Sustainability risk management in multi-tier supply chains: A case study on the Finnish textile industry

Lappeenranta-Lahti University of Technology LUT

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Examiner: Junior Researcher, Axel Zehendner

ABSTRACT

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The aim of this bachelor's thesis is to find out how Finnish textile companies manage sustainability risks in their multi-tier supply chains. The research focused on the textile industry, as their supply chains are linked to many sustainability problems. The study pursues to find the main sustainability risks of Finnish textile companies and examining the solutions developed by the companies, from the perspective of risk management of the multi-tier supply chain. The research was carried out as a qualitative case study, the material of which was interviews, as well as secondary material such as the companies' own responsibility reports. The collected data was analyzed using the content analysis method.

According to the results, traceability and verification of claims and excessive environmental stress can be seen as biggest sustainability risks in the multi-tier supply chains. In addition, lack of sustainability risk management practices and lack of transparency in these actions are major risks. Sustainability risk management practices found emphasized education of parties involved, and vast monitoring whenever visibility is compromised. Using the help of third parties and integrating written guidelines where risks are evident, further mitigates them. Choosing to use more sustainable practices and materials from the start contributes to less risks, and communicating sustainability practices used transparently and honestly provides greater stakeholder trust.

TIIVISTELMÄ

Lappeenrannan-Lahden teknillinen yliopisto LUT
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Kauppatieteet

Lotta Hyppänen

Vastuullisuusriskien hallinta monitasoisissa toimitusketjuissa: Tapaustutkimus Suomen tekstiiliteollisuudesta

Kauppatieteiden kandidaatintutkielma
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Tämän kandidaatintutkielman tavoitteena on selvittää, kuinka Suomalaiset tekstiiliyritykset hallitsevat kestävyysriskejä heidän monialaisissa hankintaketjuissaan. Tutkimuksessa keskityttiin tekstiilialaan, sillä niiden hankintaketjut linkittyvät moniin kestävyysongelmiin. Tutkimus pyrkii löytämään Suomalaisten tekstiiliyritysten keskeisimmät kestävyysriskit sekä tarkastelemaan yritysten kehittämiä ratkaisuja monialaisentoimitusketjun riskienhallinnan näkökulmasta. Tutkimus toteutettiin laadullisena tapaustutkimuksena, jonka aineistona käytettiin haastatteluja, sekä toissijaista aineistoa kuten yritysten omia vastuullisuusraportteja. Kerätty data analysoitiin sisällön analyysimenetelmällä.

Tulosten mukaan väitteiden jäljitettävyys ja todentaminen sekä liiallinen ympäristöstressi voidaan nähdä suurimpana kestävän kehityksen riskeinä monitasoisissa toimitusketjuissa. Lisäksi kestävyysriskien hallintakäytäntöjen puute ja läpinäkyvyyden puute näissä toimissa ovat suuria riskejä. Kestävän kehityksen riskienhallinnan käytännöissä korostettiin osapuolten koulutusta ja laajaa seurantaa aina, kun näkyvyys vaarantuu. Kolmansien osapuolten avun käyttäminen ja kirjallisten ohjeiden integrointi, missä riskit ovat ilmeisiä, vähentää niitä entisestään. Kestävämpien käytäntöjen ja materiaalien valinta alusta alkaen vähentää riskejä, ja käytetyistä kestävän kehityksen käytänteiden jakaminen läpinäkyvästi ja rehellisesti lisää sidosryhmien luottamusta.

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1. INTRODUCTION

Sustainability and green supply chain management are very important for business operations nowadays (Li, Li, Choi & Sethi 2019; Kalkanci & Plambeck 2020; Li & Wu 2020; Wu, Zhang & Xie 2020). Regulations by law, expectations of stakeholders (Dou, Zhu & Sarkis 2018) and the opportunity to differentiate from competitors (Papadopoulou, Papasolomou & Tharassou 2022) are just some of the reasons why companies strive to be more sustainable. When thought of the most unsustainable field of business, many might name the textile industry. The amplification of ongoing sustainability risks in the textile industry, compounded by recent scandals, has also heightened the risks within textile supply chains. (Rafi-Ul-Shan, Grant, Perry & Ahmed 2018). And for a reason: the textile and apparel industry is characterized by labor-intensive manufacturing, long value chains and relatively high degree of environmental pollution (Bentahar & Benzidia 2018; Choi, Cai & Shen 2019). From the economic and social perspectives, global production can be seen taking advantage of low labor costs in developing countries. Therefore, it has become even more important for textile companies to both ensure and to prove to stakeholders, that their products are produced sustainably. Due to the heightened frequency of risks, extended recovery periods, and the responsibility of the focal firm for ethical concerns and actions, or lack thereof, at any level of its supply chain, risk management assumes utmost significance (Christopher & Holweg 2011).

According to Nelson, Rueda, Vermeulen, Borjeson & Bostrom (2018), modern-day textile companies rely heavily on global supply chains, that consist of countless suppliers and their sub-suppliers, and because of this, companies' sustainability also becomes dependent on the extended supply chains (Heide, Kumar & Wahne 2014). Globality, complexity, and both health and environmental risks related to production create challenges for any company trying to ensure sustainability. When outsourcing of textiles increasingly globalizes to developing countries, the need to understand the integration of sustainability becomes highly important (Nelson et al. 2018, 230; Köksal, Strähle, Müller & Freise 2017) since some countries still have quite low standards for labor and environmental regulation, and therefore might take un-warranted risks (Mayer, Nickerson & Owan 2004).

The so-called multi-tier supply chains thus bring a lot of challenges, and monitoring the sustainability of merely the more downstream, first-tier suppliers simply is not enough when trying to ensure sustainability. As we move upstream in the supply chain, it becomes increasingly crucial to adopt a broader multi-tier perspective. This is because actions and sustainability performance of a single organization can end up having a significant impact on the reputation and credibility of other supply chain partners involved. In such cases, the responsibility for the practices within the entire supply chain can fall on the focal firm and Hartmann & Moeller (2014, 281) describe this phenomenon as ‘Chain liability’. This scenario poses a challenge to the legitimacy of the supply chain, as the presence of poor sustainability performers hidden deep within the supply chain can undermine overall sustainability efforts. (Sarkis, Santibanez Gonzalez & Koh 2019)

The original idea for this thesis springs from frustration towards fast fashion and the industry around what seems like endless consumption. The consumption and production of textile products is constantly increasing, and at the same time, their impact on the climate, water and energy consumption, and the environment is increasing (European Commission 2022). Despite the inspiration, the companies studied in this thesis are not considered producers of ‘fast fashion’, since there are few of them based in Finland. Rather, these companies were chosen in order to study and highlight some of the sustainability risk management practices that have been already found effective and compare them with the existing studies and literature. The topic of sustainability risk management in multi-tier textile supply chains is current and momentous, since as knowledge about climate change and the evidence of its root causes increases, so does the role of the textile industry in it. In addition, even though in Western countries people may live in a welfare state, human rights violations and poor working conditions are still a reality in many developing countries. Again, the textile industry is often linked to production in these risk countries and therefore it plays a part in either allowing or resolving these issues. The aim of this study is consequently to provide better information on the different ways companies can acquire textiles more responsibly. By taking a closer look at the different sustainability risks and how to manage them, this thesis pursues to give tools for textile companies on how to better their procurement practices and responsibility monitoring, as well as to provide education for consumers and other stakeholders on the different risks that some companies are still willing to take, just to sell cheap textiles.

1.1 Objectives and research questions

The main goal of this thesis is to better understanding on the different stages in the complex supply chain of textiles, what are the most significant sustainability risks in them, and to bring out customs on how to manage these risks effectively. There is quite a lot of previous literature and studies regarding supply chain risk management from the point of view of sustainability, but only a few focus on textile supply chains specifically and approach the topic with the multi-tier perspective. Still, the role of textile industry as a highly problematic operator in the field of supply chains is acknowledged by academics, and increasingly with consumers as well. Finnish textile companies were chosen for the study since there are many among them with transparent and advanced sustainability risk management practices. Based on the objectives, the research questions were formed.

The research questions for this study are the following:

-Q1: What are the main sustainability risks in the multi-tier textile supply chains of Finnish textile companies?

- Q2: How do Finnish textile companies respond to these sustainability risks?

1.2 Conceptualization of the study

This study consists of sustainability risks that organizations face in their multi-tier textile supply chains, as well as the management of these risks. Since the focal firm can be held accountable for any misconducts of their partners in the multi-tier supply chains, risk identification and management need to consider even the furthest partners for comprehensive risk management. Regarding supply chain risk management measures, the transparency of the supply chain is discussed in particular, because of its relevance in preventing risks caused by sustainability issues. Although the different phases of the supply chain are discussed at times in their own parts, as a whole, the study considers sustainability risk management process of the entire supply chain. In the study, sustainability risk management is divided into management of environmental and social sustainability risks. The conceptualization of the study is outlined in the figure 1.

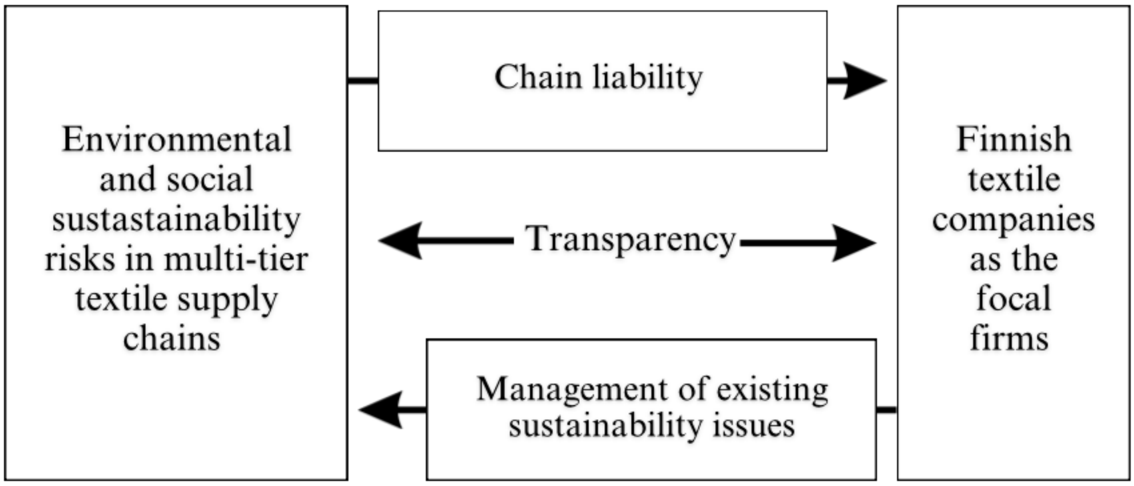

Figure 1: Conceptualization of the study

1.3 Structure of the study

The study consists of six chapters. In the first chapter, the introduction, the general issues and goals of the research are reviewed, and the background of the research is given. In addition to these, the introduction also discusses the research questions. The second chapter provides a background to the topics discussed in the study, the multi-tier textile supply chain, as well as sustainability risk management and motives for it. After these, chapter three begins with the theoretical part of the study, which deals with sustainability risks related to multi-tier textile supply chains, as well as provides a brief overlook on existing frameworks and the current state of study for their management. Chapter four discusses the research methodology and explains why certain research methods have been chosen to be used in the research. Chapter five is the empirical part of the research, where the material collected through the interviews and from secondary material such as reports is reviewed in order to answer the research questions. In the sixth and last chapter of the study, the conclusions and the results of the study are discussed, and the limitations of the study and possible research topics for the future are outlined.

The study methodology structure (figure 2) presents both the order in which the phenomenon of interest is approached and the overall components of the study. Recognizing the main sustainability risks in the textile supply chain is done by familiarization to literature around textile supply chain related sustainability risks. Division to social and environmental sustainability risks is then done to outline how different sustainability risks and management of them link to one of both categories. From there, research moves to gather material trough company interviews and from secondary data such as responsibility reports from different Finnish textile companies. The data is used to further highlight the sustainability risks that Finnish textile companies find most significant in their multi-tier supply chains. Data is also utilized to disclose management practices used for sustainability risk mitigation.

Figure 2: Illustration of the study methodology

1.4 Key concepts

The supply chain, as defined by Handfield & Nichols (2002), encompasses all organizations and activities associated with the flow and transformation of goods from raw materials to the end user, including the corresponding information and monetary flows. According to Mentzer, DeWitt, Keebler, Min, Nix, Smith & Zacharia (2001), it is a network of three or more companies directly connected through upstream and downstream flows of products, services, finances, and information, extending from a source to a customer. Mentzer et al. (2001) further distinguishes between a basic supply chain, comprising a focal company, an immediate supplier, and an immediate customer; an extended supply chain, which encompasses the suppliers of the immediate supplier and the customers of the immediate customer; and an ultimate supply chain, involving all companies from the initial supplier to the final customer. Expanding on this, Cooper, Lambert & Pagh (1997) define the scope of the supply chain as "dirt to dirt," encompassing the entire journey from the raw material source to the final consumption, as well as the return operations involving the reuse, remanufacture, or recycling of materials and products. A fundamental framework for supply chain management is *value chain* by Michael Porter (1985), and value chain as a term is often also used as a synonym for supply chain.

Multi-tier supply chain refers to a complex network of suppliers and subcontractors that are involved in the production and distribution of goods or services. It involves multiple levels or tiers of suppliers, where each tier represents a different level of the supply chain. These tiers are interconnected and depend on each other to deliver the final product or service to the end customer. In a multi-tier supply chain, effective planning and execution extend beyond the boundaries of a single enterprise, making it challenging to address issues that lie outside the company's direct control. Typically, visibility tends to diminish beyond Tier 1 suppliers, limiting awareness of activities further downstream in the supply chain. (Craft 2023)

Supply chain risk management refers to the identification and assessment of risks, as well as the incorporation of suitable measures and strategies as part of supply chain management. Risk management measures are carried out in cooperation and coordination with the various parties in the supply chain. Risk management aims to reduce losses, potential risks, and the effects of risks in order to ensure the continuity of procurement in the future. (Tang 2006; Manuj & Mentzer 2008)

Sustainable supply chain management can be defined in various ways. Proctor, Luke, Calhoun, McMillen, Brownson, McCrary & Padek (2015) found the lack of a standard definition for the term sustainability and the variety of synonyms that are used in the literature challenging, and single best definition for the term is hard to point out. Nevertheless, Seuring & Müller (2008, 1700) define sustainable supply chain management as “management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements" and this thesis follows the said definition.

Sustainability risk describes a risk resulting from issues with emerging environmental and social justice, directly affect a products manufacturing (Anderson 2006). Identifying and assessing these risks is crucial already at the product design state in order to develop items that minimize sustainability risk exposure and that are sustainable environmentally (Palousis, Luong & Abhary 2010). According to the previous definition of sustainability in supply chain management, sustainability risk can also be seen as anything that prejudices material management, information or capital flow or cooperation of companies in the supply chain from the perspective of sustainable development.

Transparency is defined by Cambridge Dictionary (2023) as “a situation in which business and financial activities are done in an open way without secrets, so that people can trust that they are fair and honest”. In the context of supply chain management, transparency refers to companies’ capability to actively communicate with different stakeholders in a way that gains more visibility and traceability for products as they move through the supply chain. This supply chain transparency relies on accurate, timely, consistent, and comprehensive information obtained through proactive communication. The information can then be structured accordingly and used in verifying sustainability and proving it to various supply chain stakeholders. (Zhu, Song, Hazen, Kang & Cegielski 2018; Hazen, Boone, Ezell & Jones-Farmer 2014; Spekman, Kamauff & Myhr 1998) Transparency is specifically useful tool for the management of sustainability related issues.

2. LITERATURE REVIEW AND THE THEORETICAL BACKGROUND

This section will cover a literature review and the theoretical background for the thesis. Its purpose is to familiarize the theory behind this research and further highlight the theoretical gap that then will be pursued fulfill. First it focuses on introducing the textile supply chain, then sustainability risks associated with the textile supply chain, and the motivations and the means by which these risks are generally managed by textile companies. Lastly, some existing frameworks for multi-tier supply chain management and risk mitigation are presented and the current state of research on the matter discussed.

2.1 Textile supply chain and sustainability risks

The textile supply chain can be divided into five different sections (figure 3). This is a simplified version of the long and complex supply chain, usually consisting of multiple partners and upstream suppliers. (Agrawal, Kumar, Pal, Wang & Chen 2021)

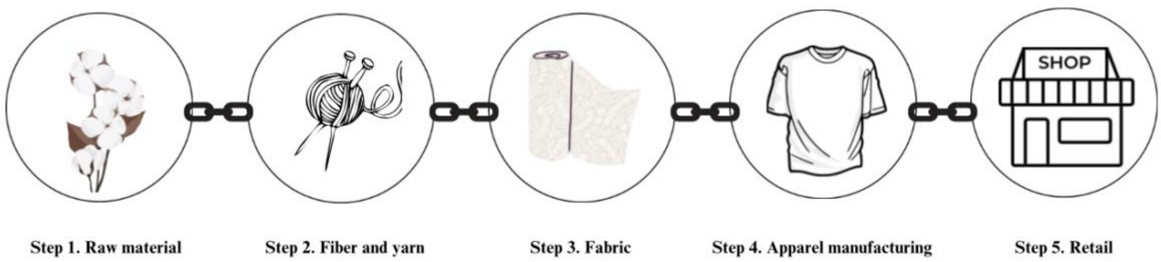

Figure 3: Typical stages of the textile and clothing supply chain (Self-made illustration based on Agrawal et al. 2021)

The supply chain begins from farms, where raw material is harvested. From there it usually gets delivered onward to factories that make it into fiber and yarn, and then again forward to another factory where material is made into fabric. Often after this point, it is delivered forward to another factor where the fabric is sewn into apparel and so on before it is delivered into retail stores. It is a very common process, and more often than not the textiles are sewn somewhere else than in the destination country, where the items will be sold. (Agrawal et al. 2021) Because of the multiple steps that are often conducted by suppliers in different areas, textile supply chains become almost inevitably multi-tier supply chains.

Sustainability risks in the textile industry are endless, in both social and environmental point of view. Managing and controlling risks in the supply chain is a challenging task due to their multidimensional nature. As the supply chain of a company becomes more complex, its influence over other parties within the chain tends to diminish. When dealing with procurement from extensive and distant networks of suppliers, it becomes essential to consider both direct (on-site, immediate) and indirect effects and risks. This principle applies not only to sustainability risks but also to other risks within the supply chain. (Wiedmann & Lenzen 2008) Textile supply chain risks can also be looked at by the different stages. When looking at the different steps, ones that are more upstream in the supply chain are often less visible. Due to many parties involved (suppliers, sub-suppliers, contractors), it can be more difficult to monitor these upstream stages of the supply chains (Kumar, Hallqvist & Ekwall 2017). Because of poor traceability, it is also easier for upstream suppliers to get away with violating standard practices in order to reduce cost and then maximize profit (Agrawal et al. 2021). The information asymmetry in textile supply chain is a major issue, and traceability is also a critical issue for the textile industry due to the complexity of the global supply chain, and the potential for labor rights abuses and environmental harm.

The first step is raw material production. Environmental risks arise due to the production of synthetic fibers like polyester and nylon, which consume large amounts of energy and emit greenhouse gases. Similarly, the production of natural fibers like cotton can lead to water pollution, soil degradation, and deforestation. Social risks include labor exploitation, child labor, and human rights violations, particularly in developing countries. (Muthu & Gardetti 2020a) Ensuring transparency and traceability in this stage of the supply chain is challenging, since it is the most upstream stage. *The second step* is fiber and yarn production, where manufacturers process the raw material into fiber and yarn. This stage utilizes substantial natural resources, such as water and energy. The use of chemicals in dyeing and finishing agents poses environmental and health risks. Waste and emissions, including greenhouse gases and water pollution, are significant concerns. Labor issues also persist, with low-paid and poorly treated workers often involved, especially in developing countries. (Muthu & Gardetti 2020b) *The third step* is fabric production, where factories sew the yarn into various types of fabric.

This stage requires significant water usage, leading to potential water pollution and negative impacts on aquatic ecosystems and human health. Chemicals used in fabric production can be harmful if mishandled. Energy consumption contributes to greenhouse gas emissions and climate change. Once again, labor exploitation and poor working conditions are associated with this stage, particularly in developing countries. (Alkaya & Demirer 2014) In the manufacturing phase, so in *step four*, environmental risks include resource depletion, air and water pollution, and greenhouse gas emissions. The textile industry is known for its substantial water consumption and the discharge of untreated wastewater, leading to water pollution. Chemicals used, such as dyes, pose risks to both the environment and human health. Social risks encompass worker exploitation, poor working conditions, and human rights violations. The prevalence of textile manufacturing in low-wage countries often results in inadequate enforcement of labor laws, exacerbating these risks. (Giannakis & Papadopoulos 2016) In the *fifth and final step,* retail phase, textile companies can contribute to environmental risks through excessive packaging and insufficient recycling. The culture of fast fashion and overconsumption within the apparel retail sector leads to excessive waste generation. Transportation emissions during product delivery further contribute to environmental risks like climate change. Retailers may also promote products produced unethically, involving practices such as animal cruelty or the use of hazardous chemicals. (Olofsson & Mark-Herbert 2020; Raian, Ali, Sarker, Sankaranarayanan, Kabir, Paul & Chakrabortty 2022) Throughout the entire textile supply chain, sustainability risks encompass both environmental and social dimensions. Addressing these risks necessitates comprehensive measures to reduce resource depletion, pollution, emissions, and unethical practices. Ensuring fair working conditions, promoting transparency, and embracing circular economy principles can then contribute to more sustainable practices in the textile industry.

There are many different motivations that drive textile companies to manage risks in their supply chain. In recent years, regulation by law in Finland and in the EU concerning sustainability in procurement has tightened and will tighten again in the near future, since European Commission (2022) has outlined new regulations regarding the environmental and social impact of the textile industry. Furthermore, recently EU Parliament approved a directive for due diligence in supply chains, and this directive specifically will further impose on risk management practices in companies that operate in high-risk sectors such as the textile industry (Thornton 2023; Business and human rights 2023). Trough sustainability risk management companies can also proceed to create value (Godfrey, Merrill & Hansen 2009). Value is created for stakeholders, and in the textile industry often specifically for customers. The rising awareness of sustainability among customers has created a demand for proof of sustainability. A sustainably produced, say a t-shirt, has most likely more value in the eyes of a customer than a t-shirt that does not come with the same claim. However, this has led to some companies greenwashing their image and claiming false statements on their sustainability, and it can be hard for customers to tell apart sincere and insincere claims (Nyilasy, Gangadharbatla & Paladino 2014). To support value creation, a key factor for companies is transparency. With transparent sustainability practices, companies are able to reliably prove their responsibility and thus value creation is much more likely. (Cura, Jain & Niinimäki 2022) Textile companies can face reputation risks if they get associated with negative social or environmental impact, and therefore effective sustainability risk management in companies can help to avoid and mitigate these risks and protect reputation as well as enhance the brand value. To effectively manage risks, there is a need for both a proactive approach to risk management, and the integration of sustainability considerations into all aspects of business decision-making. (Wilderer, Renn, Grambow, Molls & Mainzer 2018) Therefore, textile companies have recently began to invest more and more resources to be able to make sustainability a visible part of their strategy and communication.

2.2 Sustainability risk management in global supply chains

Global supply chain poses a higher risk compared to domestic supply chain due to the intricate interconnections among a wide array of firms. These interconnections are vulnerable to disruptions, bankruptcies, breakdowns, macroeconomic and political shifts, as well as disasters. Consequently, these factors amplify the risks involved and render risk management a challenging endeavor. (Manuj & Mentzer 2008) Sustainability risk management specifically encompasses the management of emerging environmental and social justice risks. To address these risks, risk managers must anticipate their potential impacts and devise suitable strategies for mitigation and financing. However, given that many sustainability risks are novel and emerging, the most effective strategies for corporate sustainability may not be immediately evident. (Anderson 2006) Managers can develop tailored and effective risk-reduction strategies for their companies by comprehending the diverse range of supply chain risks and their interdependencies. This understanding enables them to strike a balance in their approach and mitigate risks more efficiently. (Manuj & Mentzer 2008) So therefore, vast knowledge on sustainability risks is a great start for an effective management strategy.

According to Wolke (2017) risk management consist of four stages: Risk identification, risk measurement and risk analysis, risk steering and lastly risk controlling. In risk identification, different types of business risks are identified by using different analysis tools. Risk measurement and analysis then continue the process by measuring the identified risks based on some type of quantitative or quantitative procedures, and then measured risks will be compared to each other with risk analysis in order to discover the most critical risks. After that, risk steering is done to select the most fitting control instruments. Finally, in the risk controlling stage the formed risk management practices are evaluated and the entire process monitored. It also should be also noted that risk management as a whole is more of a dynamic process, than a static one. (Wolke 2017). An effective risk management process will continuously repeat itself in order to stay relevant.

Effective implementation of Corporate Social Responsibility (CSR) necessitates successful communication, supply chain monitoring, evaluation of responsible operations, reporting, documentation, and establishment of pre-set sanctions for non-compliance. Purchasing and supply management employees play a crucial role in enhancing corporate reputation. Collaborative efforts between buying companies and suppliers are essential for achieving high CSR standards. Audits hold significant importance, with suggested improvements provided to suppliers after the audit to meet required standards. Immediate problem-solving or resolution plans follow the auditing process. Supplier control ensures transparency, traceability, and continuous improvement in long-term relationships. Various methods, such as supplier visits, involvement of external parties, and clear evaluation criteria, can be employed for conducting audits. Communication through sustainability reports, questionnaires, interviews, and ongoing monitoring is vital, emphasizing accuracy and reliability. Education and informing suppliers through training and technical assistance are additional measures for risk prevention and control. Companies can also utilize educational tools, like films, to ensure CSR compliance and prevent sustainability risks. (Foerstl, Reuter, Hartmann & Blome 2010; Björklund 2010; Maignan, Hillebrand & McAlister 2002; Lippman 1999).

Sustainability standards provide additional means for ensuring the sustainability of suppliers, since it is essential to incorporate sustainability across all levels of planning, execution, and stakeholder interaction. As an example, ISO 26000 (Social Responsibility) and SA 8000 (Social Accountability) are internationally recognized standards used for CSR, that offer detailed and helpful information. ISO 26000 can be positioned within the organization's management process, serving as the first international document that supports interdisciplinary and creative collaboration. It suggests seven CSR principles for organizations. In addition to this, an audit-based SA 8000 is a standard that comprises requirements for the company, indicators for performance measurement and also guidance for implementing CSR. (Dankova, Valeva & Štrukelj 2015; Chiarini & Vagnoni 2017)

2.3 Existing frameworks for multi-tier supply chain management

Transitional supply chain management has focused primarily on first-tier suppliers and to some extent on second-tier suppliers. This can be seen from appendix 3, that pictures a supply chain management framework by Cooper et al. (1997). However, there are some frameworks specifically for the management of a multi-tier supply chain. They can be seen useful in particular for management of sustainability related risks in textile supply chains, and therefore presenting them and how they can help in risk mitigation is of relevance.

Tachizawa & Wong (2014) developed a framework (figure 4), where suppliers in a multi-tier supply chain are divided to categories from first- to lower-tier suppliers and then managed according to their category. The framework also includes firms' contingency variables such as power, stakeholder pressure, material criticality, industry, dependency, distance, and knowledge resources, which describe the context in which their management practices are effective. Lastly, the framework has four governance mechanisms that describe the type of an approach the firm has in managing their relationship with suppliers in a multi-tier supply chain. In the *direct approach*, the lead firm has direct access to even lower-tier suppliers, whereas in *indirect approach* the contact to lower-tier suppliers is always done through another supplier in the supply chain. *Work with third party* describes a practice where the lead firm collaborates or delegates responsibilities to a third party to manage lower-tier suppliers, and finally, in the *don't bother* approach the led firm focuses solely on the first-tier suppliers. Overall, this framework can help companies better understand the sustainability risks associated with their supply chain and to take appropriate measures to mitigate these risks and suggest when each of the approaches are the most efficient. (Tachizawa & Wong 2014)

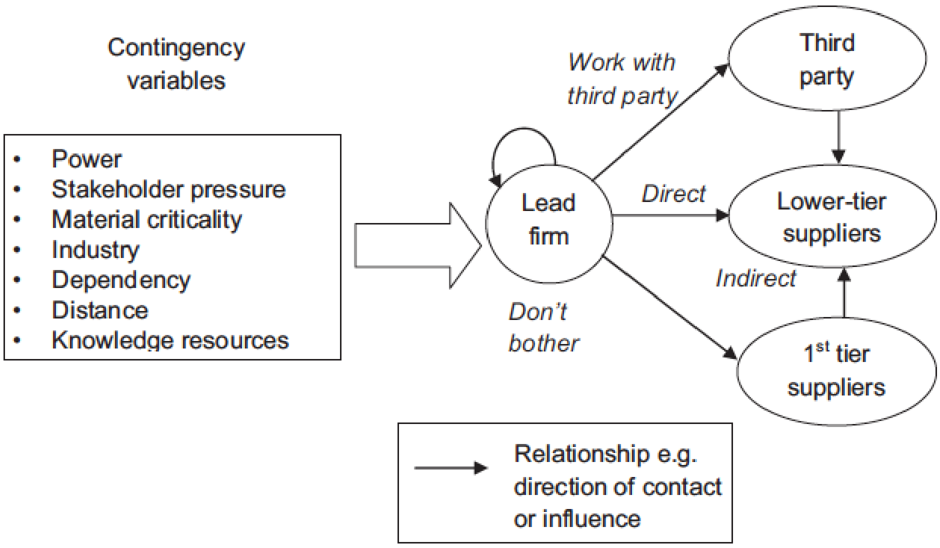

Figure 4: Conceptual framework (Tachizawa & Wong 2014)

The framework by Tachizawa & Wong (2014) was based on the observation that quite a few multi-tier supply chains are managed solely by having a relationship with only the first-tier suppliers and trusting that they follow through with monitoring of the rest of the suppliers. When this is then applied again in the relation between the first-tier supplier and their own suppliers, it creates an ongoing theme where trust can be misused and consequents of it are harmful for the entire value chain. Although this framework suggests different approach styles quite accurately, it falls short in presenting the possible issues faced with each management style. It also leaves the research of management tools suited to each approach for the user. On the other hand, this makes the framework a good base for different types of management related issues in supply chains.

Sauer & Seuring (2018) developed a three-dimensional framework for multi-tier sustainable supply management. This framework was partly build onto the previously presented conceptual framework by Tachizawa & Wong (2014), but it also takes into consideration other research and focuses on sustainability in particular. Sauer & Seuring (2018) claim that in order to determine the most suitable practice for multi-tier sustainable supply chain management, it is essential to view the supply chain as a relational space where the supply uncertainty for the focal firms and the demand uncertainty for the suppliers can be minimized through their relationship. A comprehensive evaluation involves integrating two uncertainties: the ability and necessity of the focal firms to manage the supplier, along with the institutional distance between the supply chain space and the supplier's organizational space. (Sauer & Seuring 2018) The concept of institutional distance is explained by Busse, Kach & Bode (2016, 315) as "Extent of similarity or dissimilarity (incongruence) between the institutions of two legitimacy contexts. Here specified further as mean differences of the cognitive, normative, and regulative elements of institutions in between the countries of the buyers and the supplier." So, the higher the differences between byers and suppliers' countries work cultures and legislation, as example, are, the harder it can be to align sustainable processes. In the framework the front parts represent low institutional distance, whereas the back parts represent high institutional distance. Descriptive dimensions and edge properties are divided into high and low, and this splits the cube in half for each dimension and produces the effects shown behind the brackets (Sauer & Seuring 2018).

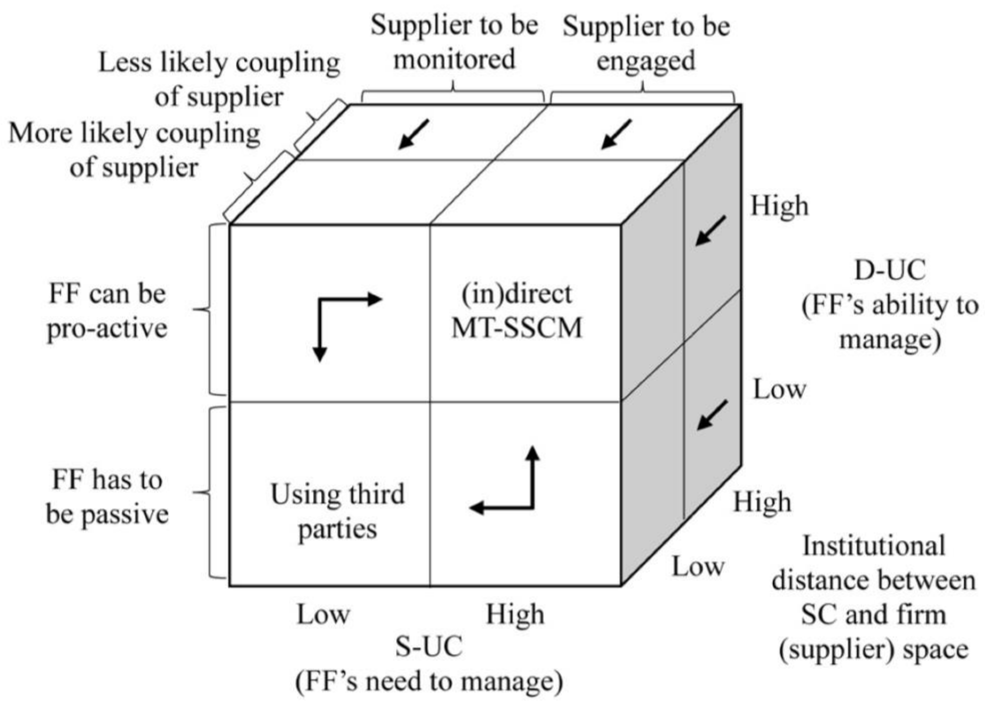

Figure 5: Three-dimensional framework for multi-tier sustainable supply chain management (Sauer & Seuring 2018)

The first level of the cube represents the intersection of supply uncertainty and demand uncertainty, which reflects the focal firms' need and ability to manage the supplier. This intersection is addressed by the norm strategies proposed by Seuring and Müller (2008) for sustainable supply chain management implementation, as well as the norm strategies on resource allocation to supply chain relations suggested by Williamson (2008). In situations of low demand uncertainty and low supply uncertainty, both sources indicate a risk- and effort-minimizing approach, resulting in a passive management and monitoring approach. Conversely, in cases of high demand uncertainty and high supply uncertainty, an output-maximizing approach is derived from both sources, leading to a proactive supplier engagement approach. The most suitable matches can be found in the cells that correspond to low or high uncertainties, while the mixed cells may have certain limitations. The practice of working with third parties is most effective for sub-supplier management when both the need and ability to manage the supplier indicate a minimizing approach. On the other hand, the indirect and direct multi-tier sustainable supply chain management practices require greater management efforts, which can yield substantial sustainability improvements. These approaches are particularly suitable when the focal firm possesses a high ability to manage the supplier. (Sauer & Seuring 2018)

2.4 State of research on sustainability risk management in multi-tier supply chains

Mejías, Bellas, Padro & Paz (2019) state that research in supply chain management beyond the first tier is not fully developed. Their research focused on the four biggest fast fashion companies' traceability management as a part of improving sustainability in fashion multi-tier supply chains. The study found that there is lack of standardization and transparency in companies' sustainability reports, that passivity and ignorance are causes of many social sustainability problems, whereas lack of control contributes to environmental issues. There is need for commitment and education at each level of the supply chain, and greater transparency, to better practices and veracity on sustainability related matters. Further study was recommended for other companies in the industry or specifically to slow fashion companies. Criteria, measurement, and standardization recommendations were also suggested topic for research. (Mejías et al. 2019) According to Shayganmehr, Kumar, Luthra & Garza-Reyes

(2021), stakeholder pressure pushes firms to adapt the multi-tier approach. Their study utilized literature for conducting a framework for sustainability assessing in multi-tier supply chains but recommended further study to be done with expert's judgement and knowledge in order to widen the amount of factors to achieve broader aspects. (Shayganmehr et al. 2021) Recent studies claim that there are still not enough available frameworks for sustainable multi-tier textile supply chain management, that focal companies must assimilate sustainability standards in order to cope and to achieve competitive advantages, and that traceability and transparency could benefit multiple improvement objectives if their implementation to practice would be further developed. These studies approached the issue from the point view of traceability implementation to support sustainable value chains and by proposing a framework for supplier performance, in multi-tier supply chains, latter of which found that especially traceability and environmental criteria are top important factors. Proposed topics for further research included operational research in order to find ways in which organizational readiness for traceability could be improved, and implementation of proposed framework and methodology in different sectors and countries. (Riemens, Lemieux, Lassagne & Lamouri 2023; Kazançoglu, Ozturkoglu, Mangla, Ozbiltekin-Pala & Ishizaka 2023) Overall, the study on the topic is still at an early stage, and different point of views and approaches needed in order to find the best-fitting practices for each sector of the industry and for different geographical locations. This study will further fulfil earlier studies by approaching the topic from the Finnish companies' point of view, which could be also seen more as slow- than fast-fashion. This study also considers both relevant literature and expert's knowledge and proceeds to find effective sustainability risk management practices that could help in developing criteria and standardization recommendations.

3. METHODOLOGY

This section goes through the research methods and different materials used in the study. It presents the collected data and explains the research method used to further study the data. Finally, it will look over how the data was processed in order to get the main themes of the interviews and secondary materials to emerge.

3.1 Research method

The research method for this thesis is a qualitative, single-case study focusing on the Finnish textile industry to identify sustainability risk management practices used in multi-tier textile supply chains. It has five Finnish textile companies as embedded units of analysis, creating a shared context. The chosen study methodology and its position in the case study research field is pictured in appendix 2. In a single-case study, material is collected from a variety of sources, including interviews, documents, and observations, and then the data is analyzed to identify key patterns and themes (Bryman & Bell 2015). In this study material is collected through semi-structured interviews, transcribed and supplemented by secondary material available from public sources, and then analyzed with a content analysis. This research approached the content analysis from an inductive approach, meaning that the coding categories formed were based on the collected data itself rather than beforehand chosen.

A single-case study is used for various reasons, most typically for providing an in-depth understanding of a particular case, allowing researchers to explore the nuances and complexities of a phenomenon. Single-case studies can also be used to build theories that can be then tested in future research. By examining a single case in detail, researchers can generate hypotheses and concepts that can be tested in other contexts. Sometimes it may be the only way to study a unique or extreme case that cannot be generalized to a larger population. This can be particularly useful when studying complex or poorly understood phenomena. Single-case studies can also be used for explanatory research, where the goal is to understand why a particular phenomenon occurred. In this case, the single case is used as an example to illustrate a broader theory or concept. (Hamel, Dufour & Fortin 1993) This thesis uses a single-case study in order to gain in-depth information about the subject in question, sustainability risk management in multi-tier supply chains of Finnish textile companies. Since the research questions in this study are very specific, and tight to a relatively small part of the industry, qualitative research was the most suited option. A case study was chosen to best support the hypotheses building in order to answer research questions.

The five Finnish textile companies, used as embedded units in the case study, were chosen for multiple reasons. First search was done to find companies that were based in Finland, operate in the textile industry, and have multi-tier supply chains. After that, their sustainability practices were viewed by the public data available, and finally chosen companies were approached with interview requests. After few interviews were conducted, rest of the companies were narrowed down by the number of public documents for their sustainability practices regarding supply chain management. The three most suited companies were chosen by both number of available secondary materials for the analysis of their sustainability risk management, and for advanced risk management practices. More information on the companies utilized in the study is provided below in table 1. Information was categorized by European Commissions (2023) definition for SMEs.

Table 1: The companies used as embedded units in the study

Company	Personel	Turnover	Main industry
Company A	51-250 workers	10-50 Mio €	Sports and leisure products
Company B	> 250 workers	> 50 Mio €	Clothing and textile products
Company C	> 250 workers	> 50 Mio €	Clothing and textile products
Company D	10-50 workers	2-10 Mio €	Clothing products
Company E	10-50 workers	10-50 Mio €	Clothing, footwear and textile products

3.2 Data collection

The interviews were carried out for professionals working closely with sustainability and supply chain management in Finnish textile companies. Interviews are a good data source for a single-case study, allowing the researcher to gather rich and detailed information about the case being studied, since by asking consistent questions across multiple interviews researchers can identify commonalities and differences in the data and develop hypotheses or theories that can be tested through further analysis (Hamel et al. 1993).

Semi-structured interview was used for ensuring the coverage of same topics in both interviews, but to also allow for a conversational approach and the possibility to ask more question or details that were brought up during the interview. Bryman & Bell (2015) describe that this interview style has a lot of leeway for the interviewee, and that compared to a structured it focuses more on to bringing out the interviewees point of view and what they find important and relevant to the topic. For this study, two interviews were carried out for separate interviewees, one by email and one on Microsoft Teams. Interviewees were chosen for the study by their organizational positions and their vast knowledge on the field of the research topic, and the expertise of the interviewees was known beforehand. Both interviewees work as managers responsible for sustainability in their Finnish clothing company. Interviews followed mostly the interview guide with some additional questions due to topics that were brought up in their answers. Before the interview, interviewees were introduced to the research topic and objectives, to ensure that the topics would stay relevant to them. The interview guide consisted of eight questions revolving around the position of sustainability in their strategy, biggest risks faced in multi-tier textile supply chain and practices used for management and mitigation of these risks. Also a few questions were asked about the role of supplier relationships and continuity as well as cooperation in these relations. Interview guide can be found as appendix 2. In total, six pages of interview data was collected for the study.

Secondary material such as sustainability reports, supplier code of conducts, and NGO reports, were also collected and analyzed to support and complement the interviews and to develop a deeper understanding of the research topic at hand. Yin (2014) states that companies' own publications and other documents are best suited for supporting data collected by other means, in this case data collected through interviews. In addition, by using multiple sources of data collection the reliability of the research can also be increased. This study used twenty-five different documents concerning sustainability practices of Finnish textile companies. In total there were 256 pages of secondary material that was utilized in the study. In addition, multiple web pages regarding companies’ sustainability were implemented into the study. They all complemented and supported the data that was collected through the interviews. Table 2 summarizes the sources used in this study and at the same time elaborates which companies had certain documents publicly available.

Table 2: Materials implemented in the study, listed by companies

Sources used (and available documents)	Company A	Company B	Company C	Company D	Company E
Interview	x	x			
Responsibility review	x	x	x	x	x
Public Code of Conduct	x	x	x	x	x
Public Supplier Code of Conduct			x	x	x
Public list of banned chemichals	x		x	x	x
Public list of suppliers		x	x	x	x
Sustainability overview on website	x	x	x	x	x
Uses certificates	x	x	x	x	x
Uses audits	x	x	x	x	x
Public emissions calculation		x	x	x	

3.3 Data analysis

The data analysis method used in the research is content analysis, which aims to create a clear and verbal description of the research topic. In the content analysis, the aim is to organize the material in a clear and concise form. There are three different stages in content analysis: reduction, clustering, and abstraction. In reducing, the material is transcribed and condensed so that the material does not contain irrelevant information from the point of view of the research. In clustering, i.e., grouping, groups are classified using the similarities of the material. Abstracting, on the other hand, creates concepts that are essential for research, by piling up the groups obtained from clustering into entities and themes. (Tuomi & Sarajärvi 2018) After these steps, research questions can be answered based on the entities (Puusa, Juuti & Aaltio 2020).

All data collected for this study was uploaded into NVivo and all phases of the data analysis were conducted with the help of it. In the processing of the material, three stages of content analysis were followed, first the material collected from interviews was transcribed and the matters irrelevant to the study were removed. Secondary material was also narrowed down to only parts relevant to the study. The information collected from the interviews and reports was separated into separate parts already at the beginning of the transcription, in order to facilitate their processing. During the reduction, simplified expressions were created from the transcribed materials. In the clustering phase, uniform groups were created from these reduced expressions. On the other hand, in the abstraction phase, groups and finally themes were created, with the help of which it was possible to create an analysis. The visual coding trees were formed with MS excel.

The themes that were created through the steps of the content analysis are 1. Violations of workers' rights and safety, 2. Excessive strain on the environment, 3. Lack of effective sustainability practices or transparency, which relate to the biggest risks. The created simplified expressions, groups and themes for biggest risks are presented in figure 6.

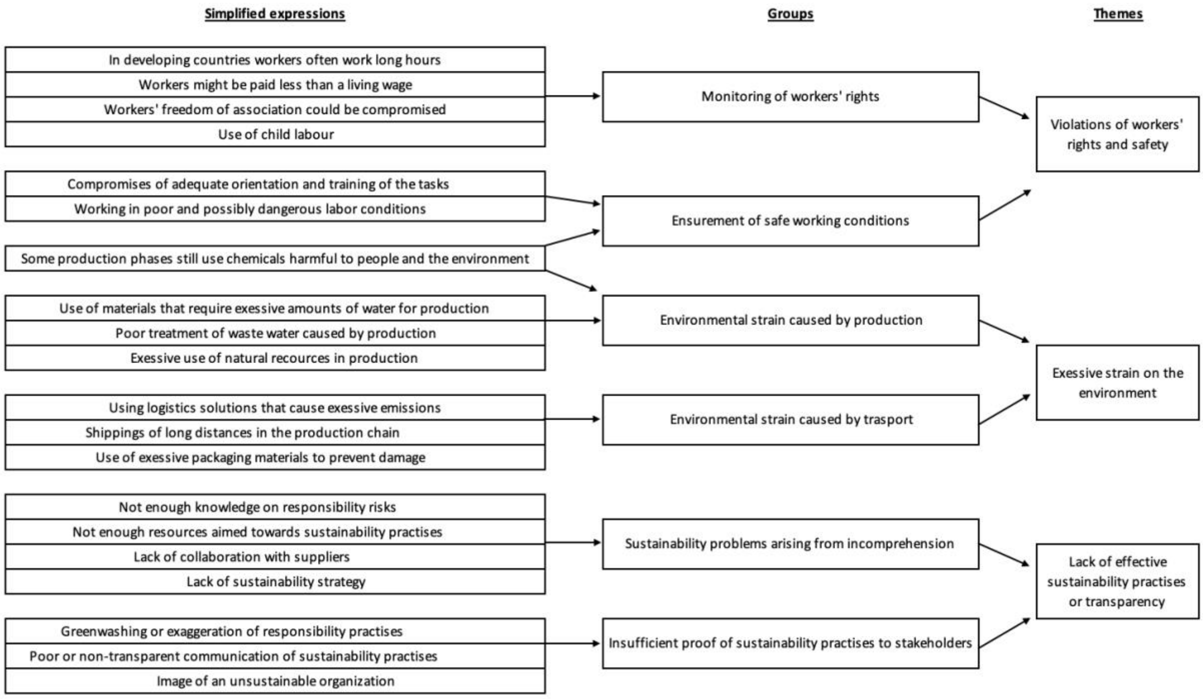

Figure 6: Coding tree of themes from the collected data: biggest risks

Moreover, themes 4. Education, and monitoring, 5. Use of third parties and written guidelines, 6. Avoiding materials and practices harmful to the environment and lastly 6. Striving for complete transparency, were conducted relating to the risk management practices. The created simplified expressions, groups and themes for means used for sustainability risk management are presented in figure 7. Based on these themes, it was possible to create an analysis and answer the research questions.

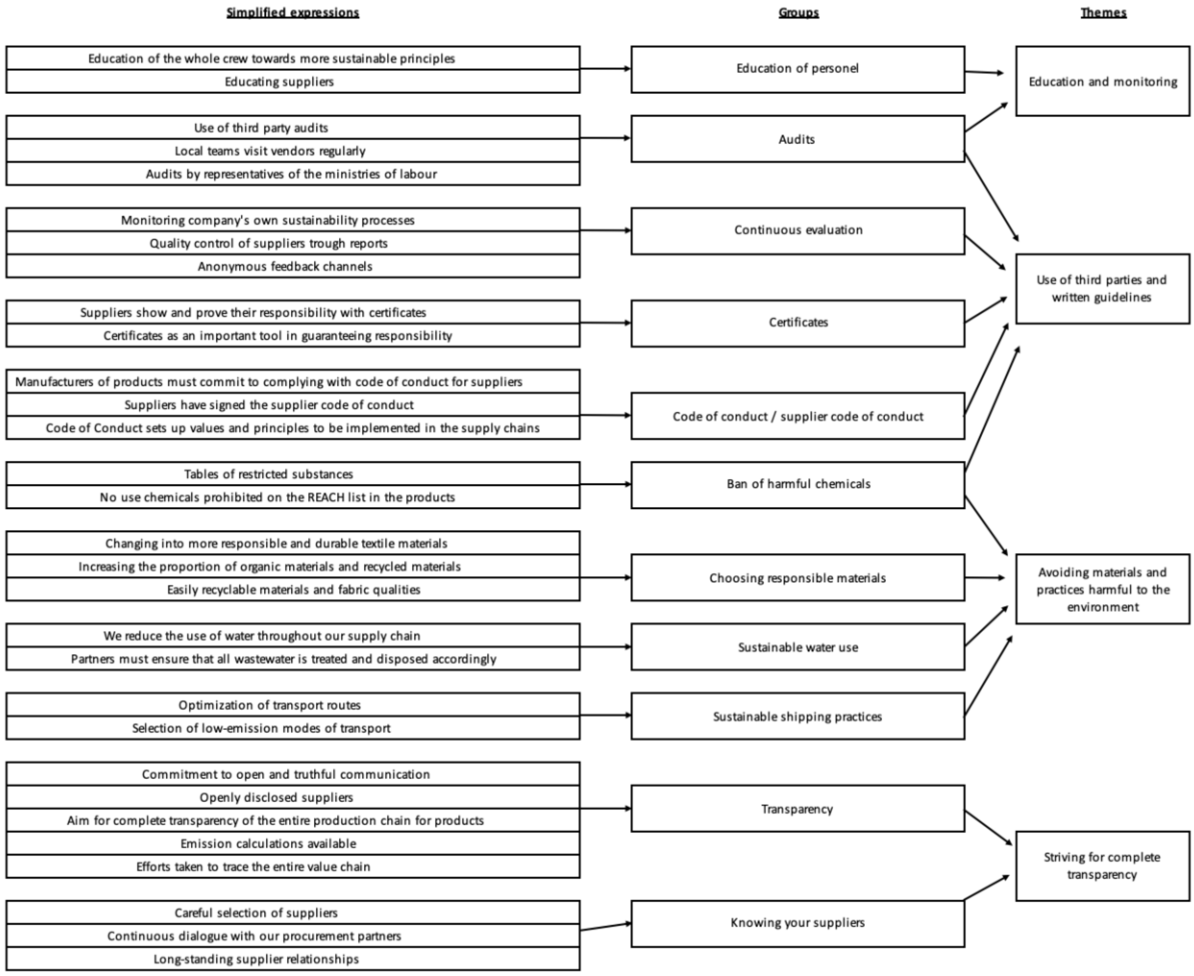

Figure 7: Coding tree of themes from the collected data: means used for sustainability risk management

3.4 Quality criteria

A reliable study describes the progress of the study, so that the study could be repeated. When assessing the reliability of the research, the most important points are the reliability and validity of the research. In the first of these, the reliability of the research, we look at whether the research topic has been reliably researched so that the measurement situation, the measurer, or other external parties have not been able to influence the results of the research. When examining the validity of the study, on the other hand, the focus is on the target phenomenon and whether this phenomenon is truly being studied without bias. When creating reliable research, the goal is to be able to justify the choices of research methods and solutions at every stage of the research. (Puusa & Juuti 2020, Dubois & Gadde 2002)

In general, interviews can be considered a reliable source of information, especially when the interviewees are experts on the subject, or have practical experience working on the subject, like the interviewees in this study. Reliability is also increased by the fact that both interviews have visible similarities between their answers to topics discussed in the interviews. However, in interviews, the interviewees' subjective views of the situation can be gathered, when, for example, it is possible that one interviewee has a different view of the matter than the other. It is also possible that the interviewees have accidentally left some things important for the research unsaid. Other sources used in the research, the companies' own reports and documents, can also be considered a reliable source of information. In these, however, it is possible that some risks have been downplayed or responsibility practices have been exaggerated, and various solutions have been over-positively emphasized, so that the companies would have as good an impact as possible in these own documents. However, by using multiple interviews and responsibility documents of many different companies as a source of information in the study, a comprehensive and reliable picture is obtained of the means Finnish textile companies use to manage the sustainability risks caused by their multi-tier supply chains.

Iterative rounds of coding, as well as a content analysis in itself, follow a structured and systematic approach for data analysis, helping to ensure that collected data is analyzed in a consistent manner and contributing to the overall validity of the study. This also creates greater transparency and consistency and makes it easier to both review and replicate the case analysis if needed. In addition, the chosen research method, a case study with multiple embedded units, contributes to the validity of the study. With this method, the study can focuse on the specific context of Finnish textile companies, but still consider multiple companies as units of study. Therefore, the results of the study can be seen as more easily generalizable to the industry in question when the research covers multiple actors in it. The results of this study are also compared to previous literature on the topic, and this further contributes to the reliability of the study. Possible similarities to previous studies can also indicate reliability.

4. FINDINGS

In this section the research findings are discussed. The chapter first reviews the findings regarding the biggest risks in Finnish textile companies' multi-tier supply chain. Results are conducted in table 3, in which companies related to the groups are marked by their letter. After this, it will go through the findings for management tools and methods used by Finnish textile companies, which have been aimed at reducing and managing the textile supply chains risks. Results for this are conducted in table 4, in which companies are again marked by letter.

4.1 Sustainability risks in multi-tier textile supply chains

To answer the first research question, the collected data was coded for the biggest risks Finnish textile companies faced in their multi-tier supply chains. As the previously presented theory also suggested, results were divided largely into humane and environmental risks. In addition, a large portion of the risks dealt with poor sustainability practices or transparency in them.

Violations of workers' rights and safety. Humane risks in the multi-tier supply chain of Finnish textile companies can be summarized into the risk of violations of workers' rights and safety. Lack of monitoring of workers' rights (A1) and that they are not oppressed or restricted is a major risk, and it is largely based on poor visibility in the long and complex supply chains. Especially in fields and factors located in developing countries, due large institutional distance, it might be still considered normal to do inhumanely long working hours and still get paid lower than the minimum wage, and Worker's freedom of association could be compromised, and use of child labor made possible due to poor traceability of these actions. The risk in ensuring safe working conditions (A2) on the other hand points to compromises in adequate orientation and training into the tasks performed, as well as to poor and possibly dangerous labor conditions for workers. In addition, some chemicals are used in material production, for example when dying fabrics, that can potentially be harmful to people in close contact with them. So, workers conducting the dying process might be compromising their health when doing so. For example, company D elaborates mitigation practices for this risk in their code of conduct.

"..business partners shall ensure a safe and healthy work environment for all employees."

- **Company D**

Excessive strain on the environment. Environmental risks associated with the multi-tier textile supply chain can be summed to excessive strain on the environment. They consist of environmental strain caused by production (B1) and environmental strain caused by transport (B2). Textile industry's production overall causes a heavy burden on the environment. Many of the materials used to make textiles require a large amount of both water and energy to process. In addition, in yarn and fabric production chemicals harmful to nature are often involved, and they can end up in the nature when wastewater is not treated according to standards. In their supplier code of conduct, company E appeals to suppliers to reduce their environmental impact.

"(Company E) urges its partners to assess their environmental impacts and develop policies to mitigate and avoid environmental degradation. Partners should strive to actively improve their material efficiency and reduce emissions, use of water and generation of waste in their operations."

- **Company E**

Transportation in long and complicated multi-tier supply chains also causes a lot of harm to the environment. Emissions from different vehicles in a global setting can end up building up to an excessive strain for the environment and usually a large amount of packaging material is used to protect the shipped items. All of these factors combined create a vast amount of environmental strain that is created in the supply chain of textiles.

Lack of effective sustainability practices or transparency. Finally, a significant risk for Finnish textile companies is the lack of effective sustainability practices or transparency. A large portion of the sustainability issues in textile supply chains arise from incomprehension (C1). If you cannot fathom that the multi-tier supply chain of textiles contains problematic practices in including workers treatment and the environment, it is impossible to act on them. Therefore, not having enough knowledge of your whole supply chain, including all sub-suppliers and the whole value chain from raw material production to retail, is a major risk for Finnish textile companies. Knowledge of these issues has, however, become more commonly known. However, only acknowledging these issues in itself does not mitigate the risk, if there are too little recourses aimed towards sustainability practices in a company. Lack of collaboration with suppliers' significantly increases sustainability risks, and it is often result of too few sustainability practices. If a company lacks a sustainability strategy altogether, it is likely that the risk of too little sustainability practices is realized at some point, since important humane and environmental issues often are left in the dark. Insufficient proof of sustainability practices to stakeholders (C2) is also a big risk, since more often than not sustainability is considered as a competitional advantage among them. This could mean that customers, staff, or partners, who only want to be associated with sustainably proven textile companies, are driven away by poor communication and transparency of sustainability actions taken. This risk therefore is proven, even when textile company in fact does fulfill the requirements for a sustainable actor but fails to implicate it as proof in their communication. The severity of this risk can be recognized as company C describes how they have set up a team that specifically works on increasing transparency throughout the production chain.

> *"As part of our responsibility strategy, we have established a team whose task is to investigate ways to increase transparency and openness in our production chain."*
>
> - **Company C**

On the other hand, greenwashing and exaggeration of responsible practices is also a considerable risk and can lead to major reputational damage. This can also leave a permanent label of unsustainability linked to the organization and be really difficult to shake even if practices are improved.

Table 3: Biggest sustainability risks found in the study

Biggest sustainability risks in Finnish textile companies' multi-tier supply chains		
A. Violations of workers' rights and safety	B. Exessive strain on the environment	C. Lack of effective sustainability practices or transparency
A1 Monitoring of workers' rights (A,B,C,D)	B1 Environmental strain caused by production (A, B, C, D, E)	C1 Sustainability problems arising from incomprehension (A, B, C, E)
A2 Ensurement of safe working conditions (A, B, C, D, E)	B2 Environmental strain caused by transport (A, B, C, E)	C2 Insufficient proof of sustainability practices to stakeholders (A, B, C, D, E)

4.2 Risk management practices

Once the biggest risks were discovered, research data was coded in order to bring out the practices that Finnish textile companies use to address these risks in their multi-tier supply chains. This was done to answer the second research question. Means by which risks are managed revolve around sufficient knowledge and practices, help of third parties or written guidelines in implementing desired strategy, choosing sustainable materials and technologies, and lastly ensuring that transparency is provided throughout the entire value chain.

Education and monitoring. A key element in any sustainable supply chain is sufficient knowledge of the risks and what needs to be done to mitigate them. Therefore, increasing knowledge about risks and sustainability practices trough education of personnel (D1) and by smart hiring choices is a great way to control sustainability risks. People who understand these risks are simply better at controlling them. In addition to educating personnel from the company itself, it was also found that education of suppliers can help to mitigate sustainability issues. Whereas sustainability can be considered as a well-known topic in Finland, some suppliers might not know a lot about it nor understand the practices needed for sustainability risk management, and by providing them with relevant education can have a big influence. Company B for instance highlighted the importance of education in mitigating sustainability risks in the interview.

"Internal and external education in order to increase and maintain knowledge is important."

- **Company B**

Audits (D2) done by company's own personnel, third parties or representatives of the ministries of labor help in verifying the sustainability claims of suppliers, where visibility is difficult. Visiting, as an example, clothing factories regularly in risk countries, helps to ensure that the sustainable actions promised by the suppliers are actually being implemented to practice.

Use of third parties and written guidelines. Many textile companies' main business operations revolve around designing the products and marketing them. And while with vast knowledge about sustainable practices inside the company benefits when creating a more sustainable supply chain, using third parties for help is often a good idea. Third parties can help with audits (E1) and by providing different guidelines for companies to base their own sustainability practices onto. In this study, one of the textile companies used the Amfori BSCI Code of Conduct as it is for their own operations, while the other four had made their own. Four of the companies also had a specific Supplier Code of Conduct to help set up principles to be implemented in the supply chain (E4). They specify sustainability practices that need to be complied to in textile supply chains specifically, and all of the companies required their suppliers to read and sign them. Moreover, all five of the companies required some certificates from the producers of the materials and the products, to ensure that sustainability practices were on their required level. Use of different certificates (E3) was highlighted as a great tool for suppliers to showcase and prove their sustainability. Continuous evaluation (E2) of a company's sustainability practices is also important. This can be done by monitoring the sustainability process, requiring annual reports from suppliers for quality control, and by providing a low-threshold platform such as anonymous feedback channel to help detect unethical or irresponsible practices. For creation of these protocols, companies may again turn to different third parties for help. Finally, listing all the chemicals that are harmful to the environment and for people dealing with them, and banning the use of them all trough out the supply chain was found as an effective risk management tool (E5), and four out of the five companies used it. Three companies had their own list, and company D referred to the REACH list for its operations.

"..partners must follow the current European Chemical regulation REACH."

- **Company D**

Avoiding materials and practices harmful to the environment. Since many materials and practices in the production of textiles are found to have a strain on the environment, a good way to mitigate sustainability risks is to avoid using the most harmful ones. As said before, banning the use of harmful chemicals (F1) ensures that the people making the textiles and the environment are not compromised in the production. Choosing more responsible materials (F2) is also a good way to lower the amount of environmental strain caused by the textile production. Using more durable materials, increasing the proportion of organic and recycled materials, and switching to easily recyclable material and fabrics can go a long way in decreasing the environmental strain caused by textile production. Two of the companies mentioned that they have been incorporating the use of monomaterials, so fabric conducted of only a single material, into their products for easier re-use of the materials later on. Sustainable water use (F3) is also important. Reducing the amount of water used trough the supply chain and ensuring that the created wastewaters are treated and disposed accordingly, is crucial. Finally, the use of optimized transportation routes and low-emission modes of transportation helps to mitigate the environmental strain caused by the shipping of the textiles (F4). Company A described the benefits of their use of monomaterials, as well as how forecasting, planning and vehicle choices are contributing to more sustainable shipping practices.

"Monomaterial design means that the garment is easier to recycle back to raw material – and therefore reduces the use of virgin materials. In other words, choosing monomaterial makes the recycling process more efficient resulting in premium quality recycled yarn."

"We optimize our logistics with accurate forecasting and strict material and production planning. Primarily, we transport our goods by sea."

- **Company A**

Striving for complete transparency. Transparency (G1) was a recurring theme in the risk management practices. With open and truthful communication companies can gain trust of stakeholders and effectively manage reputational risks associated with sustainability. Transparent practices such as open disclosure of the suppliers used, public calculations of yearly emissions and proven efforts for tracing the entire value chain of the products for anyone and everyone to see, were considered as actions that are valued among different stakeholders. With transparency, in this context in the study, it is mainly referred to transparency in communications directed at stakeholders other than suppliers. Company C also mentioned this in their sustainability report and explained that trough the transparently enclosed sustainability efforts they want to both promote better circumstances to the people working in their value chain, as well as provide the end users with vast knowledge of the origin of their products.

"We want to promote the realization of justice and equality in our value chain and offer an inspiring, sustainable and caring workplace. We are constantly offering more information about the origin of products, and our long-term goal is that our supply chains are completely transparent."

- Company C

All of the companies involved in this study had a specific section on their website for sustainability, and they also conducted a yearly responsibility overview for public distribution. A big part of transparency in textile supply chains is also contributed by knowing your suppliers (G2). This begins with careful selection of suppliers, which can be done using different sustainability measures in order to ensure best possible suppliers to match sustainability goals. Making sure that there is a continuous dialogue with these procurement partners, and one that works in both ways, is also a great practice for ensuring transparency. An open an honest communication usually fosters a great relationship that can be helpful for mitigating sustainability related risks, as well as for providing a foundation for complete transparency throughout the supply chain. Building long-lasting, trust-based relationships with suppliers is also a good way to increase trust for both parties and to integrate methods of operation in a way that is beneficial for both. This can be especially helpful when trying to align sustainable practices trough out the multi-tier supply chain, and when trying to have as much transparency as possible in the entire supply chain. So, knowing your suppliers in a sense also points here to transparency in communications to and from suppliers. Aiming for complete transparency of the entire production chain for products does not only help to mitigate reputational risks associated with sustainability, but also helps in thorough reviewing of the practices that are used in the value chain currently.

Table 4: Risk mitigation practices found in the study

Practices used for mitigation of sustainability risks in the textile multi-tier supply chain			
D. Education and monitoring	E. Use of third parties and written guidelines	F. Avoiding materials and practises harmful to the environment	G. Striving for complete transparency
D1 Education of personnel (A, C, D, E) D2 Audits (A, B, C, E)	E1 Audits (A, B, C, E) E2 Continuous evaluation (A, B, C, D, E) E3 Certificates (A, B, C, D, E) E4 Code of conduct / supplier code of conduct (A, B, C, D, E) E5 Ban of harmful chemicals (B, C, D, E)	F1 Ban of harmful chemicals (B, C, D, E) F2 Choosing responsible materials (A, C, E) F3, F4 Sustainable water use & shipping practices (A, B, C, D, E)	G1 Transparency (A, B, C, D, E) G2 Knowing your suppliers (A, B, C, D, E)

5. DISCUSSION

In the discussion chapter, review of the key results of this study is made and research questions answered. Theoretical and managerial contributions are also discussed. Finally, the chapter examines and evaluates the reliability of the research and considers further research topics for future studies. In this last chapter the research will be completed.

The aim of this study was to better understanding on the different stages in the complex supply chain of textiles, and to bring out customs on how to manage sustainability risks in them effectively. To do so, it approached the topic by finding out how Finnish textile companies manage sustainability risks in their multi-tier supply chains. Firstly, the study divided the perspective to environmental and social sustainability issues, and then focused on finding out the biggest sustainability related problems faced in Finnish textile companies' multi-tier supply chains. After that, the study pursued to find out, what practices Finnish textile companies' use for sustainability risk mitigation in their multi-tier supply chains. The topic of the study was selected due to both personal interest and topicality of the issue. Furthermore, since the climate change is a constantly accelerating and more current phenomenon and human rights violations, especially in the supply chains of the textile industry, are still a serious problem, this topic is also very important. A qualitative case study was selected as the research method for the study, so that the most comprehensive picture of the research topic could be formed.

The results were linked to previous literature on multi-tier supply chains and sustainable supply chain management, and many similarities were found between them. However, the results of this study tied the sustainability risk management even closer to specifically multi-tier textile supply chains. A comprehensive picture of motivations, biggest risks, and both found to be the best and studied to be the best means for managing sustainability related risks were discovered. The biggest risks found for Finnish textile companies are compounded in the table 2, and especially insufficient proof of sustainability and lack of verification for claims were found to be recurring issues. Practices used by Finnish textile companies for sustainability risk mitigation are compounded in the table 3, where four main management topics are presented. Transparency was found to be a key element in both recognition and mitigation of risks in the supply chain itself, but in addition an important tool for efficient sustainability communication and for proving companies' overall sustainability.

5.1 Theoretical and managerial contributions

Firstly, this study focused on answering the first research question, *"What are the main sustainability risks in the multi-tier textile supply chains of Finnish textile companies?"*. This was done so that the risk management practices used could be tight to specific risk areas, and because effective risk management should focus mainly on the risks that are the most dominant. The empirical study proved that lack of traceability and verification of claims is a root cause for many risks related to social sustainability. The same observation is also evident in previous literature as Kumar at al. (2017) explain that the more upstream we go in the supply chain, the harder it can be to monitor. Muthu & Gardetti (2020a, 2020b) and Alkaya & Demirer (2014) also claim that these types of social sustainability issues are prone to the early stages of textile production. This study further highlights how lack of traceability and verification of claims is relevant to several humane risks in the multi-tier textile industry. This risk can be seen to arise from incomprehension, or from absence of sustainability related knowledge, either within the purchasing company or in the supply chain itself. Moreover, insufficient sustainability practices in the value chain, whether the root cause being lack of trying or lack of knowledge, often lead to major risks. Since traceability is proven to be a significant risk, it could leave companies in a situation where the only proof of suppliers' sustainability practices is their own claims. This can then in worst case lead to abuse of trust in order to maximize profits, as Agrawal et al. (2021) also state. This is also evident in some of the environmentally related risks. Concerning the environmental risks within the multi-tier supply chains, empiric shows how the textile industry as a whole has excessive potential for environmental stress. Theory also states how every single step in the long value chain bring in more harm for the environment, and transporting the materials and product for long distances in vehicles that cause emissions only worsen the situation (Giannakis & Papadopoulos 2016; Olofsson & Mark-Herbert 2020; Raian et al. 2022). Therefore, a far too large carbon footprint is one significant risk associated with the textile supply chain. Lack of transparency in sustainability practices or the lack of such practices to begin with, was proven to have a significant connection to credibility risk or reputational risk due to the image of an un-sustainable actor in textile field.

The second research question, "*What practices do Finnish textile companies use to address the sustainability risks in their multi-tier supply chain?",* was also answered by the empirical study, and backed with the theory. Knowledge, of both sustainability issues and how to manage them, within the company and in the whole supply chain was proven by empiric to be important, and Manuj & Mentzer (2008, 193) confirm this finding. Careful selection and education of suppliers is important, and active communication can help to align shared sustainability practices and objectives. Using the help of third parties was also proven to be an effective risk mitigation practice, and written guidelines are a great way to communicate and share ways in which more sustainable manners could be integrated into the value chain. Different certificates are also used for proof of both quality and sustainability. Previous literature by Foerstl et al. (2010), Björklund (2010) Maignan et al. (2002) and Lippman (1999) also state the importance of these practices. Empirical studies showed that significant sustainability risk mitigation can also be done at the very beginning of the products lifespan, in the designing state, by choosing materials that inherently cause less harm to the environment. Lastly, striving for as transparent value chain as possible can both help to identify areas that are risky by mapping out the entire sustainability strain caused by a specific supply chain, but also to prove to stakeholders that there is action behind the claims. Mejías et al. (2019) also state that there is need for more transparency in the sustainability actions of companies. Open and honest communication, even when it means recognizing and admitting the practices that still need improvement, was proven to be the best course of action.

Apart from making theoretical contributions, the results of this study have also managerial implications. Sustainability risks are managed by tracing back the whole multi-tier supply chain and finding out the parts which could end up to realization of these risks. This is easier said than done, since multi-tier supply chains are complex, and it can be really laborious to map them out. Managers should consider assigning the task of sustainability mapping and risk identification to either someone in the company with enough time and resources to do so, hire new personnel for the work or have a third party to conduct the task. Making sure to work with partners and suppliers who share or are willing to commit to the same sustainability goals is also an efficient way to manage sustainability related risks. Again, managers need to consider who makes the supplier decisions, and based on what criteria. Using the help of written guides and third parties where there might be unclarities or risky practices is common, and certificates are also used for verification of claims. Although building supplier relations onto trust is valued, some type of verification for the claims is almost always used, especially when production is located in high-risk countries. Considering whether to conduct these instructions inside the company or have a specialist do so, is also something for managers to consider. Inherent change is happening also in the product design, and more sustainable material choices are done to lower especially environmental risks. Even if some more sustainable materials are pricier to acquire, they might save on other expenses such as extensive risk management. Therefore, it is also wise for managers to consider more sustainable materials as an investment for the overall sustainability. Finally, at least now most of the Finnish companies in the textile industry have realized the role of transparency in their sustainability risk management. Transparent communication, about the current state of sustainability and the goals, inside the company, with suppliers and partners, and with different stakeholders also plays a significant role in sustainability risk mitigation. Since aiming for complete transparency requires the company to carefully review all areas related to its responsibility in the entire value chain, it can help to realize where there is room for improvement. Furthermore, Finnish textile companies use transparency to mitigate any reputational damage that could be linked to un-sustainable practices in their supply chain, whether social or environmental. Managers can even take the sustainability communication of some Finnish textile companies as a model, in order to bring their own company's communications to the same level.

5.2 Limitations and future research directions

This research was limited to Finnish textile companies, since the knowledge of sustainable procurement tends to be high among them, and considering only one country in the study fits the scope of a bachelor’s thesis. This study also focuses mainly on social and environmental sustainability risks. Since the study examined the management of sustainability risks related to the supply chain of Finnish textile companies, as well as their biggest risks, the study is not fully comparable to the responsibility risks of other Finnish companies, or textile companies in other countries. This research specifically focuses on the textile industry, considering the industry's unique sustainability requirements and characteristics. Since the textile industry also has a lot of unique risk factors, the results of the study should not be compared as such to the sustainability risks of other industries. Sure, there are certainly some similarities, so this study could also inspire themes from studies in other fields.

It is important to underline that qualitative research method of this study delimits scope to the perspective of the five companies involved. In addition, some bias could have been formed from the researcher's point of view when forming the questions for the interviews as well as when coding the material. Bias could also have formed from the interviewees point, since their previous opinions and expertise in the field could have shaped their answers. In the secondary material, underestimation of risks and exaggeration of risk management measures is possible in order to convey the most sustainable image of the companies.

This study was limited to five Finnish companies operating in the textile industry. It could be beneficial to widen the scope by either extending the number of companies or geographic locations. The study considers social and environmental scopes, but research on the financial sustainability risks faced in textile supply chains could be done. Focal firms are only considered in this study, so further research could also consider the view of other partners in the supply chain.

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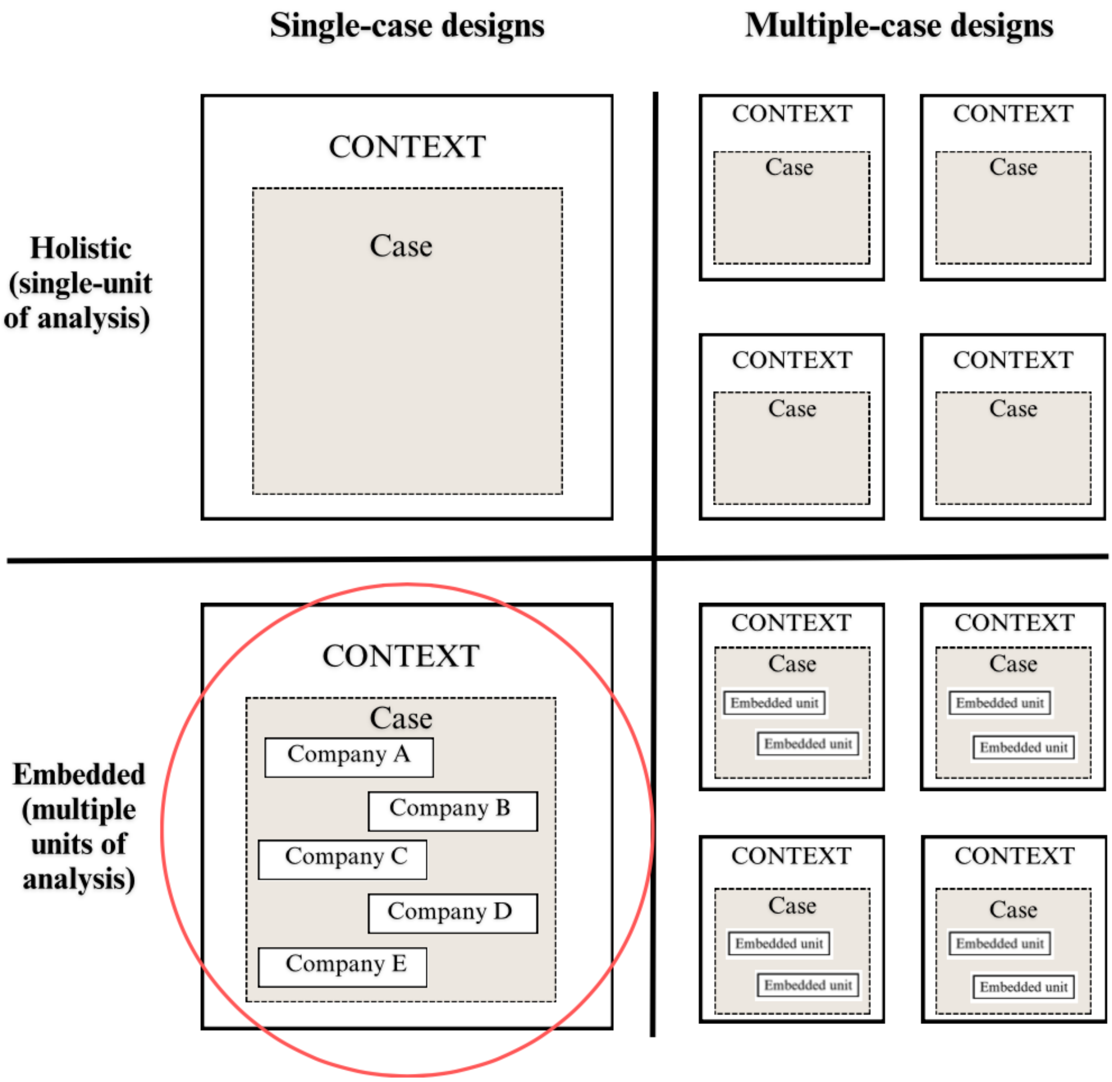
APPENDIX

Appendix 1: Case research methods: single-case analysis with multiple embedded units (self-made illustration based on Kim, Price & Lau (2014))



Appendix 2: Interview structure of the study

How does your company manage sustainability risks in the multi-tier textile supply chain?

Interview form for the bachelor's thesis to be carried out under LUT University (topic: Sustainability risk management in multi-tier supply chains: A case study on the Finnish textile industry).

This study will focus on Finnish textile companies that either purchase material as fabric and further process it into clothes themselves, or that purchase a ready-made end product for direct sale. The interviews are carried out remotely via Microsoft Teams and the purpose is to discuss using the attached questions.

1. How important is sustainability as a part of your company's strategy?

2. How big a role does sustainability risk management play in your procurement?

3. What do you think are the biggest sustainability risks in the multi-tier textile supply chain?

4. In your opinion, do the procurement related sustainability risks differ in different procurement stages (raw material suppliers, fiber and yarn production, fabric production, manufacturing)?

5. What kind of practices does your company use to reduce the sustainability risks of the multi-tier textile supply chain? (If necessary, broken down into different procurement phases).

6. What kind of measures does your company use to proactively improve sustainability in the clothing supply chain?

7. How important is cooperation and continuity in the management of sustainability risks in the multi-tier textile supply chain?

8. What actions does your company use to improve cooperation (and continuity) with the members of your multi-tier textile supply chain?

Appendix 3: Traditional framework for supply chain management by Cooper et al. (1997)