure of what has been inserted if it has undergone any change and that change is registered." **SC Specialist:** "The moment the brand has the same access to information as the supplier and with the same speed, perhaps they will be able to have a more collaborative and equal relationship. The benefit also comes from this quick access to information and truthfulness. I think the brand becomes much less "hostage" than I can only act when I have been given this information. So, I think it puts herself in a position where, once it has direct access to that information, it may have an obligation to be more proactive and less reactive. "

Thus, (Broad & Turnbull, 2019) exposes there are already a lot of different frameworks to address the problem. Nonetheless, it is impossible to that a "one-size-fits-all" solution (International Labor Organization & Walk Free Foundation, 2017). However, having a tool to accurately collect data and a way to secure it is paramount to have in a relationship full of third parties (Azzi et al., 2019). That is why blockchain fits in this scenario as an unbiased application to improve the social sustainability of companies and their partners (Pournader et al., 2020). As explained by the Statistic Specialist "*this ability to guarantee trust over certain information can be used by several areas specially in terms of working conditions, you are sure of the information that is recorded and you are confident that it is reliable and has not been changed*".

By disclosing the inside of a supply chain, transparency will make pressure on the companies to change their work conditions. They will become responsible for how their seamstress is treated through their direct and indirect suppliers. As the SC specialist stated SC Specialist "*I think it puts herself in a position where, once it has direct access to that*

information, it may have an obligation to be more proactive and less reactive". In other words, the company must be prepared to take action about the indicators that traceability will take into the light.

The theory shows that blockchain can be used to explore how clothing pieces are being made by its has transparency, reliability, and invariability (Baralla et al., 2019). Azzi et al. (2019) claim that it can reduce errors, fraud, and delays to identify issues in the supply chain, aside from the ability to increase trust between not only consumers and suppliers. As the IT Specialist explained "*Blockchain is the chaining of blocks, we see that this information is sequential and cumulative. Therefore, we managed to have immutable records that one necessarily leads to the other and this sequencing brings visibility to the network and makes us have more reliable information*". Furthermore, it can be seen that the technology in the pilot project had the same aspects of changes as seen in the theory.

As explored in the documents D02, D03, D05, and D06 of the project that was compiled by the COPPEAD team, the project also has impartiality – Because COPPEAD and Blockforce are unbiased regarding how they will treat the data, which turns this project reliable. The same documents also state that the project has the potential to access the SC as a whole, resulting in a tool able to explore the capillarity of the manufactory.

Regarding how to implement the technology, the pilot project had two phases as explained by the SC Specialist "*we had two validations insertions on the field. First, we presented the perceptions of the field and advances in the app development. Second, to get deeper information and to test the app*". It also can add the statement of the Statistic Specialist "*We did a field mapping, so we created a list of giving and get, which are things that are given and received for each actor and the sectorial objective of the project is supported by the institutes*".

When speaking about the cost for brands and suppliers to adopt this tool, it has to take into consideration that reducing the time of coordination by having a tool to track the performance is also a way to reduce costs (Estrada, 2020). As Kraisintu & Zhang (2011) say by reducing non-compliance problems with suppliers, will decrease the risk for companies that have many tiers. The app will not be enough to guarantee that brands will take action against the suppliers that violate the conduct codes of working conditions, so it would be interesting to think about how to enforce this commitment. One way to achieve such action is to give visibility to consumers or other types of auditors.

Brands that are inserted in the competitive economic environment and have a demand to differentiate themselves and also brands who are "born" with and committed with the cause of bringing transparency to the consumers are the main are more willing to adopt this technology. As explained by the SC Specialist "*In general, the brands were more interested in technology, because they are made up of people who are in a competitive economic environment and for them, the differentiation aspects are more important than just costs, which differs a lot from the workshop and suppliers who have a greater emphasis on productivity*". Thus, the IT Specialist compliments by saying "*(...) brands that are committed to this (improving social conditions) and that need to improve their chain and want instruments for that, so, before opening the results of this SC to the public and everything else, this information will serve for it to create and feed the executive giving the ability to make accurate and assertive decisions up the SC*".

According to Perry et al. (2015), there will always be a trade-off when talking about changes in your CSR policies. There are both challenges and benefits as stated before to implement this tool. However, as the SC Specialist states in the interview "*I believe that in an initial moment it generates a positive impact for the brand to be making itself available to this by placing itself to receive this information. But, it is necessary to*

be prepared not to have a negative impact in the sense that she is not prepared for all the consequences that this can cause". So, companies that are willing to take part in the project must be aware and prepare for a possible backlash in case some negative information comes into the light. Plus, the trade-off has also to consider the suppliers from different tiers, as it can be difficult to make them engaged in it as well as SC Specialist explains "*However, the challenge of implementing this I think is to engage the entire chain. We realized a little that it is not just you highlight the benefit for the brand that this will have adhesion and engagement*".

The main bias that can affect your business when dealing with the stores and suppliers from different bias is that the brands do not have absolute authority under the chain, and even though they may impose the use of the tool, many workshops may refuse. For this reason the pilot project there were some to overcome as stated by the SC specialist "*I think that a bias that we tried to overcome was the issue of size, so, for example, as it is a process of a large workshop and then we saw the parallel of a small workshop*".

Aside from the data collected in the blockchain, the other measure to ensure the tool is being used correctly was the workshops with the seamstresses and the guidance that the team provided in the field visits. Aside from that, there is no way to be certain that the data inputted is true. The brand, the sewer offices, and the seamstresses have to be open and on the same page to use the tool for it to work. As stated by the Statistic Expert "*Therefore, this ability to guarantee trust over certain information can be used by several areas Specifically in terms of working conditions, you are sure of the information that is recorded and you are confident that it is reliable and has not been changed*".

The changes in a company when they disclosure all this data to the public are diverse. As stated by Marques et al. (2020) companies must be aware of their suppliers' activities and be responsible for any negative weight it can add to the supply network. So

as the Statistics Specialist said "*I also see another aspect in relation to risk control, in the sense that for the brand it is difficult to get there at the end, that is, in the workshop and to know that it is working correctly and within safety standards. When there is an accident or a report of some kind of irregularity, the tendency is that it will hit the marks in some way and cause some impact*". Blockchain can improve brands to have visibility of how their products are being made throughout the chain and different tiers and it also links with what the SC Specialist put in the interview "*I think they trust more and has more security*".

The project had as a result the Fair Fashion app. Though it is now known that it is viable for brands to create their tool using blockchain technology to keep control over working conditions, the results regarding scalability are still unclear. The pilot project only got 60 surveys answered, which is a considering sample, but it is ideal to have firm results in the end. As the own interviewers said there were points they had to go back to change and adapt the tool as it was being developed. There is a need to scale the project in larger prospects to get the tool more in tune with the reality of the seamstresses and the necessity of the workshops and brands.

Aside from the points above, the literature shows blockchain has a great potential to solve work conditions because of the traceability feature. However, this project shows the potential to give information to the brands and workshops. What they are going to do with this data is in their power. So blockchain is a tool that may prevent illegal practices, but it is hardly useful if the brands and workshops do not act with the knowledge they have. Public pressure will only help if the information inputted into the app is available for consumers, which is also a choice for the brands.

Finally, as stated by Schmidt et al. (2017), companies must take into account the final consumer as a part of the supply chain, and for this reason, they must have access to

the network as well. The Fair Fashion pilot project did not involve consumers of the brands in their surveys or to share the data. For this reason, there is no way to explore how the app would be received by them. To conclude, Table 7 summarizes all the research framework created with all the topics from the literature review and main points of the case analysis.

Table 7: Research Script Analyzed

Research Framework Analyzed		
Item	**Literature Review**	**Case Analysis**
Social Impact Measures	Highlight possible new tools to solve social issues	By giving voice to seamstresses, the importance of traceability is highlight as a mean to audit suppliers in a daily bases.
	Bring awareness about the importance of disclosing information and being transparent with consumers	
Issues to be explored	Modern Slavery	Traceability is a tool to uncover social issues in the SC. Fair Fashion app gathers information about the real conditions that seamstresses work in. The ability to remain anonymous and have unchangeable data given by Blockchain creates the trust needed in a complex relationship.
	Real work conditions of employees in the fashion supply chain	
	How traceability can help improve social issues	
	Blockchain as a tool to improve social issues	
Work Conditions Aspects	Working hours per day	Fair Fashion apps use ABVTEX surveys as a guide for its questions and indicators to be monitored.
	Wage per piece	
	Infrastructure of workplace	
	Access to basic needs such as water, toilet and	
Reflections	How can traceability affect the fashion supply chain?	It gives the ability to explore information about how or where a product is made. The information does not get lost throughout the SC.
	Is blockchain an asset when thinking about tools to improve work conditions?	Blockchain is an asset when thinking about the confidence it gives to the app that brings visibility to the seamstress's work condition.
	What is the impact a company can make by disclosing its data	Be more reactive and collaborative with their suppliers.
What is going to be observed?	Real practices of blockchain in the fashion supply chain	Fair Fashion uses blockchain as a tool to track information through the SC with security and immutability and impartial audits.
	How is blockchain being used to explore how clothing pieces are being made	
	What are the difficulties and challenges to be addressed	The most challenging aspect of the project is to engage new suppliers and brands in this novelty.

	What are the benefits of giving visibility by using blockchain	Being able to get real-time information about your suppliers and management performance.
	What can be the next step to improve the current scenario	Implement the project in scale, having different brands and suppliers. Furthermore, it would be interesting to consider the end consumer as an actor of the SC to get access to it.
Questions to be made	Are there any smart contracts in the blockchain you use?	Yes.
	Who can authorize the insertion of new information?	The information is authorized by a third impartial party.
	How to implement this technology in suppliers? Is it expensive?	It is not expensive, but there is a cost of the downtime to have workshops to explain how it works for seamstresses. To implement, it is needed to have a team to support and explain step by step how to use the app.
	Are the sewers and employees of suppliers able to give proper information? How can you guarantee it?	The employees can put real information in the app with no fear to be recognized by it. There is no way to guarantee the all information is true.
	What type of suppliers and stores seek this new type of technology?	Brands that are active for this cause or that want to have a differential.
	What is the main bias that can affect your business when dealing with the stores and suppliers?	The belief that brands have power and control overall their suppliers.
	What are the requirements a store/supplier needs to have to affiliate?	There are no requirements, but they need to sign a NDA and be in the fashion industry.
	Aside from the data collected in the blockchain, is there any other measure you do to ensure the tool is being used correctly?	Several workshops were made to ensure the tool is being correctly used. Thus, a team was present to help if needed.
	What are the changes in a company you see when they disclosure all this data to the public?	Companies have more information about their operations, which enables them to make decisions and be proactive when facing a problem.
	Have you had any response from consumers? Do they seek you out to find new stores?	End consumers were not part of the pilot project.
	What is the direct and indirect cost to transition to this platform and to keep it running?	The downtime of the seamstresses is a cost supplier had, but getting more information about your operation reduces risks and future costs that may arise.

6. Conclusion

6.1. Theoretical Implications

This study explores blockchain in a scenario where it can be an asset in disclosing information about the work conditions in the fashion SC. The research question that was

chosen to be answered is how blockchain can be applied to solve the issue of precarious work conditions in the fashion industry by using traceability to hold companies accountable for their actions and decisions. It was used as a case study to explore how the tool may impact in practice with real brands, sewer offices, and seamstresses. This research contributes to the theoretical view as described hereafter.

To the traceability concept, this research shows that, as stated by Kraisintu & Zhang (2011), it can give visibility to the process and practices of suppliers in different tiers of an SC. Plus, as Sodhi & Tang (2019) explain, it also gives the ability to explore the SC's capillarity, understanding all the actors involved in the manufacture of the product. The pilot project also shows that Touboulic & Walker (2015) is accurate in saying that traceability may be the answer to build trust in a complex environment. Thus, Raja Shree & Abi Shek (2018) claim that it can also make companies accountable for their actions, as well as suppliers. The study reveals that being able to have direct contact with the people behind the products, it can give a voice to them to expose the real conditions they are working in, uncovering the provenance of the "how/what/who/where" about the products Pournader et al. (2020).

As for the contribution blockchain can make, as Azzi et al. (2019) explain, each block of the blockchain contains the information necessary to be approved and all of them need to be authenticated before joining the network by a certificate authority. After that, all the information inputted is immutable. Fair fashion app uses this technology to assure the confidentiality of the data, so the seamstresses do not have to worry about retaliation on their job by giving truthful information. Thus, Pournader et al. (2020) say that it can fit scenarios of low trust between actors because it is an unbiased application, and the project implies that this dynamic works, specially when all actors are in agreement to take part in it. To conclude, the theory shows that blockchain can be used to explore how

clothing pieces are being made by its has transparency, reliability, and invariability (Baralla et al., 2019), and the Fair Fashion pilot project shows that the tool works to compile inputted information throughout the SC about work conditions in the fashion industry.

6.2. Managerial Implications

The study shows that it is possible to use blockchain to disclose information. Nonetheless, companies should be aware of the benefits and challenges that are detailed in the text. By improving their ability to trace their production, companies have the power to reduce risks by gathering information to be proactive with their action and of their suppliers too. By decreasing risk opportunities, managers should be aware they are also reducing cost by upgrading how they take control of how their suppliers' actions.

Fair Fashion pilot project is a case that shows how to successfully create a tool that uses blockchain to keep track of the work conditions in a fashion SC. However, it was only applied in a small number of workshops and two different brands as a test, collecting a short amount of data. Aside from that, the case also shows that companies may implement the tools, but if they are not going to take action against the wrongdoers in their network, all the data compiled is going to waste.

As Perry et al. (2015) explain, trade-offs are always going to exist When improving CSR policies, so in a highly complex setting, there must an equilibrium, which can go as far as helping suppliers to achieve common sustainable goals or setting an achievable goal. All in all, it is important for companies to keep track of their performances using blockchain as a tool and do not turn a blind eye to it. Moreover, the study proposes a guideline of how blockchain can be implemented in this scenario highlighting details of the project implementation and challenges needed to be addressed.

6.3. Limitations & Future Research

This research, being qualitative research, has always the risk of author bias, some of which are not even clear (culture, life background). This is the main limitation that can influence the results of this study. Aside from that, it was only used one case study, which can be not enough to truly capture the use of blockchain as a tool. More studies and cases can be explored with the purpose to confirm or refute the findings. Moreover, Schmidt et al. (2017) claim that the final consumer is part of the SC, so to have a full understanding of how blockchain can affect the fashion SC, there is a need to research projects that also consider them as actors. In this way, it can also explored how consumers react when having the information in their hands and how can it affect their perception of a brand.

Otherwise, the next steps for the project can be to follow the Fair Fashion project in scale to determine if, by being used in a large number of participants, the results remain the same and the tool turns into an indispensable item for workshops, seamstress and brands. Thus, other initiatives use blockchain as a tool to trace social issues in the SC that can be also studied and compared with the case presented in this research. Furthermore, it is interesting to take a broader look into the scenario and include final consumers' perception and what are the changes a brand can have when taking all this information to the public.

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Appendix

Appendix 1: Project Timeline

Month	Activities
02	- 2 COPPEAD internal meetings to prepare material (NDAs, presentations); - 1 Blockchain fashion survey workshop with COPPEAD, NGO 1 and Brand 1; - 3 Alignment meeting regard technological aspect with COPPEAD and Blockforce; - 1 Field visit by COPPEAD; - Workshop with 2 suppliers and 4 sewer office with Brand 1 and Blockforce.
03	- 5 Alignment meetings with Blockforce and COPPEAD; - Participation on ABIT (Blockchain event) by COPPEAD; - Preparation of the database to choose Brand 2 by COPPEAD.

04	- 3 Alignment meetings with COPPEAD and Blockforce; - 1 Meeting with NGO 1, Blockforce and COPPEAD; - Analysis of field trip material by COPPEAD; - Initial version of screens of the app by Blockforce; - Negotiations and prospecting with Brand 2 by COPPEAD.
05	- 3 Alignment meeting with COPPEAD and Blockforce; - Analysis fo field trip material by COPPEAD; - Setting Brand 2 and scheduling second field trip by COPPEAD; - Development of the seamstresses app screens by COPPEAD.
06	- Field visit by COPPEAD; - Visit to 2 Sewer offices and 3 suppliers by Blockforce and Brand 2; - 2 Alignment meeting with COPPEAD and Blockforce; - Blockchain validation workshop with COPPEAD, Blockforce, NGO 1, Brand 1, NGO 2 and Brand 2. - 3 Meetings to prepare material, compile development and analysis of the field trip by COPPEAD; - Development of the screens of the app by Blockforce.
07	- 3 Alignment meetings with COPPEAD and Blockforce; - Preparation of material for C&A International Board by COPPEAD; - Workshop with C&A International Board, COPPEAD, Blockforce, NGO 1 and Brand 1; - Development os app screens by Blockforce.
08	- 3 Algnment meeting with COPPEAD and Blockforce; - Teste of the "fake-app" by COPPEAD; - Handout draft of App use for seamstresses v1 by COPPEAD.
09	- Fair fashion validation workshop with COPPEAD, Blockforce, NGO 1, Brand 1, NGO 2 and Brand 2; - 2 Compilation of the app test feedback by COPPEAD; - Internal alginment with COPPEAD team; - 1 Alignment meeting with COPPEAD and Blockforce; -Handout draft of app use for seamstresses v2 by COPPEAD; - Test of the app with seamstresses with Brand 1, COPPEAD and Blockforce.
10	- 3 Alignment meetings, before and after visit with COPPEAD and Blockforce; - Site visit for application of the app survey in 2 workshops of Brand 1 with COPPEAD and Blockforce; - External call with Supplier 1 of Brand 2 and COPPEAD.
11	- 3 meetings between COPPEAD tema to manage the project and prepare material; - External Call with Textile Rio Branco (Supplier 2 of Brand 2) and COPPEAD; - 3 Alignment meetings with COPPEAD and Blockforce; - Workshop with 2 suppliers and 3 sewer offices of Brand 2 with Blockforce; - External alignment with Supplier 1 and 2 of Brand 1 with COPPEAD and Blockforce; - Collection of data for survey app with COPPEAD and Blockforce;

	- Preparation for analysis of the survey with COPPEAD and Blockforce; - Draft of the final report by COPPEAD and Blockforce.
12	- Closing workshop of the Pilot Project with COPPEAD, Blockforce, NGO 1, Brand 1, NGO 2 and Brand 2; - Collection of the data for survey app workshop for Brand 1 with COPPEAD and Blockforce; - Collection of the data for survey app workshop for Brand 2 with COPPEAD.

Appendix 2: Data collected from the project

Questions	**Key points**
How can blockchain be an asset when thinking about tools to improve working conditions?	- It gives means to collect information that cannot be altered. - It provides a means for all parties to expose their routine without disclosing information that can damage a party. Blockchain operationalize data security and confidentiality and it also allows communication. - Collecting data with a trustful data security tool not only enables the sewers to expose the truth without being able to track and put their jobs on the line but also the certainty that the data inputted there is immutable. - It manages to have immutable records that one necessarily leads to the other and its sequencing brings visibility to the SC.
What are the benefits of giving visibility by using blockchain technology?	SHORT TERM - Impartiality: COPPEAD and Blockforce are unbiased regarding how they will treat the data, which turns this project reliable. - Traceability over their SC: Having more control over the steps of their productions, at the same time, collecting data they would not normally have otherwise. - Capillarity: Having access to the supply chain as a whole. - Time: Information in real-time and monthly reports. - Risk: reduction of risk by having visibility of all the processes as a whole. LONG TERM - Productivity: information about 100% of the

	productivity in the supply chain. - Cost reduction with audits
Is the seamstress able to provide truthful information? How can the solution guarantee it? How do you make sure that the information that goes into the blockchain is genuine?	- Blockchain only guarantees that the information is real and will not be changed. To be sure that is being used correctly, there must be a movement between brands, suppliers, and seamstress to realize the importance of it and make it work. - There is no way to ensure that a person is not lying in the app. However, by obtaining a large number of data, the information can be diluted. The solution is a good indicator for brands to keep track more frequently. - Blockchain ensures that the information inputted in the system is truthful, but it can not ensure that the sewers are going to input what they think.
What are the requirements a brand/supplier needs to have to affiliate?	**Project database:** The only requirements to participate in the pilot project was: - Sign an NDA agreement - Open their operations for the project to analyze their data - Be in the fashion supply chain sector - Interest to be a pioneer in the area
What are the main benefits suppliers and brands have when implementing this tool?	- A way to differentiate themselves and to manage a system for small suppliers. - Standard tool that enables information flow, giving brands and workshops the ability to be proactive about some subjtects, instead of just reacting. - The moment the brands have the same access to information as the supplier and with the same speed, they will have to be more collaborative and have an equal relation.
What is the impact a brand can make by disclosing its data on working conditions?	The brand turns responsible for its actions and will be held accountable for its supply chain.
What are the changes in a brand you see when they disclosure all this data to the public?	Risk control, companies will be able to make a point that they are willing to disclose their information and be able to adapt and make changes as issues come into light with the transparency.
What are the main challenges suppliers and brands have when implementing this tool?	- Suppliers may be troubled by having to liberate sewers' time for them to answer the questions - Suppliers may also not see the long term benefits for their implementation of the project at this moment
What is the main bias that can affect Fair Fashion when dealing with brands and suppliers?	The brands do not have absolute authority under the chain, and even though they may impose the use of the tool, many workshops may refuse.

What are the difficulties and challenges to be addressed when implementing a project like this?	- It was more difficult to have access to the sewer workshops than the sewers themselves, which is why a low barrier for them to join the project is important for further studies, and clear end benefits as well. - Because it was difficult to have access to the workshops, a recognition program should also be considered. - The relevance of the project is difficult to be grasped only by its qualitative results, it should be also be analyzed its quantitative aspect as well. - It was difficult to have a planned number of os responses. - the app needed to be adjusted by the time the test started, which made the time of response longer than needed for the pilot. - Being a pilot, the workshop was hard to convince to allow us to talk to a large number of sewers, which also explains why the low number of responses. - The only time available for the sewers to be part of the project was their lunchtime.
How the project concept came alive?	It was a demand of C&A foundation.
What were the legal and social aspects needed to make the project work?	The main idea is data privacy and being in full agreement with the LGPD (Brazilian data production law).
What is the direct and indirect cost to transition to this platform and to keep it running?	The main cost of this project's first step was the downtime of the sewers.
What was the financial aspect needed to implement the project?	C&A and E Institute were the main founders of the project, but it is important to consider paying for the workshop time as the sewers are training and using the app.
What is the step by step for implementing this technology in a firm? Is it expensive?	First, it was done field mapping to understand what each actor would give and got from the project, but the understanding of what the app would mean for the workshop was lost in the beginning.
What were the barriers to implementing this project? What can make it easier and/or difficult?	Availability of employees and leadership to engage in the needed actions. Plus, the usability of the first version of the app, which required changes to adapt to the public. It would make it easier if there was a type of incentive to sewers and workshop to participate.
What was not possible to make it real from the concept because of the technology itself?	Number of participants.
What was the operational aspect to make the project work?	The mobile internet, the lack of a usable cellphone, and even the type of language used in the app needs to be taken into consideration

What can be the next step to improve the current scenario?	More number of people using and workshops available to disclose their information, perhaps using some type of incentive.
Aside from the data collected in the blockchain, is there any other control do to ensure that the tool is being used correctly?	Other audits can be used to compare data in the final result. Aside from that, there was a team to help the sewers to use the app.
What type of suppliers and brands will seek this new type of technology for disclosing social responsibility?	Brands that are inserted in the competitive economic environment and have a demand to differentiate themselves and also brands who are "born" with and committed with the cause of bringing transparency to the consumers.
Are there any smart contracts in the blockchain you use?	There are Chain Codes.
Who can authorize the insertion of new information?	They are self-validating automatically.
What are the main aspects of the project related to technology?	The mobile internet was a technological bottleneck and the assumption that every seamstress would have a cellphone available to download the app.
How can traceability affect the fashion supply chain?	- By disclosing the inside of a supply chain, transparency will make pressure on the companies to change their work conditions. They will become responsible for how their seamstress is treated through their direct and indirect suppliers.